THE MICROCOSM:

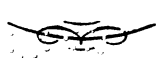
THE ORGAN OF THE

Substantial Philosophy.

DEVOTED TO THE DISCOVERIES, THEORIES, AND INVESTIGATIONS OF MODERN SCIENCE, AND THEIR BEARINGS UPON THE RELIGIOUS THOUGHT OF THE AGE.

A. WILFORD HALL, Ph. D., LL. D.,
FOUNDER AND EDITOR.

VOLUME VIII., 1891.



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The Microcosm

A MONTHLY JOURNAL OF SUBSTANTIALISM AND COLLATERAL DISCUSSIONS.
THE ORGAN OF THE SUBSTANTIAL PHILOSOPHY.
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OUR WORK IN ENGLAND.

We give below, at the request of many friends in England, including Drs. Pearce and Audsley, our reply to the chief points of criticism urged against Dr. Pearce's arguments in the *London Musical Opinion* by the eminent Prof. Sedley Taylor of Cambridge University. Our reply, though containing some points we have urged in previous volumes of the MICROCOSM, will bear re-examination and will be found re-assuring to our readers. They can not be answered by Dr. Taylor nor by any other advocate of the wave-theory:

THE NEW SOUND-THEORY. DR. SEDLEY TAYLOR'S REPLY TO DR. PEARCE REVIEWED BY DR. HALL.

To the Editor Musical Opinion and Music Trade Review:

Sir,—In the September and October numbers of your journal Dr. Sedley Taylor, of Cambridge University, attempts a reply to the arguments which Dr. Pearce had condensed in previous issues from my writings on the substantial theory of sound as opposed to the wave-theory. I feel sure that your readers, seeing my name so often mentioned as the originator of the new theory of sound, will be interested in a full reply from me to Dr. Taylor's strictures, as well as an explicit statement from my pen as to the real principles of the Substantial Philosophy. I shall try to be as brief as the nature of the case will permit, and at the same time shall hope to be so explicit in my statements of facts and arguments that no advocate of the wave-theory will fail to see and feel their force.

As a matter of course no one will expect me to make an exhaustive reply to every point raised by Dr. Taylor in his criticisms of Dr. Pearce's paper, as this would consume too much space; nor would the necessarily brief and imperfect discussion of so many incidental objections be at all necessary, since the main criticisms of his reply, involving the cardinal laws of the wave-theory, being conclusively answered and set aside, the weaker points of defence naturally cease to have any important weight.

Now, without further introductory remarks, I will undertake to meet and neutralize the only criticisms urged by Dr. Taylor that really bear in support of the wave-theory with any degree of plausibility. Here is a full quotation of his remarks:

"Dr. Pearce lays it down as an obvious consequence of the wave-theory 'that the sounding body which vibrates furthest, or causes the greatest disturbance of the air, should produce the loudest sound, and should be heard at the greatest distance.' It is, however, not true that a considerable extent of swing in a vibrating body necessarily sets up an equally extensive vibration in the air. Thus, to take the illustration adduced by Dr. Pearce, when a tuning-fork is in vibration a large part of the air in contact with the prongs slips off laterally from their faces, instead of being condensed or rarefied by their movement; and, therefore, but little wave motion is directly communicated by the prongs to the air, and but a weak sound started in it. Accordingly, when a tuning-fork is held in the hand its note is feeble, but if its stem be made to touch a sound-board—the particles of air in contact with which can not slip off it laterally in anything like the same degree as from the prongs—the sound heard becomes much louder. It is, I think, a further error that, in the sentence quoted above, the carrying power of a sound is assumed to depend only on the amount of air disturbance caused in originating it, and not at all on the *pitch* and *quality* of the sound, which, common experience tells one, have much to do with its capacity for being heard at a great distance."

The points raised in this criticism I have answered in my various discussions of the subject on more than a dozen different occasions in my various writings, which, had Dr. Taylor seen, would have prevented the penning of his reply.

He seems at first inclined to deny the truth of the position that according to the wave-theory, the sounding body of the greatest amplitude of swing, and which consequently produces the greatest disturbance of the air should necessarily produce the loudest sound and be heard at the greatest distance. Plainly at first he was tempted, as we judge by reading between the lines, to attack this well-known teaching of the wave-theory, seeing the manifest destruction to that phase of the theory which the widely and powerfully vibrating tuning-fork had wrought, considering its

sound only capable of being heard eight or ten feet away when its prongs were vibrating at their greatest amplitude in a still room. No wonder the learned professor should feel that the case as presented by Dr. Pearce called for some desperate remedy. Hence his first impulse as we suspect to deny the doctrine of the theory that the loudness of sound must correspond exactly to the width of swing of the air-particles caused by the vibrating body. But instantly remembering the teaching of all the text-books that

"We have already learned that what is *loudness* in our sensations, *is, outside of us nothing more than width of swing or amplitude of the vibrating air particles.*" * * *

"The loudness or intensity of the note depends on the *distance* within which the *separate atoms of air vibrate.*" * * *

"The *greater volume* of sound heard everywhere throughout the room *can only be due to the greater amount of motion communicated to the air of the room.*" (Tyndall on sound, pp. 48, 62, 73.)

The doctor apparently stopped short here, accepted the situation, and caught at the only other visible means of saving the theory, namely, that the tuning-fork, being so small a body, permits "a large part of the air in contact with the prongs to *slip off laterally from their faces instead of being condensed or rarefied by their movement!*" Of course if this *dernier resort* of our critics ignominiously should break down even Dr. Taylor would admit without hesitation that the wave-theory is no longer tenable, especially in the face of the fact that if there is no slipping off admissible, then the powerfully vibrating fork, with its consequent powerful condensations of the air which actually produce almost no audible sound, must necessarily destroy the theory.

But before proceeding to answer this slipping-off attempt to escape the force of Dr. Pearce's argument—an attempt by the way, which originated with the distinguished Prof. Stokes, of Cambridge University, and was adopted by Lord Rayleigh—let us carefully examine a few of the highest authorities on the subject in regard to the real function of the tuning-fork in the production and propagation of sound waves. Prof. Tyndall says:

"Imagine one of the prongs of the vibrating fork *swiftly advancing*, it *compresses the air* immediately in front of it, and when it retreats it leaves a *partial vacuum* behind, the process being repeated at every subsequent advance and retreat. The *whole function* of the tuning-fork is to *carve the air into these condensations and rarefactions.*"—*Lectures on Sound*, p. 62.

Thus the highest English authority declares that the "*whole* function" of the tuning-fork is to "*compress* and *carve* the air" in front of it "into condensations and rarefactions,"—not to compress a small fraction of this air and let a "*large part*" of it "slip off laterally" without being compressed.

Prof. Helmholtz, the highest German authority, says:

"A periodically oscillating sonorous body produces a *similar periodical motion, first in the mass of air* and then in the drum of the ear."—*Sensations of Tone*, p. 16.

Now, how can the air-particles in front of the prong receive a "*similar* periodical motion" when a "large part" of them "slips off laterally without oscillating at all? Is there any slipping off laterally of the prong itself?

Now hear what Prof. Alfred M. Mayer, the highest American authority says, in his great articles on Sound in "Appleton's Encyclopedia:"

"It is also apparent that *all the characteristics* of the periodic motion at the source of the sound *will be impressed on the surrounding air, and transmitted through it to a distance.*"

Is it one of the characteristics of the source of the sound—"the oscillating prongs"—to "slip off laterally" and stop vibrating?

Thus all through these authorities it is taught in dozens of places that all the air in contact with the front of the prong is compressed into a condensation at each forward movement, and such a desperate resort as this slipping-off laterally of a "large part of the air in contact" to account for certain instruments giving forth but little sound, never entered the mind of any writer on acoustics till it came up as an offset to the otherwise insuperable objection to the wave-theory, that the prongs of the tuning-fork with their great amplitude of swing and their powerful condensations of the air according to theory, "produce absolute silence" ten feet away. Manifestly, as before remarked, this quibble killed, and the whole wave-theory dies with it, as Dr. Taylor evidently sees. We now come to the administration of its death blows.

Before taking up the sound-board phase of Dr. Taylor's argument, we refer the reader to the fact that the common little pitch-pipe with a tongue only the eighth of an inch wide and an inch long—not the twentieth the area of a tuning-fork's prong—produces a sound that can be heard half a mile in an open field. Why does not the air slip off laterally from this little brass reed and refuse to be condensed?

But I will now give Dr. Taylor an easier case and one of less complication than a pitch-pipe and see how his slipping-off explanation will meet it: A certain species of *locust* described by Darwin in his "Origin of Species," and which is heard during the summer months all over the American continent, will sit on a green leaf, without even its poor little body serving as a sound-board, and by an almost

imperceptible vibration of its thorax will emit sound-pulses that are heard in the open air from a mile to a mile and a half in all directions. These trifling vibrations, which liberate this enormous amount of sound-force, are scarcely perceptible when standing within a few inches of the insect, as I have frequently observed; yet this sounding instrument—not a thousandth part the weight of a tuning-fork of the same pitch—will send forth sound-pulses (not *air-waves*, my dear doctor) that will fill more than four cubic miles of air with audible sound, sending it more than 1,000 times as far as can the most powerfully vibrating fork ever bowed.

Why do not the air-particles, so accommodating in the case of the tuning-fork, "slip off laterally" from the polished thorax of this little vibrating instrument and thus be audible only eight or ten feet away, thereby to save the wave-theory from annihilation?

No; according to that theory, this little instrument by its almost infinitesimal mechanical power actually converts four cubic miles of air into "condensations and rarefactions"—as these alone, according to the theory, constitute sound-waves—thereby generating sufficient *heat*, according to Laplace as now universally taught, to augment the elasticity of the air one-sixth, and thereby add one-sixth, or 174 feet a second to the velocity of its own sound.

Yes, the learned Dr. Taylor, as instructor of acoustical students in Cambridge University, should know that in thus filling four cubic miles of air with its sound this insect must exert mechanically upon this mass of air an actual condensing or squeezing force of *more than the mechanical energy exerted by a million locomotive-engines under full head of steam drawing trains of cars*, if there be one shred of truth in the wave-theory of sound. Reader, this astounding proposition I will now proceed to demonstrate.

The real question at once presents itself, how much mechanical pressure must be exerted upon a given mass of air through which a sound-wave is passing, in order to raise its temperature sufficiently to generate the heat required by the wave-theory? Prof. Tyndall did not dare to give this increase of density in the compressed half of the sound-wave, for he well knew that every cubic inch of air required mechanical energy, and if he should name any fraction of the normal density, never so small, it would involve a fatal multiplication for the wave-theory. Laplace did not dare to name the fraction of increased density necessary to the theory, though his formula required every cubic inch of the air filled by a given sound to be mechanically squeezed by the sounding body sufficiently to give the necessary heat thereby to be generated, as really as if each cubic inch were compressed in a cylinder under the force of a piston. Why did he not intimate the fraction of increased density this quantity of heat would require to be given to the air?

Helmholtz, in like manner, in his "Sensations of Tone," steered clear of the problem so essential to the very existence of the wave-theory. So did Lord Rayleigh in his "Theory of Sound." So did Dr. Sedley Taylor in his critical work entitled "Sound and Music." Not one of them ventured to give this essential fact of the wave-theory by which to show its rationality.

But our own Prof. Mayer, to his credit be it said, was not afraid of facing the figures. Seeing this missing-link staring the wave-theory in the face, which no other writer on sound had dared to broach, like a brave scientist he flatly gave it to the world in his Encyclopædia article before referred to, and without seeing the result of his bravery thus closed down the lid of the coffin upon the wave-theory forever. Here are his words:

"This *compression* gives for the *compressed half of the wave an increase of* $\frac{1}{6}\frac{1}{5}$ *to the ordinary density of the atmosphere.*"—*Article on "Sound," American Encyclopædia.*

Now it only requires a beginner in arithmetic to calculate the number of cubic inches in the four cubic miles of air condensed by the mechanical energy of this insect, according to theory, and then to consider that it takes fifteen pounds of mechanical pressure to double the density of each cubic inch, and he will at once demonstrate that the locust in thus increasing the density of every cubic inch of that mass of air $\frac{1}{6}\frac{1}{5}$ over its normal density, must actually exert a squeezing force for about one minute at a time, of more than *five thousand million tons!*

There is no evading these facts and figures. Yet that insect could not produce a quarter of a pennyweight of mechanical pressure upon any object by exerting all its strength upon it. Such, reader, is a mere sample of the prodigious mechanical absurdities with which the wave-theory is loaded from beginning to end.

But Dr. Taylor seems to derive consolation from the fact that after the tuning-fork's prong has allowed a great part of the air to "slip off latterly," if its stem should be held against a sound-board, so broad that the air can not slip off to the same degree, its sound is very much louder than before.

I have shown in the "Problem of Human Life"—my original scientific book in which the wave-theory was for the first time assailed—that writers on sound have always

been mistaken concerning the cause of this augmentation of the sound of strings, tuning-forks, etc., by means of sound-boards. Dr. Taylor, like his predecessors, has, of course, fallen into the same almost inexcusable error. Let me first state the law upon this subject as laid down by the substantial theory of sound-force in a general way, and then prove its truth beyond a doubt by application to the increased loudness caused by touching the stem of the tuning-fork to a sound-board. This law is,—that the volume or intensity of sound produced by any sounding body, depends entirely upon the sonorous property of such vibrating body itself, or in other words, upon its inherent quality of liberating this form of force from the fountain of natural energy, and that in no sense does it depend upon the air-waves or atmospheric disturbance such vibrating body may send off. This is one of the fundamental laws of the substantial theory, the correctness of which will immediately be demonstrated.

As positive proof that the increased sound heard by touching the stem of a tuning-fork to the sound-board is not caused by the increased air-waves thus sent off from the broader surface, let any one of my readers try the following simple and conclusive experiment: take a very thin dry pine board about six by eight inches, press the stem of the vibrating fork against it, and instantly its sonorous property will so augment the volume of sound as to increase it at least a hundred-fold. Now, take a piece of *iron* of the same dimensions, having very slight sonorous property but which, owing to its less compressibility and greater elasticity, will repeat the vibrations of the fork many times more distinctly and powerfully than will the soft, yielding pine wood, as can be felt by the hand, and consequently will transfer said vibrations much more energetically to the air than will the wood, *yet it is a fact that almost no perceptible augmentation of the sound will be produced from the iron!*

Why is it, ye sages of the wave-theory, that the more energetic vibrations of the iron sound-board under the stem of the fork, with their much greater action on the air, do not produce a fiftieth part of the sonorous effect caused by the soft pine sound-board with its less vibrations and its consequently less energetic effect on the air?

The wave-theory can give no sort of answer to this question, but stands dumb before the bar of scientific justice with its jaws locked and its tongue tied. But Substantialism, on the contrary, has a quick and ready answer which is in exact accordance with the sonorous law just laid down, as will soon be shown.

Plainly, the fifty-fold increase, both of the intensity and range of the sound from the pine wood over that from the iron is not caused by the pitch or quality of the sound as Dr. Taylor intimates, for in both cases the sound remains exactly of the same pitch and quality as when the fork was held sounding in the fingers. Surely Dr. Taylor must know that the pitch has nothing to do with the loudness or range of sound even according to the wave-theory, for the intensity and range both depend upon the "width of swing of the vibrating air particles," according to Prof. Tyndall. A tuning-fork of a high key can be heard no further than one of a low key, while an A-fork, of the same pitch exactly as that of our little locust, produces less than the $\frac{1}{800,000,000}$ of its volume of sound counting the cubical space they each fill, with perhaps a hundred times greater vibratory effect on the air from the fork!

Who, then, but a substantialist could be expected to give any rational answer to our question as to why the fork, with its stem resting against the piece of wood, should produce so much more sound than with its stem resting against the piece of iron? Here is the answer that any young substantialist in America would give to this problem without even stopping to think: The piece of wood, though vibrating less energetically than the piece of iron and producing less action on the air, possesses a superior sonorous property and is the better adapted to the liberation of sound-force from the natural fountain of substantial energy, just as our little locust, with its hundred times less vibration or action on the air, is a million times better liberator of sound-force than the tuning-fork, *simply because of its superior sonorous property.*

This is an unequivocal demonstration that the sound-board augments the sound of the tuning-fork and of the strings of musical instruments, not by increasing their action on the air, but by the liberation of a larger quantity of sound-force from the surrounding reservoir of natural energy, and consequently the whole wave-theory breaks down right here without another argument against it. Will Dr. Taylor squarely meet this argument or else manfully give up the wave theory, since evidently he can conceive of no reply to the trifling sound of the tuning-fork with its powerful action on the air, except this slipping-off and sound-board explanation now summarily taken from him? The eyes of America as well as of England are upon him, and no mere skimming remarks will meet the case.

Further, we ask Dr. Taylor now to tell us why a set of magnets on one dynamo-machine

will liberate ten times more electricity than another set of the same size and revolved at the same rate?

His answer no doubt would be, that the one set of magnets contains ten times more of that mysterious magnetic property that develops the electric current than the other, and consequently is ten times better adapted to liberating the substantial but immaterial electric fluid from the natural fountain of force. Why can he not apply the same reasoning to sound-force, with all the insuperable facts and arguments here presented, and let the impracticable notion of air-waves assumed by his theory be cast to the scientific dogs, where it should have gone long ago?

Dr. Taylor would hardly be satisfied at this enlightened day to look upon that marvelous electric fluid, that is now working such mechanical wonders, as the mere vibration of the air caused by the rotation of the dynamos. On the contrary, his common-sense would the better be satisfied by regarding electricity, as well as the magnetism which aids in its liberation, as a substantial something,—as a real though immaterial entity. Why not then apply the same common-sense logic to sound-force, and look upon it as an objective, substantial, though immaterial entity, which addresses our sense of hearing practically on the same principle as substantial *odor* addresses our sense of smell?

No one thinks of teaching that odor consists of the motion of the air, or that we *smell* by the vibration of the nasal membrane set into simple harmonic oscillations by the odorous pulses issuing from a flower garden. Nor does any scientist teach that we *taste* the various delicate flavors by our palate "swinging to and fro with the motion of a pendulum." Nor would any man be so wedded to wave-motion as to insist that we see by the to and fro oscillation of the retina when it is known that any motion of any part of the eye, however minute, interferes with our sight.

Of what use then are the analogies of nature if we do not view all our sensations from the same substantial standpoint, and abandon the preposterous idea that the tympanum (not a stretched membrane as usually supposed, but a flaccid mass of tendenous fiber) was ever intended to vibrate to and fro to every sound heard, as well as distinctly to reproduce the vibrations of a hundred conflicting instruments at the same time!

The fact that the wave-theory falls helpless at our feet in attempting any kind of answer to the difficulties sprung in this paper, while the substantial theory unstammeringly advances to the footlights—answering with a clear, ringing yes and no in every case and without the least hesitation—should leave no room for doubt on the part of young scientists either here or in England who have no prejudices to conserve.

A. WILFORD HALL, Ph. D., LL.D.
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ASSUMPTIONS IN REGARD TO LIGHT.

BY THOMAS MUNNELL.

The wave-theory is the arch beggar of the age. There is scarcely a position taken it its own defense whether relating to sound, light or heat in which it does not beg the main question. With a view to testing the truth of this assertion let us look into a few of the chief assumptions as to the nature of light.

1. The existence of ether extending through all space, interstellar and interplanetary, is confidently assumed in order that light may have the means of traveling everywhere in the shape of undulations of said ether. This huge, but to them indespensable, *petitio principii* is defended with all the earnestness due to a well ascertained scientific fact. The assumption being vital to the theory its defense is unavoidable, for how could the sun send its undulations over ninety odd millions of miles if there were no medium by which to carry these undulations? How could light reach our atmosphere where undulations are possible without an undulating medium of some kind? This demand of the wave-theory makes the defense of the ether theory a necessity however presumptuous it may seem to all unprejudiced men. But if light as taught by the Substantial Philosophy is a real entity lying along not far from the line which separates the material from the immaterial, why could not solar force send *it* across said space in straight lines as well as in supposed crooked ones? And why could not this be done with less expenditure of energy than would be needed to keep in constant perturbation the illimitable depths of such ether? If our sun has forever to keep up such agitation to the most distant planet—28,000,000,000 miles—making one orbit of 56,000,000 diameters and extending the same distance in all directions, the mechanical force required would be an inconceivable waste, and as the Creator seems always to execute the mechanical work of the universe on the most economical principles it is hard to believe that He has made an exception to his general rule in this case. The space embraced in a shell of solar light of 56,000,000,000 miles radius would contain more than three quadrillions of cubic miles of ether (3,000,000,000,000,000,000,000) all of which must be kept in unceasing commotion by force of solar rays if the ether theory be true. I do not affirm the negative of this, for it is not our present duty to affirm negatives so much as to point out the huge *petitio principiorum* of the undulatory philosophy. The duty of the hour with physicists, therefore, is to show first that there are any waves of sound, light or heat, and if this can not be proved why every scientific requirement can not be provided for by Substantialism just as well.

2. Another assumption is, that admitting the undulations of light as it flies from the sun to the moon, and that it also waves its way from the moon to the earth, how could said tiny waves go dashing at the rate of 192,000 miles

per second against the craggy surface of the moon and not be too much deranged to pick themselves up again, reorganize and come on in good shape to the earth? Let no one suppose that we are trifling either with the facts or the logic of the case, for all wave theorists hold them to be real and veritable waves produced in a material substance, and of course they are subject to physical laws no matter if billions of them do pass a given point every second. If they are not too small to be created they are not too small to be destroyed, and who knows that lunar reflection has force enough to reform them and drive them onward again just as they started from the sun? Scientists well know that "the light of the sun is 600,000 times as powerful as that of the moon," and also that the moon reflects none of the sun's *heat*, so that with no solar heat and only $\frac{1}{600,000}$ of its light the theory has but a poor showing from a lunar standpoint. Should it be true that undulations are the very nature of light,—are light itself,— and do not need to be formed either on sun or moon, we reply that light waves would be very unlike waves of air or water, for these confessedly are generated by external forces. Here are the winds, bells, prongs of tuning-forks and stringed instruments supposed to produce waves, and should it now be held that luminous waves are not generated by some sort of solar force it will greatly weaken the argument for the generation of sound waves on earth by forces exterior to the waves themselves. But if it be conceded that it requires all the power of King Sol—both heat and light—to cause said luminous waves to reach the moon, what power has Queen Luna with only $\frac{1}{600,000}$ of solar light and none of its heat to reorganize said smashed-up waves and send them on to us at precisely the same speed, right side up and in good order?

I would remind the reader again that it is not my business to-day to prove a negative, but to present this second *petitio* of this giant scientific beggar—the wave-theory of sound—and to suggest how easily all these difficulties are overcome by the theory of Substantialism; for if light is an immaterial substantial entity emanating from the sun and flying by some law of conduction not yet understood, its striking the moon and glancing or reflecting off to the earth is as natural as the boundings of a rubber ball from the oblique surface of a wall.

3. It is well known to physicists that "In numerous phenomena light exerts a chemical action (Ganot), which would be impossible if light were nothing but motion." "Chloride of silver blackens under the influence of light; transparent phosphorus becomes opaque; vegetable coloring matters fade." Not only so, but the chemical action differs in different parts of the spectrum. It is more energetic in violet than in any other part, and then away beyond the violet are the invisible and still more refrangible *actinic* rays from the sun of decided chemical power. Then it is admitted that "the most remarkable chemical action which light exerts is in the growth of plants," and that "under the influence of the sun's rays the chemical attraction which holds together the carbon and oxygen is overcome." * * * "When we burn petroleum or coal we reproduce in some sense the light which the sun has expended in former ages in the production of a primeval vegetable growth."

The assumption that light is a nonentity as soon as what is supposed to be its luminous vibrations have ceased, requires its advocates to account for this stored up power it possesses after geological ages have rolled into the eternity past, and ready to leap into active and even violent energy as soon as the necessary chemical conditions are present.

Now if the sun's rays were nothing but undulations of ether, air or of both, how are we to explain its chemical power, its influence on vegetation, and many other powers we have not space to mention? It becomes luminous when it reaches our atmosphere, but beyond that it may be as invisible as when locked up and packed away for millions of years in coal beds, mineral oils and otherwise, without even suspecting its own potential nothingness. We touch the piano keys and thereby tap nature's great reservoir of sound force; we develop the subterranean storehouses of carboniferous deposits, and flames of sunlight break away from their long confinement to contradict the notion that light is and always has been a nonentity—but here we pause for the present, hoping ere long to dig a little deeper into this mine of argumentation for Substantialism.

THE EFFECTS OF OUR ATMOSPHERE ON THE APPARENT SIZE OF HEAVENLY BODIES.

Dr. Hall,—I need not say that it is with diffidence the following thoughts are exposed to public view, and that nothing but a desire to know the truth impels me to write them.

The atmosphere acts as a convex lens, and magnifies all bodies seen through it, as much as a glass lens of the same refracting power. Is not this self-evident? The disc of the sun, at the zenith, subtends an angle of 33′. How much of this is due to refraction? Have astronomers made any allowance for such refraction? It occurs to me that the sun's disc ought to be magnified, even when at the zenith, and that it ought to increase in diameter as it recedes from that point and goes towards the horizon, because the atmospheric lens increases in thickness. This may be the cause of the sun's enlarged appearance at sunset or sunrise.

I respectfully suggest that the MICROCOSM investigate this subject.

If my conjecture is not faulty, very important results must follow. The atmospheres of the planets may be, and no doubt are, of such thickness and density as to cause the sun to appear to all nearly alike, and, of course, to equalize the amount of light and heat received by them. The appearance of the sun, and the amount of light and heat at the different planets, as given in astronomy, depend upon the law of decrease according to squared distance, and were calculated independently of atmospheric conditions. The *densities* and *specific gravities* of the sun and planets, mentioned in text-books, are evidently unfounded, and should be expunged from the record.

Yours truly, D. JAMES.

LIFE AND DEATH.

BY J. I. SWANDER, D.D., PH.D.

What is life? The question still challenges the wisdom of the world. Our observations of its phenomena, however, justify us in our attempts to give a definition of its essence.

Preparatory to such an undertaking, we may assume that there are two orders of life in the universe—infinite and finite—and that while the one is distinct from the universe the other is a constitutional part thereof. We may also safely assume and assert that the latter form of this mysterious something is the product of the former. Even the great apostles of atheism have either been driven into silence or compelled to surrender the position they once occupied, that life is evolved from matter as a phenomenon thereof. Upon the other hand, Christian theism has of late years been so quickened and strengthened by the tenets and beneficial teachings of the Substantial Philosophy as to acknowledge no evolution except that which is rendered possible by previous involution. The life of the creation is from the Creator. It owes its existence to the pre-existent. To assume the existence of such a pre-existent Being is the essential starting-point, not only of all sound religious faith, but also of all truly rational thinking and logical reasoning.

While Substantialism is largely in agreement at many points with the best teachings of other organic modes of thought, it yet goes beyond and rises majestically above all others by the originality and consistency of its claims that finite life is a *substantial* force, created and ordained of God as a constituent part of nature, and endowed with its own peculiar mission to animate matter, mould it into various gradations of organic forms, and thus enable it to praise the Creator for his goodness, wisdom and power as demonstrated in the grand economy and sublime purpose of the universe.

If the foregoing definition of finite life, the account of its origin and view of its nature be correct, it must, in logical reasoning, follow that death is something antithetic and in opposition thereto. If life is a substance, death must in some sense partake of the nature of a shadow. If life is from God, the actualization of the possibility of death must have had a different genesis. If life is a positive entity, death must in some sense be like unto a negative quantity. If life is a force, death must be either an unqualified weakness or a *perversion of vital force.* (See our "Substantial Philosophy," chapters xi. and xii.)

In this paper we will aim to confine ourself to the discussion of our subject as it relates to the rational domain of finite being. The vegetable and animal orders of organic existence are not subject to death in the sense that that term is properly used when applied to the human race. The dissolution of the plant does not disturb the harmony of nature or make it subject unto vanity. The subsidency of the animal is in accordance with the Creator's purpose. In either case the economy of nature is helped rather than harmed; no violence is done when plants and animals live just long enough to fulfill their mission in the wise and subordinate purpose in the general constitution of things. Barring cruelty and needless destruction by man, the animal surrenders its life-force in an orderly way. Beginning, living and growing it *appropriates* only from nature, and ceasing to live it *yields back* the original elements of its organic subsistence. There is no violence done to any law; no matter is annihilated; no force has been destroyed or abnormally dissipated. While the plant and the animal grow such growth is the result of the mastery of life-force over mere chemism; when they subside such subsidency is but the result of the reversal of this order. The chemical forces so gain upon the vital as to dissolve the organism and send its constituent elements back to their common reservoir. Hence of the animal, rather than of man, it may be said: "There is no death; what seems so is"—solution.

Advancing, then, to the discussion of our subject proper, we lay down the proposition that only within the realm of rational being should death be viewed as such in fact. Passing by those apostate creatures "who kept not their first estate," and in consequence of their apostacy were "hurled headlong from the ethereal skies," we confine our inquiries, for the present, within the domain of the human. Here we have an order of beings each one of whom combines the spiritual as well as the sensuous and material in his personal and individual organization. As his spiritual substance is directly from God, and his person in the image of God, his well-being demands continued union and consequent communion with his Maker. All the lines of man's normal existence meet in a heavenly center, and the whole periphery of his proper being is so intoned with a divine melody that

> "Through all the compass of the notes it ran,
> The diapason closing full in man."

The continuance of this harmony between man and his maker is the fundamental condition upon which man's spiritual and physical forces may continue to work with harmony in his wonderfully wrought constitution. In the rational domain disharmony is incipient death. Here we have death in reality. Because of the deathlessness of man's spirit, the perversion of the substantial life force of his personal being is the beginning of the death that never dies—an everlasting abortion—a failure to retain his proper dignity, and a consequent failure to attain his proper destiny.

The foregoing is an intimation that death in the human family is the development of sin. But whence is sin? It is the realization of a possibility. Then whence is the possibility? It has a two-fold basis—anthropological and theological. In other words it grounds itself in human liberty of choice and in the divine purpose to produce a creature possessed of and perfected in that moral goodness which is not attainable except through voluntary obedience. It should, however, always be borne in mind that there was no necessity for the sad realization now seen in the records of history. Hence it follows in logical reasoning that while the possibility of death was a necessity in the essential constitution of man, death itself was not forced arbitrarily into the race or upon the world.

We now lay down the next proposition, viz.: that just as little as animals can sin and die, as a consequence thereof, so little could sin and consequent death have entered the organism of humanity through the animal or physical side of its being. Whatever there may have been of incipient lust or sensual desire awakened in the primitive head of the race, it certainly did nothing more than to open the way for sin and consequent death to make their beginning in the spirit side of human existence. In whatever manner the instigation confronted and entered man's spiritual being, the possibility of sin was first actualized in his spirit—at that point

where the human stands in touch with the Divine—and continued thence its development through the province of the soul into the body. The record of inspired history shows that such was the fact. Although man died spiritually on the very day—in the very instant—that he transgressed, the power of death, *i.e.*, the perversion of the substantial life-force of his personal being, was gradual in its march into his corporeity. There is no record that there was a genuine case of bodily death until nearly 1,000 years after the Creation. Abel's early departure partook more of the nature of martyrdom than of mortality. Death, however, reigned from Adam to Moses. The struggle between two laws, or rather two antagonistic forces, was continued in Adam's corporeal nature for 930 years, "and he died." Several of his posterity attained to even a greater longevity. After Noah's time the age of man began to shorten. The death-force, *i.e.*, the perverted life-force, asserted itself with ever-increasing power. At the time of Moses—a 1,000 years after the flood—it was only by reason of strength that some could pass their four-score years. At the present time the average duration of life in the world does not exceed thirty years, and would doubtless fall very much below that number were it not for the blessings of Christianity and the consequent benefits of Christian civilization which are constantly dispensing their sanitary influences over many of the nations and individuals of the earth.

"And so it is written, the first man, Adam, was made a living soul, the last Adam was made a quickening spirit." Christ came that men might have also physical life, and have it more abundantly. Christianity brings a sanitary influence upon the human body, as well as a sanctifying substance into the human soul. He who fails to see this as one of the benefits of the incarnation had better mount another pair of soteriological spectacles. Statistics show most clearly that there is a marked increase in the average duration of life in those countries and under those conditions of society where Christianity and Christian civilization are dispensing the healing benefits which come fontally from "Him who came to destroy death" by giving new life to the world. This fact has been carefully observed by the actuaries of life insurance companies in settling the basis of their calculations. Dr. Lange, in his excellent commentary, says: "So does the healing of the new life mark its passage; first in renewing the spirit-life, then the life of the soul, and finally becoming visible in the restoration of a new corporeal capacity for transformation at the end of the world." Perhaps it is in this view of the truth that we are enabled to see the meaning of Isaiah, 65:20. The power of death shall be so diminished that "there shall be no more thence an old man that hath not filled his days: for the child shall die an hundred years old."

Such greater longevity is attainable. 1. Because the life of the second Adam, the quickening spirit, is already at work in the organism of humanity, delivering it from the "bonds of corruption," and freeing it from the "law (force) of sin and death." 2. Because that under the influence of Christianity men are led to look upon life as worth living, and are consequently less disposed to shorten its course in senseless dissipation. 3. Because Christian civilization so quickens the intellectual energies of the world's advanced and advancing thinkers, and so incites them to such thorough investigation in the healing art as to result in supplying the masses with that most rational principle and practice of therapeutics which consists in inward cleanliness and hygienic wisdom in the hidden parts.

Of course it is not claimed that any longevity thus attained is equivalent to immortality. It is not thus that "this corruptible must put on incorruption." That which is born of the flesh must remain flesh, and continue under the power of corruption. The rejuvenization of the race by hygienic treatment, if such a thing were possible, would still be something different from regeneration. God's purpose of elevating the race to a higher plane includes a different method. The way into that higher kingdom is by a principle and process as yet unknown to mere human healing art. Even those saints that shall be found alive on earth at the final coming of the King will need to be changed in the twinkling of an eye. Then and thus shall come to pass the saying that is written, Death is swallowed up in victory.

Fremont, O.

DR. SWANDER'S NEW BOOK.

We were surprised as well as pleased to learn that Dr. Swander, our able contributor, has for some time been writing a new volume on the Substantial Philosophy. It is to be entitled "The Substantial Philosophy, Vol. II." The size of the book is not yet determined, but the price we learn will not be more than $1, by mail. We shall announce the full details of this volume as soon as it is in shape to be examined either complete or in advance proofs.

The preparation of this volume, with other important literary and educational work, has, as we learn, been the cause of Dr. Swander's silence for months past, which he has now broken in this number of the MICROCOSM. We shall hope to hear often from the doctor's pen now that he seems to have gotten over his rush of work.

He wishes us to say to our readers that his first volume of the "Substantial Philosophy" will still be sent by mail to all who may desire a copy for 65 cents—its actual cost of production and postage. No clergyman should neglect to secure a copy of this book at the price named, as it is a work of nearly 400 pages—the published price being $1.50. Send all orders to Rev. J. I. Swander, D. D., Ph. D., Fremont, Ohio.

THE TIME TO RENEW OR SUBSCRIBE.

This number commences the VIIIth volume of the MICROCOSM. If the reader, whoever he may be, shall consider the articles herein contained as indicative that twelve such numbers will be worth 50 cents, we will be glad to put the name of such reader on the mailing list as one of our subscribers.

We send this number to all our old subscribers, and intimate that now is the time to renew for the present volume if it has not already been attended to. If, in stopping the MICROCOSM after this number to those not renewing, any mistakes shall occur, our bookkeeper will immediately make correction with thanks on being notified by postal card.

Two new names will entitle the sender to the third copy of Vol. VIII. free.

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Since the "Problem of Human Life," our first scientific book, was issued, we have published nine other volumes, making ten in all, bound substantially in cloth, namely.

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We make this offer at actual cost for the purpose of spreading a knowledge of the Substantial Philosophy. Vol. VII., MICROCOSM, now completed and bound, will be added to the above library for $1 extra.

☞ Since the notice, a few months ago, that the editor's large photograph would be sent at cost (25 cents) to those desiring it, several thousand copies have been ordered. It is quite natural that persons sending for the Health-Pamphlet should wish to inspect the present appearance of the man who forty-one years ago made the discovery of the treatment and who has steadily practiced it upon himself ever since. As a further encouragement to this wish on the part of purchasers, the doctor now proposes to send a copy of this photograph free to every purchaser who shall hereafter send the $4 for the Health-Pamphlet provided the desire for it be expressed in the same letter with the remittance.

DR. KOCH'S CURE FOR CONSUMPTION. WHO FIRST SUGGESTED IT?

BY THE EDITOR.

The papers of Europe as well as of this country are now full of the new sensation,—a claimed certain cure for consumption discovered by the eminent German specialist, Dr. Koch. The most remarkable feature of this now widely-prevailing sensation is that without waiting for any well authenticated cases of cure of consumption the papers all over the civilized world should, as by concert of action, have taken up the cry of Dr. Koch's wonderful discovery almost precisely as was the elixir craze of Dr. Browne-Sequard caught up and proclaimed without waiting for authenticated and practical tests of its efficacy in prolonging life.

From the vague hints given to the public it appears that Dr. Koch claims to have discovered a certain "lymph" or vaccine which he produces by a secret process, and with which he inoculates consumptive patients, claiming thereby to neutralize the bacilli or parasites which cause that disease. This vaccination he administers by subcutaneous injections of the lymph on the back of the patient somewhere between the shoulders. He has not yet, as he admits, cured any case of consumption, but claims to have cured several cases of lupus, a kind of skin disease of a virulent character, and as supposed somewhat related to consumption in its tuberculous growth.

So important is this claimed discovery considered by prominent physicians in Germany, even in advance of all adequate proofs by experimentation of its actual cure of consumption, that extensive preparations are already making for gathering into suitable barracks all the consumptives of the army for treatment by this new process.

But a hitch occurs just here. After vast numbers of sufferers are collected and waiting to be inoculated, Dr. Koch tells the physicians that the "lymph" is so *expensive* and difficult of preparation that it will be several weeks before he can have a supply, and even then only for the more important cases of the soldiers, and that the masses of the poor can not be inoculated at all without long waiting unless an appropriation be made by the government to meet the great cost of a supply of the *lymph*.

The Emperor of Germany, as is reported, has been so impressed by Dr. Koch's claimed discovery that he earnestly recommends a large appropriation expressly for the manufacture of *lymph*, and a correspondingly large sum as a compensation to Dr. Koch for his discovery, so he can afford to give the whole secret to the world, both as to the production of the costly compound and the method of its application.

Now we take the liberty of expressing our conviction, as we did of Browne-Sequard's elixir in advance of all other adverse criticisms, that this inoculation with anti-bacterial lymph in order to cure consumption unless aided by another process is a chimera of the most fallacious and imaginary character, the reasons for which we will give.

On the very face of the claimed process of inoculation of a consumptive with a vaccine by which alone to destroy the microbes that have taken possession of the patient's lungs, is, in our opinion, a self-evident absurdity. This diseased condition of the lungs being a disease of nutrition, is fed and re-inforced necessarily by the diseased condition of the blood and other circulating fluids of the body, and if these fluids shall continually carry to the lungs thus surcharged with bacilli the very food upon which they thrive and multiply, in the shape of organic impurities and seeds of decay, is it likely that a drop of this anti-bacillus lymph the one-five-hundredth part of a cubic centimeter, or less than the one-sixteenth of an inch in diameter, would without assistance rout this army of occupation fortified and provisioned as it is for permanent possession?

Not a syllable has Dr. Koch intimated as to any necessity for hygienic aid to his anti-bacterial lymph in the shape of blood purification, when administered to a consumptive patient. Had his claim been to *prevent* by inoculation alone consumption in persons who had been exposed to that form of microbe, as Pasteur claims to prevent hydrophobia in persons who have been exposed to rabies and before the bacilli had become fortified in the organism, the claim might reasonably have been admitted.

No one pretends to cure small-pox by inoculation alone; but vaccination aims to prevent those peculiar microbes which cause the disease from becoming fortified in the system after exposure. To cure small-pox as well as consumption, after such disease has become well-seated and its parasites have entrenched themselves in the vital parts, will, as we think, require more than the mere inoculation of the patient with the milder form of bacterial lymph.

What would have been thought of Pasteur's claim had he pretended to cure hydrophobia with a sub-cutaneous injection of his lymph, and thus to stop the ravages of the disease after the rabid bacteria had swarmed throughout the entire vascular system and had set the brain, heart, lungs and stomach on fire?

It is perhaps reasonable to admit that in the early tendency toward consumption, either

by heredity or from exposure to the germs, in which a few of those peculiar parasites might have begun their work upon the lungs, inoculation might, by the use of a suitable anti-bacterial vaccine thrown into the blood, rout such bacilli and drive them from the system.

But even in such incipient cases how does Dr. Koch know but that a much simpler, less dangerous and more effectual process of communicating the lymph to the blood could be employed than sub-cutaneous injections which require a painful puncture of the skin? Why does he not, for example, try administering his vaccine by rectal injections to be retained and absorbed, thus allowing the circulation to take up and carry to the lungs a much larger quantity than he now employs of the bacillus-destroying liquid? If the vicious army of occupation is to be overcome and driven out by an invading army of a milder type of bacteria—that will be less harmful to the organism—why not adopt a channel of injecting the lymph which, while producing no pain, will send a sufficient force into the circulation to do the work effectively?

True, as Dr. Koch announces, he may have tried his lymph by the channel of the stomach and have found, as he declares, that it produces no effect whatever. This may reasonably be supposed to be the case, since the chemico-vital action of the gastric fluid is known to be capable of transforming substances taken into the stomach into other and entirely different elements. Thus the milder bacilli of the curative lymph may be entirely destroyed by digestion before entering the blood. Hence the wisdom of testing the rectal application of the remedy which, if it is anything like what is claimed for it, must in the nature of the case prove more effective than by the sub-cutaneous process.

This process, however, of rectal application of the anti-bacterial lymph seems never to have entered the doctor's mind, or he certainly would have intimated it while reporting the neutral results of tests made by the stomach. We respectfully suggest to the doctors of Germany carefully to try the experiment of applying the new vaccine by rectal enemas to be vigorously retained for absorption into the circulation before producing any more painful punctures in the backs of their confiding patients.

As to the practicability of effecting a radical cure of consumption, even in its advanced stages, the writer has not the least doubt, having himself experienced a complete cure after having been given up by his physicians to die of that disease.

That consumption is a disease of nutrition which takes possession of the lungs by a concentration of organic impurities in the shape of living germs, he has never questioned. Hence, before consumption has become sensibly seated in the lungs, it is rationally probable that the bacilli which produce true tuberculosis are floating in the blood and to some extent lodging in other congenial portions of the body, but finally like a swarm of bees will settle upon the lungs as the most available spot from which to commence their deadly assault upon the organism. But like the swarm of bees, while the majority of these bacterial invaders thus settle down to work upon the lungs, vast numbers of the stragglers continue to circulate through the blood and infest other weak and diseased portions of the body, till they are finally attracted by sympathetic affinity to the lungs as the main citadel of the invading forces. It is then that the fatal phase of the disease begins to show itself and the hope of the well-informed sufferer begins to weaken.

To eradicate these germs from the system, after they have formed a settlement upon the lungs, is no easy matter, as the ablest specialists know. Whether these disease-producing parasites be regarded as living microbes or vegetable fungi—the result of fermented and unassimilated food carried into the blood—there must be, in the opinion of the writer, first of all a renovation of the circulating fluids of the body by some effectual process, as well as a safeguard placed against an entrance of any extraneous germs of decay into that circulation thereafter if the army of bacilli are to be successfully combated.

It is manifest, after the first formidable settlement of the invading parasites upon the lungs, that these bacilli, like the bees in our illustration, may occasionally loose their hold and circle off into the blood, repassing through the lungs and again entering all parts of the vascular system, picking up by affinity other germs of like character, and thus returning to the seat of disease re-enforced, to unload their poisonous cargoes to add fuel to the fatal fire, and thus augment the diseased condition.

Plainly, under such circumstances, if the supply of disease-germs can even to a partial extent be cut off from the circulating fluids of the body, and if a consequent stoppage can occur in the deposit of new germs of decay to the already infected parts, the nutrient processes of the body, whose office it is to eliminate and excrete impurities as well as to assimilate nutrition, will gradually get the mastery, and by casting out of the system the stragglers as they weaken and let go their hold of the lungs, will in time free them entirely of the disease and its cause, particularly if the radical method of blood purification here foreshadowed shall perseveringly be followed out.

It was by this intimated process, and on this theory of bacterial invasion and their support by absorbed impurities, that the writer claims to have cured himself forty-one years ago of well-defined consumption, and without medicine of any kind, as fully set forth in his "Health-Pamphlet."

We were confidently impressed, when actually staring death in the face, that the common-sense discovery we had made would so guard the circulating fluids of the system from the absorbed germs of disease and decay, that these fluids in their rush through the lungs would naturally carry off these invaders from their stronghold and then cast them from the system, provided the blood were not allowed to return to the lungs loaded with more disease-producing germs picked up from absorbed impurities than it could take away.

We have always believed that nature would be able to fight her own battles with all classes of invading bacteria if she were given a fair chance, and if her efforts to cast them from the system were not interfered with by almost criminal neglect of the proper safeguards. We believe that no disease-center of bacillus germs can be established in any part of the body unless nature has been imposed upon by the violation of some physical law. When in our direst extremity we saw that if nature were

only aided by an effectual effort to keep all foreign and absorbed impurities out of the circulation, the eliminating processes of the organism would infallibly pick up from the blood as it recedes from the lungs and hand over to the excreting processes and channels any such weakened bacilli as had become partly exhausted, to be cast summarily from the system.

Our method of assisting nature to be her own microbe-killer, in the manner hinted, demonstrated the correctness of our hygienic philosophy, in that immediately after the systematic renovation of the circulating fluids of the body the preponderance of give and take, as between the receding and returning circulation, was greatly in favor of the departing currents in that they carried away from the lungs and excreted vastly more disease-germs than they brought back. In the opinion of this writer, to begin with anything except a radical purification of the blood—such as sub-cutaneous injections, inhaling gases, drinking lung medicines, etc., in order to effect a permanent cure of consumption after that disease has become seated, is to put the therapeutical cart before the physiological horse; or in other words, it is like essaying to exterminate a thistle by clipping off its leaves instead of digging it up by the roots and casting it into the fire.

The result of our own system of first renovating the blood by a purely mechanico-physiological process, made us a well man in a single year, and has kept us in general robust health ever since, now nearing forty-two years since the first application of the discovery.

How trivial compared with this rational view of the nature, growth and operation of consumption is the theory of injecting a tiny drop of "lymph" of any kind or character under the cuticle! And how little do the German physicians now gathering about Dr. Koch seem to realize the true nature of that mysterious disease and the real renovating process which nature herself had in store for its permanent cure when properly and radically applied! This may appear egotistical in a layman, but we know whereof we speak.

In addition to the facts of our own case, now known to hundreds of thousands all over the United States, we have the unimpeachable testimony of scores of persons, both male and female, who have had their lungs restored by this process from well-defined consumption, many cases so marked as to be given up as incurable by their physicians. Yet, not having been associated with the higher or more influential circles of life, our announcement, nearly two years ago, of the cure we had discovered was not, of course, received with the applause of courts and crowned heads, nor rewarded by offers of great appropriations from government to compensate for giving the secret to the world. Thank heaven, we did not need the aid of an emperor to put the discovery into practical operation, as the result has gloriously shown.

But startling as is the claimed discovery of Dr. Koch, and valuable as it will be to the world should it prove a success, it becomes an interesting question as to whether or not the doctor was the original suggester of this theory now creating so much excitement throughout the world, that consumption was the result of bacterial bacilli which might possibly be successfully driven from the system by vaccination. In other words, was not Dr. Koch put on the track of these bacilli by editorial suggestions, first published in the MICROCOSM in 1882, in which we had the honor of explaining this theory in all its details, and in calling the attention of specialists throughout the country to the possibility of curing consumption by vaccination? We close this paper by copying the following prediction, verbatim, from our September number, Vol. II., 1882:

"As to the transmission of diseases from parents to children there is a great mystery involved. Mental diseases must manifestly depend upon the mental organism alone for transference. Physical diseases, such as consumption, scrofula, syphilis, etc., which, as now generally believed, are spread through organic substances by self-propagating organisms or bacterial parasites, may depend chiefly on the physical substance which, however small the quantity, descends from parent to child, and, by multiplication of such poisonous animalcules, may continue in the system resisting displacement, and thus finally bring about death. In the case of small-pox and the well-known beneficial effects of vaccination, we have a theory which we have long held provisionally, and will here give for what it is worth. We suppose the virus of small-pox, which exhales from the diseased body and passes off into the atmosphere or clings to clothing, to be living germs of bacteria which in suitable soil, or blood having the proper affinity for the disease, will hatch and multiply by throwing off similar living germs till the whole body becomes diseased. If the blood of a person be not in the physiological condition to furnish suitable soil or nourishment for propagating these germs, he may inhale them with impunity and even sleep in a pest-house without danger. But if the blood have the right affinity for the bacterial germs a single inhalation of impregnated air will start the disease by starting the bacteria. Now inoculation (by putting into the circulation bacteria of a milder type of disease) tends to ward off the more dangerous type, on the same principle that a city garrisoned by friendly soldiers tends to counteract the enemy's forces by fighting them off or destroying them if they chance to enter the gates. Though the friendly garrison is a curse to the city, it is less so than it would be to suffer devastation by the enemy. The same may be considered true of all infectious or contagious diseases, and we see no reason why consumption, scrofula, measles, scarlet-fever, cholera, and even whooping-cough—all of which originate no doubt in bacterial germs—may not be prevented by suitable vaccine, could it be found, containing a garrison of a milder or less unfriendly type of bacteria which would protect the blood from invasion by these different hordes of dangerous enemies. We need not be surprised to learn before the present generation passes away, of the discovery of a perfect vaccine for counteracting the various physical diseases that flesh is heir to, and that vaccination for small-pox was but the entering-wedge which will ultimately drive from existence all kinds of contagious and infectious diseases."—(MICROCOSM, Vol. II., page 45.)

A COMMON SENSE DEMONSTRATION.

Editor MICROCOSM:—In Dr. Alonzo Hall's recent "Appeal to Teachers of Science" he queries, "Can the air-wave generated by an explosion of gunpowder be shown to be identical with the sound pulse incident to the explosion?"

A recent experiment of mine clearly demonstrates the negative of this proposition, as follows: During the repeated firing of a large cannon, I stood about twenty rods distant from it, in the open air. With my back turned to it, to avoid being deceived or distracted by the smoke, I distinctly *felt* the *shock* of the advancing wave of compressed air, an appreciable interval of time *before* the *sound* of the explosion reached my ears. I infer from this that, for a certain distance, probably quite short, the air shell travels faster than the sound-pulse, but as the sound unquestionably is audible at a greater distance than the wave is perceptible, the wave spreads with a constantly decreasing velocity, and must soon be overtaken and passed by the sound. Should

the observer stand at or near the point where this junction occurs, he might conclude the two to be identical, as they would reach him together—and this is possibly the cause of the erroneous conclusions deduced by some experimenters. The above experiment is conclusive evidence to me that the sound-pulse is distinct from the air-wave, travels at a different velocity, and consequently can not be identical with it.

Fraternally yours,
LUTHER G. WILLISON.

Flint, Mich., Nov. 17, 1890.

REMARKS BY THE EDITOR.

Mr. Willison has no doubt here reported a practical demonstration of the truth of the philosophy of sound-pulse propagation as entirely distinct from air-waves, just as we laid it down in the "Problem of Human Life" and nearly in the same language, though much better expressed. (See page 104 and onward.)

That Prof. Tyndall and all the great writers on sound should have fallen into the error of supposing the air-wave and sound-pulse sent off from an exploding magazine to be identical, can only be accounted for by the inherent falsity and misleading character of the wave theory which assumes sound-pulses to consist of air-waves and nothing else. Being committed to that theory it was an easy error to fall into, as Mr. Willison hints, especially by making the superficial observation of the equal rate of travel of the two kinds of pulses (air and sound) at the exact point where the air-wave overtakes the sound-pulse.

It is passing strange, however, that such men as Tyndall, Helmholtz, Lord Rayleigh, Sedley Taylor, Prof. Stokes, of Cambridge University, Sir Wm. Thomson and our own Prof. Mayer should never have observed the fact that in the immediate vicinity where a bolt of lightning strikes, sending forth the loudest peal of thunder, not a sign of an air-wave is felt or observed in its action upon any material body, and no motion produced except when such body happens to be tuned or tensioned in unison with said peal. With no breaking of window glass or the slightest shattering of buildings by this loudest of all sounds known to human experience, yet the great and world-renowned physicists just referred to never once caught the idea till it appeared in our own writings that the phenomenon of thunder alone annihilated the wave theory of sound.

They never even suspected that the destructive effects which occur near a magazine explosion were due alone to the air-wave compressed and driven away from the center of explosion by the instantaneous generation of thousands of cubic yards of gas, which expanding in all directions necessarily forced the air outward in a densely compressed pulse, and which Prof. Tyndall innocently calls the "sound pulse" in his description of the memorable explosion at the village of Erith.

We have in vain asked any reader of our criticisms to point us to an intimation in any work on acoustical science where this true distinction between these two phenomena (air-pulses and sound-pulses) had been made or even hinted at. We boldly deny the existence of any such intimation, since the writer who should have been fortunate enough to make that discovery, would logically, if honest, have been forced to abandon the wave theory of sound and thus to have anticipated us.

No man can rationally believe in the wave theory after catching a glimpse at this true distinction between sound-pulses and air-waves, upon which all writers on acoustics seem to have been confessedly in ignorance as shown by their erroneous discussions of magazine explosions. Let them once see the light upon this single phase of their motion-theory of sound, and overwhelming doubts will at once assail them from every other point of the acoustical compass. Hence, let it be the work of substantialists everywhere to call the attention of advocates of the wave theory to this prodigious and fundamental error, and then compel them to explain or surrender.

(Continued from page 183, vol. vii.)

What is Sound? The Substantial Theory *versus* The Wave Theory of Acoustics.

BY GEORGE ASHDOWN AUDSLEY, F.R.I.B.A.

Further, in speaking of the tuning-fork's motion, Professor Helmholtz tells us that its prongs move like a pendulum, "only very much faster." He, of course, realizes that the fastest pendulum ever made could, under no possible conditions, be expected to carve the air into sound-waves, simply because the air would refuse to be carved into condensations and rarefactions, and naturally elect to quietly flow round the moving body; and he also realizes that if the pendular motion of the tuning-fork is to produce sound-waves, etc., it must move "very much faster" than the fastest pendulum ever set wagging by the hand of man. His great and unpardonable mistake lies in his not condescending to inform his readers and the scientific world generally just how much faster the sound-producing fork must move than the fastest known pendulum. You can, however, arrive at a fair conclusion for yourselves in this important matter—make a pendulum with a weight and thread, and time its swings after measuring them. Then compare the results with the facts I have given you with reference to the vibrations of the tuning-fork. You will most certainly find that the latter are very much slower, and not, as Helmholtz affirms, "very much faster" than the motion of the pendulum. Professor Tyndall remarks—"When a common pendulum oscillates, it tends to form a condensation in front and a rarefaction behind. But it is only *a tendency;* the motion is *so slow* that the highly elastic air moves away in front before it is sensibly condensed, and fills the space behind before it can become sensibly dilated. Hence sonorous waves or pulses are not generated by the pendulum. It requires a certain sharpness of shock to produce the condensation and rarefaction which constitute a wave of sound in air." Now, are we expected to believe that a small tuning-fork prong, which oscillates the $\frac{1}{500}$th, the $\frac{1}{17,000}$th, or the $\frac{1}{4,000,000}$th of an inch, can generate sound by condensing and rarefying this elastic air, which defies the large swings of a pendulum? I, for one, refuse to believe any such nonsense.

I have in the foregoing remarks endeavored to show you the simple truth about the vibratory motions of the tuning-fork whilst it is producing audible sound; and, further, to impress you with the fact that its motions are far too minute to exercise any effect on the surrounding air, even to the distance of an

inch from its prongs. All this upsets the theory that the sound we hear from the vibrating fork is constituted of sound-waves, as taught in our text-books; but it does not prevent our hearing the sound the fork is sending forth; nor does it directly inform us how or why the fork sounds, or what constitutes sound *per se*.

Before proceeding to the consideration of certain phenomena of sound, upon which the undulatory theory of acoustics is built up, I think it desirable to submit for your consideration the Substantial Theory, the claims of which I urge on the present occasion. I must do this very briefly, and, unfortunately, I must leave many important matters connected with it untouched upon in a necessarily short Paper like this. I shall first give you the definition of sound according to the new theory, and then quote a few words from the writings of the founder of the theory, with reference to the subject.

Sound is one of the primordial forces of nature; it is a substantial force, or an immaterial objective entity, governed by laws ordained and fixed immutably by the great Architect of the Universe. This form of force can only be generated or liberated from the force-element of nature by one means devised for that end—namely, vibration of the sonorous body itself.

Such is, briefly, what I believe sound to be; and I accept the definition as reasonable, perfectly consistent with all the observed phenomena of sound, and with "daily experience." You will remember the words of Professor Helmholtz, who says, although he accepts the time-honored wave theory: "In daily experience, sound at first seems to be some agent, which is constantly advancing through the air and propagating itself further and further." How nearly this great scientist's "daily experience" had wafted his scientific reason into the haven of truth; but the waves, with their condensations and rarefactions, carried the frail and rudderless bark out into the stormy sea of false science.

Now let me somewhat enlarge upon the definition just given.

When any sonorous body is set into vibration, sound-pulses or pulses of the substantial force element are released and sent off from it. Such pulses are generated by the interaction of forces in the sonorous body, and depend on the sonorous properties of the body. In certain bodies the force stored up in them by the mechanical action of setting them into the required state of vibration, is partly converted into heat and partly into sound-pulses; and the difference between the quantities of these two forces constitutes the difference of sonorous property in any vibrating body. The cohesive force and other forces present in the body control the action of the mechanical force exercised, converting some of such force into heat, and some into sound-pulses. To aid you in grasping what I have affirmed, I may remark that the pulses of substantial, but immaterial sound force, are analogous to electric discharges. Several of the common phenomena of sound fully support the hypothesis.

I shall now turn to the writings of the founder of the substantial theory, and briefly direct your attention to the reasoning which led him to reject the wave theory as false and untenable.

The Substantial Philosophy teaches and lays down as its "central and cardinal proposition," says Dr. Hall, "that every force of nature, as a *phenomena-producing cause*, must, in the very necessities of true science and of the relations of cause and effect, be a substantial entity or an objective existence."

Dr. Hall assures us that he found himself confronted, at the outset, with difficulties in essaying to reconcile such a radical assumption with the existing theories of science which teach that some of the most conspicuous natural forces, and the causes of observed phenomena, are the *mere motions of material particles*. He says: "To have admitted for a single moment the assumed basic facts of the current motion-theories of science—namely, that the forces of sound, heat, and light were but the motions of matter, and that there was nothing substantial about them as phenomena-producing causes, would have been to abandon the entire Philosophy of Substantialism which, from the very start, we had mapped out as of universal application.

"To concede to science as at present taught the truth of the position that any force could be but the *motion* of material particles such as air or ether, would be to make force an *effect* and not a *cause*. Surely no one is so superficial, after his attention has been called distinctly to the subject, as not to see that the motion of matter, which is intrinsically inert, can only be the *effect* of some applied force which is its moving *cause*.

"To suppose force of any kind to be the motion of matter, and at the same time to be the cause of such motion, was to our mind an absurdity, though it glared at us from every page of our physical text-books; and it was no easy task to invent or discover a system of natural philosophy or scientific reasoning which would harmonize such inconsistency and thus bring order out of confusion. For plainly, as the motion-theories of science had presented the subject of force, the whole question seemed to us but a jumble of incoherent and self-contradictory statements.

"To assume force of every kind or character to be a *substantial cause*, and the motion of matter under all possible circumstances to be its *effect*, seemed at once the entering wedge for the solution of the whole mystery. But how was it possible to regard the physical forces as substantial entities or objective things, especially the force of sound which produces the sensation of hearing? This was the serious obstacle which met us at the very start. We saw but little difficulty in assuming magnetism and electricity, for example, to be substantial or objective things, since it was self-evident that the physical effects produced by these forms of natural force, such as the displacing and lifting of ponderable bodies, could by no possibility be accomplished except by some real substantial cause. To suppose otherwise, as we reasoned, would be at once to fly into the face of all philosophy and even of common sense.

"But at this point a concomitant difficulty struck us. If these forces are substantial, and at the same time penetrate, pervade, and occupy other bodies at the same time and without any displacement of their material particles, as is the case with magnetism, how about the supposed law of the impenetrability of matter, or the impossibility of the double occupancy of the same space by two material bodies at the same time?

"Of course this had to be met and reconciled with our new departure, or good-bye to Substantialism. But the task of unlocking this scientific door was easy with the key already discovered and in our possession. Universal substance, we assumed in the very rationality of entitative existence, must involve *immaterial* as well as *material* substances. Hence the idea of that grand classification was for the first time sprung upon the world—namely, of making two departments of the existing entities of the universe by dividing them into material and immaterial substances—placing all tangible and ponderable objects in the first division, and all the forces of nature in the second.

"This fortunate thought, though somewhat difficult to grasp at first, soon brushed aside that whole difficulty involved in the idea of two actual substantial bodies occupying the same space at the same time, since now the most impervious steel can be wholly occupied, pervaded, and penetrated by the *substantial* forces of heat, magetism, electricity, gravity, cohesion, and sound in every part and particle of the matter composing it, and at the same instant of time."*

As I have already stated, Sound is, according to the teachings of the Substantial Philosophy, a force of nature—*that form of force by which the sense of hearing possessed by men and animals is addressed and affected.* Such is sound in its true and primary sense—an external and substantial force, or *objective cause;* but in common language it has a secondary meaning—namely, the *sensation* in our consciousness, which is more correctly called *hearing*—an internal sensation or *subjective effect.* Thus by a trope, which is designated metonymy, we have the *effect* put for the *cause.* It will be well to bear these facts always in view, and so avoid confusion of ideas. In all cases the true and unfigurative signification should be intended in using the word sound, when one is discussing matters connected with music, or the science of acoustics.

Let me now briefly consider how far sound, according to the definition given, bears the test of reasonable and logical comparison with the other forces of nature, which immediately address and affect the animal consciousness. *Sound* is that force in nature having definite laws of production and propagation, which by entering our ears, or coming in contact by any other means with our auditory nerves, produces in our consciousness the sensation of *hearing. Light* is that force in nature having definite laws of production and propagation which, by entering our eyes and coming in contact with our optic nerves, produces in our consciousness the sensation of *seeing* or *sight. Heat* is that force in nature having its own laws, which, by affecting any portion of our system of tactile nerves, produces in our consciousness the sensation of *warmth. Odor* is that force in nature which by entering our nostrils and coming in contact with our olfactory nerves, produces in our consciousness the sensation of *smelling* or *smell.* And *flavor* is that force which, coming in contact with our system of gustatory nerves, produces in our consciousness the sensation of *taste.*

It will at once be realized that in removing sound from its time-honored place as a purely *mechanical effect* (for no logical reasoning on the part of the wave-theorist can, under the mechanical or undulatory theory, place sound or sound-waves as a *cause*), and placing it in the dignified position amongst the primordial forces of nature, we reconcile it at once with all the other forces which more immediately address and affect our animal consciousness, as well as with those greater forces which we call cohesion, gravity, magnetism, and electricity. In such dignified position is it not infinitely more worthy of the musician's love and respect; and when viewed as a force direct from the hand of the Creator, does it not account for much which has hitherto been most mysterious in the power of music? Think of it, oh ye musicians!

(To be continued.)

* See different articles in Vols. VI. and VII. of the MICROCOSM, in which these statements occur.

DR. AUDSLEY'S LECTURE.

We especially invite our new readers to the series of extracts we are printing from Dr. Audsley's lecture, delivered recently in London, the first installment of which appeared in last month's MICROCOSM.

Dr. Audsley was the first prominent convert made to the New Sound Theory in England. He was astonished when he accidentally took up the "Problem of Human Life" to find that this new theory had been published for more than ten years, and that not a word had appeared on the subject for or against it in England from the pens of the great writers on acoustical science, though the arguments in that book, claiming to overthrow the wave-theory, as universally taught, he considered to be absolutely conclusive.

He saw at a glance, upon reading the arguments, that the claim of acousticians in America, that the work was beneath the notice of the great authors of acoustical text-books as the reason it had not been answered, was a sham of the shallowest pretense, since no possible reply could be made to most of those arguments.

Such facts as these induced Dr. Audsley to come out as a bold and uncompromising advocate of the substantial theory of sound, both in the columns of scientific journals and on the lecture platform.

His very first published article aroused the attention of acoustical professors all over Great Britain, many of whom at once became converts to his views. Among these was Dr. Pearce, a Professor of Acoustics in Cambridge University, whose able paper in *Musical Opinion* called out the reply of Prof. Sedley Taylor, which is reviewed in this number of the MICROCOSM, first article.

From letters received from Dr. Audsley we are assured that he is more thoroughly satisfied than ever that the doom of the wave-theory of sound, as well as of all the other motion-theories of science, is near at hand. When we consider, he says, that a single fact absolutely opposed to that theory, according to Prof. Huxley, overturns it as completely as would five hundred, how can it be expected for that theory to survive when incontrovertible facts by the dozen crop out at every phase of the theory, as shown in our various publications.

As an illustration of this, we ask our scientific readers, who are not tied down to the text-books, but who are capable of doing their own thinking, to study carefully the three or

four fundamental facts examined in our review of Dr. Sedley Taylor in the article referred to in this number, and if, upon a candid investigation of their hearing, they shall deem such facts irreconcilable with the theory, then, as honest investigators, we ask such readers to renounce that theory and make the fact known through the MICROCOSM. We wait.

NOTICE.

We hereby call the attention of our readers who may be in want of palm leaves or mosses for the decoration of their homes or churches during the holiday season, that our esteemed friend Dr. R. Dennison Dashiell will be glad to supply such needs from his Florida home, on reasonable terms. It would be wise to consult him before making final arrangements. His address is Fort Meade, Polk County, Florida.

Extracts from our Health-Pamphlet.

[Last month we promised to present our new readers with some extracts from our Health-Pamphlet, giving them a brief idea of its style. The following is part of the first chapter]:

"In approaching this important subject and attempting to explain my hygienic discovery and the treatment in pursuance thereof in as brief a space as possible, I find it by no means an easy task. I will try, however, so to word my explanation as to adapt it to every condition of life and education where its benefits may be sought or desired. And in this very first paragraph, I earnestly beg of the reader, however his curiosity may be excited, not to skip one line or sentence, but rather to read sentences and paragraphs twice over, and even study them if they do not seem clear or important at first glance. The pamphlet is small, and the reader can not afford to lose its perfect continuity to gratify a desire for the denouement. If the reader will so examine these introductory and essential ideas, and study them as here suggested, we will almost guarantee that before he gets through with PART I. he will himself have made the same discovery from its apparent necessity and without even a hint as to its nature and details. Let each reader, therefore, test his own original ability to discover and invent, especially after the possibility of a discovery or invention is foreshadowed and assured as will here be done.

"And first, I have to say, that much as I dislike to write about myself or refer to the details of my personal experience, it becomes a matter of necessity in the present case, if the hygienic advantages to result from the discovery here unfolded shall ever be placed in their best light before the public.

"The duty I owe the world in thus placing permanently on record the history of facts and circumstances which led to my present physical, and as I believe largely to my mental, condition, must shield me somewhat from the charge of egotism or want of modesty in what I am about to write. Nothing short of outspoken frankness in narrating the history of the discovery and treatment under consideration, and the circumstances which led to them, with the processes of reasoning by which they were suggested and carried out, will satisfy the purchaser and student of this pamphlet. I shall, therefore, try in every part of this statement to make myself understood, and will only reiterate where repetition may seem to be necessary for clearness.

"During the years in which I have been before the public as an author and journalist, my friends, who had read the 'Problem of Human Life' and who had realized its foreshadowing importance in its relation to the probable after-work of my life, have manifested the most intense solicitude concerning my present health and my reasonable prospects of longevity. I can safely and truly assert, and bear the statement out by the testimony of living witnesses, that during the eight or ten years of my journalistic labors, since the volume above named was issued, I have received thousands of personal letters from various sections of the country inquiring earnestly after my health, and soliciting information concerning the probable duration of my life and my consequent ability to serve in the cause which the 'Problem of Human Life' had so unexpectedly inaugurated.

"A majority of these letters have come from clergymen of the different denominations, and have almost invariably ended with prayers for the continued preservation of my health and mental vigor, that the work of Substantialism so promisingly begun might not flag or fail of complete formulation till others should be educated up to the full capability of defending and maintaining that cause.

"Out of respect to this solicitude, as well as on account of many inquiries made from persons who had received an inkling of the hygienic discoveries on which my own life has entirely depended for its continuance, I have determined to offer to all these friends, as well as to the world at large, the benefits of the discoveries by which I am now alive, and by which I was raised from the condition of an emaciated consumptive forty years ago to my present robust health.

"For several years I have been urged to print the details of the new hygienic treatment in the columns of the MICROCOSM, and then later in the *Scientific Arena*, and at one time I had thought of so doing, and even intimated the purpose in one of the earlier volumes of the MICROCOSM; but on reflection I saw that the minutia of the treatment would hardly be suitable for a popular magazine other than one devoted to some phase of medical science, and, therefore, withheld the suggested publication.

"Besides, I had a great desire, as before intimated, to wait till I had by practical test rounded out the first forty years of experimentation upon myself as a practical and reasonable gauge to the probable working and permanent value of the new system or hygienic treatment to mankind. That time having now arrived, and the various conditions and prospects of my health and continued ability to work conspiring to the final publicity of this greatest discovery of my life, and what I conscientiously regard as the greatest discovery of all time as relates to human health and longevity, I have decided to wait no longer, lest by some peradventure my career should suddenly be cut short and the world should thus be deprived of the value of that to which no wealth or other emolument can bear the slightest comparison.

"I have given herewith an engraving which represents the entire alimentary or intestinal canal from the entrance of food into the stomach to the final exit of the excrementitious residue after the nutrient portions have been extracted and absorbed into the system. This illustration of the intestinal apparatus, with a full description of the same, is given to assist the reader in understanding the explanation of the treatment as it will advance, and its necessary relations to health and longevity. With this end in view the cut should be well studied.

"And first it may be laid down as a truism, nearly self-evident on its face, that most of the ailments which afflict humanity come from the impurities that enter into the vital circulation from what we eat and drink, thereby finding their way into every part of the tissues of the human organism. These impurities may come directly from the food and drink thus taken into the system when they are deleterious, or indirectly from the fermented and decayed residuum even of the most wholesome food which is retained in some portion of the intestinal canal and then absorbed into the circulation after it should have been discharged from the system.

"Most of human ills, resulting in early physical decay or premature old age, originate from this latter cause, namely, the absorption into the circulation of excrementitious impurities from the intestines, which interfere with the normal effects of nutrient assimilation, and which furnish gradually and imperceptibly the nuclei of disease and the seeds of decay, ending in premature dissolution.

"These disease-bearing germs of putridity are taken into the circulation from all portions of the intestines, as we shall hereafter prove, but especially are they absorbed from the *colon*, and thus they easily find their way alike to every portion of the organic structure where the vital fluids circulate. But should any particular portion be deranged or weakened by strain or over-work, so as to form a nucleus of physiological sympathy for such foreign and poisonous ingredients, that part will respond with the greater alacrity and receive the greater concentration of such deleterious particles, and, through affinity for such diseased matter, will grow under its accumulation into the definite form of disease which the nucleus indicates and excites in that particular organ.

"Thus, for example, the lungs may be weakened by over-exertion and successive colds, or may naturally be defective from heredity, furnishing a sympathetic soil for the lodgment of these disease-bearing germs absorbed from the contents of the bowels and carried constantly through this already infected organ. In this way the tendency to accumulation of the diseased condition grows with its growth and strengthens with its strength; whereas, if the blood were free from such impurities, no such accumulation could occur. These impurities, when absorbed into the circulation, thus

finding the lungs, for instance, a congenial camping-ground, so to speak, rush past other organs found to be in less sympathy, and unload their poisonous influence where the diseased soil is already in cultivation.

"Medicines may partially and temporarily neutralize these seeds of irritation, and thus, by diversion of the enemy toward other parts may for a time put off the evil day; but drugs of whatever kind or character can not touch the cause and continual instigation of the trouble, but rather must leave the organ in a more sensitive condition than before.

"With all the medicine that may be taken into the human system, so long as this absorption of the disease-bearing germs continues from the intestines, the blood will supply the lungs with this congenial food for consumption more rapidly than any system of drug-medication can divert or counteract it.

"Plainly and rationally then, as it must strike every thinking person, if some simple, effectual, and perfectly harmless means could be discovered by which to prevent or put a stop to this excessive absorption into the circulation of disease-bearing germs, so that their lodgment would be prevented by the natural eliminating and excretive processes of the physical organism, nature would act in the direction of health rather than disease, the lungs would at once become master of the situation, and the tendency to disease-sympathy and disease-accumulation would cease. This is what the new Hygienic Treatment claims successfully to have accomplished.

"The same rationale, as to the beginning and the accumulation of disease in any other organ, applies with equal force. Let a start be made in the kidneys by strain, excess, or undue indulgence in wines, liquors, etc., and instantly the circulating fluids of the body begin to unload their impurities and disease-bearing germs in this congenial soil, and by their pernicious affinity attract similar germs as the vital fluid rushes by loaded with death, till soon the foundation of diabetes or Bright's disease is hopelessly established. No conceivable cure, which complies with natural law and physiological logic, can touch such cases successfully, save that which will remove its cause, namely, a complete cessation or stoppage of the excessive absorption into the circulation of diseased and putrescent matter from the contents of the intestinal canal.

"I speak of *excessive* absorption advisedly. The entire prevention of such absorption of putrid matter into the vital circulation is probably not possible, nor is it absolutely essential to excellent results of alimentation as relate to perfect health and maximum longevity. The natural process of the assimilation of nutriment and of the elimination of waste and worn out tissue, as well as of the repulsion of deleterious matter carried and deposited by the circulation, will take care of itself infallibly if it is only given a fair chance to act; and this fair chance consists in not allowing the circulation, by leaving putridity unnecessarily in its path, to be so *excessively* loaded with impurities as to deposit them among the organic tissues *faster* than the normal eliminating and excreting process can disentangle and send them adrift to be hurried from the body. In a word, *normal nature* will do her work infallibly correct, if she is not interfered with by *abnormal conditions*.

"As proof that nature will do her work effectually, when not excessively taxed, we have only to note her efforts in her three other outlets for the elimination and excretion of impurities from the circulation, in addition to the intestinal means of escape, namely, the *kidneys*, the *pores* of the skin, and the *breath*.

"When excretion is defective through the chief channel of the body for keeping the organism pure and healthy, notice how soon the urine is unduly loaded with offensive and poisonous excretions in the effort of nature to find the next best means of eliminating the waste and deleterious refuse of the organization.

"Next, the pores of the skin are brought into requisition by our faithful friend, *nature*, to help forward this work and assist the kidneys: and last, but by no means least, our incessant respiration is always at work, night and day, in this effectual process of aiding in the elimination and excretion of effete and poisonous matter from the system.

"Not only the carbonic acid exhaled from the lungs at every breath, but the vapory fluid thus expired at the same time, is loaded with deadly poison to the system if it should be retained even for a single hour.

"The distinguished Prof. Browne-Sequard, of Paris, has recently proved the truth of what I have been stating by condensing these exhalations of vapor from the lungs of a person of average health, and after concentration he has demonstrated their poisonous character on different animals,—a single drop injected under the skin of a rabbit producing immediate death."

(To be continued.)

PRICE OF OUR HEALTH-PAMPHLET IS $4.

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Had Dr. Hall at the start published his remedy to the world free of charge it would have fallen flat and in a short time been forgotten, and the world would have received no benefit from its discovery or publication. But by systematically and at great expense advertising and making it known, as he has done, at the same time charging a moderate price that meets the cost of so doing, hundreds of thousands of sick persons have been induced to avail themselves of its advantages, and are now well men, women and children.

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As a guarantee that this contract will be faithfully carried out on our part, we refer to Mr. Wm. Plimly, Gen. Supt. of the Money Order Department, New York Post Office.

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P. S.—We will not print our usual installment of testimonials this month, though we have thousands to select from. Those wishing to see a dozen pages of the most enthusiastic indorsements ever written in favor of any remedy, can drop us a postal card for our *Extra* MICROCOSM and *Supplement* which contain also many pages of philosophical reasoning bearing on the subject of this treatment. H. & Co.

CONTRIBUTIONS LEFT OVER.

Owing to the unusual length of our own two editorials in this number in reply to Dr. Sedley Taylor, and in review of the discovery of Dr. Koch's consumption cure, a number of contributions are unavoidably crowded over to the January number. Among these are our regular paper from Prof. Alonzo Hall, one from the regular series of Prof. Isaac N. Vail's Annular Theory, one from Rev. Dr. James A. Buck, one from our Associate Editor, etc.

The extracts from our Health-Pamphlet, and the article following as above, we were obliged to put in smaller type to make room even for what this number contains. We hope not to be compelled to resort to this measure again.

EDITOR.

Press of H. B. ELKINS, 13 and 15 Vandewater Street, New York.

The Microcosm

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THE ORGAN OF THE SUBSTANTIAL PHILOSOPHY.
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(Author of the "Problem of Human Life," "Universalism Against Itself," Editor of the *Scientific Arena*, &c., &c.)
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ELECTRICITY, HEAT, LIGHT AND SOUND.

BY THE EDITOR.

Some time ago we stated in the MICROCOSM that it was by no means improbable that a process might yet be discovered of "tapping" nature, so to speak, by which to draw directly from the fountain of natural energy any required supply of electricity, as one now taps a reservoir of water and draws off a supply for domestic or mechanical use.

At present we have no means of supplying ourselves with this form of natural force except by the expenditure of a corresponding amount of mechanical energy or its equivalent in the waste of costly materials. But could some prolific inventor discover and adapt the means as here supposed, of drawing electric fluid direct from the surrounding air, the ground, or the waters of ocean, lake or river, without the application of mechanical force as now required, the *ultimathule* of all human achievement and happiness would be reached, at least so far as the facilities for earthly enjoyment and physical wants would be concerned.

No more tiresome bodily labor would be required of man or woman. The energy for all necessary mechanical work of every grade would cost us nothing but the trifling act of turning a faucet. All the mills, factories, ocean and inland vessels, farm machinery and household industries would be kept in operation by this exhaustless power, requiring only the intelligent direction of the human intellect to guide the almost intelligent machinery, thus to inaugurate a physical millennium and make this world a million times more a home for humanity than all that is implied by the term Eden. How does the reader like the picture?

Besides all this, such a supply of electricity drawn from nature's universal fountain, would not only give us absolute control of our thermal environments and conditions, thereby giving us heat in winter, and cold in summer by the manufacture of an everlasting supply of ice without cost, but it would furnish us with an unlimited supply of light, at any time desired, converting night into day, both indoors and out, to meet any emergency of life.

Although, as expressed in our former article, we believe such an achievement possible, and a no greater stride in advance of all expectation than many discoveries already made in our own times, still for the present we can only enjoy by anticipation such a millennial reign of physical law as this modest prediction foreshadows. With our present facilities and experience the efforts of our great inventors seem to be confined to the discovery of cheaper methods of producing heat and light—the two great economic necessities of life.

Recent investigations by Prof. S. P. Langley and Mr. F. W. Verey at the Alleghany Observatory, Pa., have demonstrated that the amount of light-intensity obtainable through various means in nature differs enormously in proportion to the mechanical energy expended in its development, all the way up from the weak intensity of a tallow candle to the almost unbearable rays of an arc light.

By photometrical and thermal experiments, as well as by spectroscopical tests, they have proved that the light of the *fire-fly* is by all odds the most economical means of illumination furnished either by nature or the art of man, so far as the comparative expenditure of energy is concerned;—that not more than the $\frac{1}{100}$ part of the mechanical energy is exerted by the great fire-fly of Cuba, in proportion to the light emitted, that is utilized in the burning of a tallow candle. Or in other words, while this insect emits no heat-rays at all, its intensity of light could not be equaled by any means known to our arts without the development of at least 2,000 degrees of heat, Fahrenheit, in so doing.

Now, although these able physical investigators were not aware of the true outcome of their reasoning, yet in our opinion their re-

searches and conclusions have totally upset the undulatory theory of light, and when legitimately carried out have likewise overturned the wave-theory of sound.

According to all modern science, light has its source in the mechanical energy of the central heat, which in vibrating acts upon the all-surrounding ether, driving it into waves which necessarily travel with an intensity of vibration or amplitude of swing exactly proportioned to the central heat-energy by which they are actuated and driven off. But here we have in the fire-fly a light-center of great intensity, as these two eminent men have shown, having no heat-center at all and generating no heat by which to put the assumed ether into vibration, but whose assumed waves travel with the same assumed amplitude of swing that would be produced by a central heat-energy of 2,000 degrees Fahr.!

No other conclusion than the absolute breaking down of the motion-theory or ether-theory of light can be deduced from these facts as here demonstrated by two of its able advocates.

But we will go further than Messrs. Langley and Verey and compel the facts they have produced to include sound as well as light, as we will show in a moment. If this exhibition of the fire-fly proves that its light can not be the vibrations of ether, as we have seen, since there is no heat-center to start the vibrations, then it follows that light *per se* must be a substantial but immaterial entity, traveling as a distinct form of natural force by a law of conduction peculiar to itself. It proves further *that the intensity of light depends entirely upon the luminous property of its source as to the amount of force-liberation which takes place from the force-element of nature.* This is the doctrine of the Substantial Philosophy as opposed to the motion-theories of science.

Applying the same principle and process of reasoning to sound, how consistently does the substantial theory hang together! As we showed last month in our letter to the London *Musical Opinion* in reply to the argument of Dr. Sedley Taylor, sound in no possible sense depends upon the energetic disturbance of the air by the tremor of the musical instrument, just as light is proved not depend upon the supposed heat disturbance of the ether, though the air, in the case of sound, is agitated slightly by the vibrating body and in exact proportion to its size and width of swing, just as the ether would be disturbed by the heat-energy at the center were there any such thing as ether to be disturbed.

But sound, as in the case of light, as we proved, depends for the immediate cause of its intensity upon the sonorous character or property of the vibrating body, or in other words, upon its power or facility, as conferred by the cohesive arrangement of its particles, for liberating sound-force from the fountain of natural energy.

Thus, as in the case of the fire-fly in evolving light-force, the locust will produce a greater intensity and range of sound, by actual measurement, than any other object known to human experience, in proportion to the energy employed at the center of disturbance. This shows conclusively, as in the case of the fire-fly, that the sonorous property of the locust is the real and immediate cause of the enormous quantity of sound it sets free, and that the trifling air-disturbance it produces is but a circumstance incidental to such sonorous effect; while sounding bodies of a hundred times the action on the air of this insect, such as the tuning-fork, will not produce a millionth part the sound that is sent off by the locust.

Surely, if an argument like this—running the logical parallel between the acknowledged production of *light* by the fire-fly and the corresponding production of *sound* by the locust—will not carry conviction to the minds of wave-theorists that their undulatory doctrines are false, then their enlightenment in the true principles of physical philosophy we shall regard as very nearly hopeless.

HEAVEN.

BY J. I. SWANDER, D. D., PH. D.

Human nature, wherever found or whatever its condition in its terrestrial sphere, is filled with deep undertones that rise like "echoes of unearthly melody." Notwithstanding the fact of general human depravity, most men are still sensible of the "stirrings of deep divinity within," and, therefore, experience longings for a better realm beyond. Indeed it may be said that every rational soul of man feels, at least occasionally, that "this shred of life can not be all the web" there is for human spirits.

Of course these dreams of a better land are crude, and incorrect according as men are destitute of the light in which alone they may arrive at measurably correct conceptions of that world where "reigns the eternal sun with an unclouded ray," and where life will be the science and redemption the song of everlasting years. How various these night dreams of the coming day! The Birmans expect to transmigrate to the mountains of Meru: the Mohammedans look for a paradise of sensual delight: some of the islanders and Indians hope to paddle their migratory canoes to happier hunting grounds in some congenial clime: the more cultivated among the heathen associated their ideas of heaven with their speculations as to the homes of their gods, and some of them fondly expected to see the god of their idolatry forging his thunderbolts on Mount Olympus. "It is pleasant," says Harbaugh, "to notice these drops of consolation bubbling

up from the deep wants of pagan hearts; and although they form a stream which runs a dark, crooked and tedious way, and whose waters stagnate in many a pool of superstition and ignorance; yet when it once finds its way out into the light of revelation, it becomes 'a pure river of life, clear as crystal.'"

In arriving at a correct and full conception of heaven, so far as a true concept thereof is possible in this world, the assistance of both science and revelation is indispensible. The full idea of heaven includes both the future condition and future place of redeemed and glorified humanity. Hence the mistake of any one-sided mode of investigation. Neither astronomy without theology nor theology without astronomy can solve this most interesting of all problems. The proper solution is to be sought and ultimately found by the co-operative and complimentary efforts of faith and reason. When these twin activities of man's regenerate being are brought to a fair and full recognition of their mutual relation to and dependence upon each other, and when the Christian scientist is thus lead to see and acknowledge that the Bible and science teach different sections of the same truth, then will the New Jerusalem begin to descend more directly from God out of heaven, revealing the exact locality of the latter in the full glorification of the former.

Let us inquire a little after that *condition* or *state* of man which is one essential element in the full conception and realization of heaven. In doing so we shall, first of all, reverse the poet's couplet: "Man always is, but never to be blest," except when he is in right relation with himself. Such relation can never exist, however, only as he is also in right relation to God, the source of his normal existence. Man is in right relation both to God and to himself only as he is in moral communion with his Maker. This is possible only as his "life is hid with Christ in God." When this is the case he is in his native element. We should not suppose, however, that such heavenly blessedness is possible for any individual man as isolated from the common life of a glorified community. It holds in a perfected kingdom in which there is a communion in the King's life, and a consequent community of His children. This social element of heavenly condition must be held as belonging essentially to the fundamental contents and environments of the saint in his future felicity. Indeed, already here he has a foretaste of those social clusters that hang upon the celestial vines of God. His conversation (citizenship) is in heaven before he reaches the heavenly fields or walks the golden streets. Milton's description of Satan's hellish condition may be paraphrased and transferred to express one essential factor in the blessedness of the man who already now becomes a Son of God:—"Which way I fly is heaven; myself am heaven." And still it doeth not yet fully appear what he shall be. There is another factor equally essential to his full consummation of redemption and bliss.

A heaven without locality would neither meet the nature of man's wants nor satisfy the wants of his nature. In his essential constitution man is an inhabitant of time and space. This he must always continue to be, even though time be merged into infinite duration, and his present idea of space be swallowed up in the vast expanse of the illimitable. Men of intelligent Christian faith are, therefore, justified in their efforts to "seek a country, a better country, that is an heavenly;" and one that has a location in distinction from all other sections in God's created universe. Only those ethereal souls who are content with a half-truth lose sight of the other equally important half. The Christian philosopher, however, is not satisfied with a mere state of blessedness, even if such a state were possible without its complemental hemisphere. He wants that blessedness localized in accordance with the yearnings of his Father's children and the promised mansions of his Father's house. In brief, we have as little adaptedness as we have desire for a mere ethereal realm with nothing more definite and substantial than the immortality of dreams and the immensity of emptiness.

Where then is heaven as something to be viewed also under a local aspect? At what place in the universe are the garden-gates of the Hesperides open to the Christian's feet no less than to his faith and fancy? Where is the telescope of sufficient power to sweep the longitude, the latitude and the altitude of the steller dome, and discover to our weeping eyes the final abode of our homesick selves? Shall we permit our imagination to soar with unlimited license into all space until our conception of the Elysian Fields is sufficiently comprehensive to embrace all worlds? We are not so inclined. Such an idea of ubiquitous felicity would leave no room for locality in space. Shall we, with Isaac Taylor, seek for our future home in the sun? Such a theory is too thermal for our orthodox dread of the other place; yet that might serve as a place of very beneficial resort for those philosophers who continue to insist that heat is nothing more than a mere mode of motion. Shall we look with Dick or Mædler beyond our own luminary, to some more central sun, or central place in which to locate the eternal city of the Great King and the ultimate home of his happy children?

One thing may be said in favor of the last mentioned theory. It affords plenty of room for speculation. But speculation is not a safe guide. We need a more sure word of prophecy, whereunto we would do well to take heed. The Holy Scriptures are not entirely silent respecting this subject of such absorbing interest. They tell us of the way to the place by pointing us to the Forerunner who "passed into the heavens" (Heb. iv, 14) "ascended up far above all (visible) heavens" (Eph. iv, 10), into *heaven itself*, "now to appear in the presence of God for us" (Heb. ix, 24). And there can be no doubt that it is the highest mission of astronomy to confirm the truth of the Scripture cited in the passages as quoted above. When in the further advancement and achievements of astronomic and theological science these two celestial sisters shall be glorified together in the mutual confirmation of each other's testimony to the truth, then will men be the better able, not only to grasp and hold clear conceptions of heaven, but also to approximate the solution of the problem which has to do with the very location of that happy place "beyond the clouds, beyond the tomb."

Assuming the correctness of the foregoing observations, we repeat that the true and full idea of heaven lies between two equally false conceptions, viz., that of exclusive spiritualisticism on the one hand, and a prevailingly materialistic notion on the other. This true con-

ception holds in proper conjunction what God has decreed should not be put asunder. God has ordained that the highest attainable condition of man should be joined in everlasting wedlock with the holiest place in the universe. Hence, while the Forerunner has gone to prepare a place for his disciples, he is also here preparing his disciples for the place.

But what of the nature, extent and variety of heaven's glorious and glorified contents. Suffice it to say, that everything in the Father's house, of which the happy child can form a positive concept will be *substantial.* The saint will find his ransomed spirit clothed upon with a body. Both spirit and body will be of an equally enduring substance. The proper distinction between material and immaterial substances will there be continued. As matter is neither essentially evil nor exclusively phenomenal, and as the Father of human spirits ordained that they should externalize themselves, it must follow in logical reasoning, as well as from the teachings of revelation, that the material body and immaterial, yet equally substantial, soul of the saint are to share with each other in that common glorification that awaits them in a substantial place, surrounded with substantial environments of future perfection and bliss.

And what of their employments? Reason assumes and revelation teaches that there will be no idleness there. Activity is the fundamental law of man's normal existence. In heaven human activity will perfect itself in praise; praise will culminate in celestial music, and music will be both vocal and instrumental. "They sing the song of Moses the servant of God, and the song of the Lamb: and there will be heard the voice of harpers harping with their harps." Thus "the daughters of music," instead of being "brought low," as in the death-march of Ecclesiastes, will

> Soar and touch the heavenly strings,
> And vie with Gabriel while he sings,
> In notes almost divine.

Fremont, O.

MOLECULES AND ETHER.

BY PROF. ALONZO HALL.

If sound propagation is the result of wave-motion, and wave-motion—in air—consists of condensations and rarefactions of the air as the wave passes through it, I am of opinion that, in order properly to understand the philosophy of ærial undulations, it is important first to analyze the movement of the instruments which make an air-wave possible.

The wave-theory teaches that, when the tuning-fork, for example, is bowed, the air is forced into periodical condensations and rarefactions by its forward and backward movements, and this effect is what we call sound. It also teaches—by implication at least—that the greatest amplitude of vibration or width of swing of any air particle, is in the wave nearest the prong; and the greatest excursion to and fro of any particle in the wave, can not be shorter than the swing of the fork. Whether it can be longer, remains to be seen, or rather, determined.

The air-wave, then, is caused by the periodical movements to and fro of the air-particles or molecules; and if we can first analyze and understand the theoretic motions of the molecules, the true conception of a complete sonorous wave would be more likely to be gathered. With my mental vision I try to see the primitive molecule make its first excursion. I mean a molecule in contact with the prong of the tuning-fork whose vibrational number, we will assume, to be 256 per second.

According to the wave-theory I will be able to see the molecule moving outward from the center of disturbance, and describing an ellipse (so the theory teaches) whose diameter should not be less than the greatest swing of the fork's prong.

But before the molecule completes its orbital swing and is ready to repeat the excursion, every particle or molecule of air, in a direct line outward from the prong, constituting a complete vibration or wave, must have made a start toward completing its own individual swing or excursion. Half of the molecules in the alleged wave, will have completed their forward movement, and will be in all phases or positions of their return trips called the rarefaction of the wave while the other half will be in all phases of forward movement, making the condensation necessary to the complete wave. The first molecule of this condensed half will have just completed its forward movement, while the last one—farthest from the fork—will have just begun to move and the two molecules mark the extremes of the condensed part of the complete sonorous-wave.

Of course that part of the wave that is now rarefied, was *all* in a state of condensation and when so condensed, is, in what might be termed a graduated density; the densest part being at the source where the molecule has completed its half excursion, and the least dense at the particle that had just begun to move.

The condensed part of a sonorous-wave, therefore, must be a shell half as thick as the whole wave-length. If the fork vibrates 256 times per second, the wave-length, as a consequence, should be four feet four inches, the condensed part of the wave, therefore, would be a shell two feet two inches thick.

I can conceive a person to be so stationed that his entire body would, at one instant, be wholly within the condensed, and the next instant as wholly within the rarefied air as the wave was moving outward. Disregarding the fact that the shell, in changing from the condensed to the rarefied state, presents the phase of an unlimited number of infinitely thin shells ranging from condensed to rarefied, and remembering that the alternate temperature is warmer and colder than still air, I can conceive that a person so placed—if his physical perceptions were keen enough—would experience the most exquisite rigors as the changes from hot to cold should take place.

Let us examine the motion of our primitive molecule still further. Knowing that the calculated velocity of the wave, according to the accepted theory of density and elasticity of the air, is about one-sixth less than observation makes it, and remembering Laplace's ingenious explanation of this discrepancy, namely, that the compression caused by the advancing molecules evolves heat, thereby increasing the elasticity of the air sufficiently to augment the velocity from 916 feet as Newton calculated, to 1,090 feet as observed, it is in order to discover, if we can, where the extra heat comes in. No doubt it must occur in front of the molecule.

But I must first see the ether particles in front of the advancing molecule of air, and which fill the interstices between them, *crowded together* and evolving this heat, then see the

air molecule quickening its speed and charging into the hot ether-waves with a motion one-sixth greater than that given it by the prong! But if the molecule goes faster than the prong it must go *further* than it would have gone from the impulse of the prong alone, and if the first instant of forward movement evolves heat and quickens its motion, then as the molecule must have *accelerated velocity* to the end of its swing, this swing should become infinite!

I believe no wave-theorist denies that the change in temperature of the condensed part of the sound-wave is due to the sudden squeezing together of the ether (?) particles surrounding the molecule of air or wave-element, since the air-particles do not touch each other, and that the compression is effected in the short time of the half vibration of the prong. The alleged wave-element can, no doubt, be moved so slowly that no heat or at best an insignificant degree of heat will be generated. That is to say: more heat will be evolved from the condensation or moving forward *one-twentieth* of an inch in a given time than the *one-millionth* of an inch in the same time; and so proportionately less heat is evolved by the excursion of the molecule at the last than at the first of its vibrations.

It will be remembered that the Laplace formula gives the same extra degrees of heat as evolved for all sounds and for all intensities, without any reference to the energy exerted in moving the molecule. It may interest the readers of the MICROCOSM to know just how many degrees of extra heat are evolved by a condensation, and I take the liberty of inserting an equation copied from "Bartlett's Acoustics." It is the last equation where the determined values, *i. e.*, the *normal temperature, calculated velocity, observed velocity*, etc., are inserted for the algebraic values, and is as follows:

"$t-32^\circ=\frac{1}{0.00205}\left[\left(\frac{1089.42}{916.69}\right)^2-1\right]=199.71^\circ$ Far."

"(t)" is the temperature of the condensation and 32° is the temperature of the atmosphere at freezing point. If a thermometer could record the augmentation it would show 231°, or 19° *above the boiling point of water!*

To repeat, then, it is plain that the molecule must make a longer excursion than it would if it depended wholly on the impetus given it by the prong.

It is also clear that when the molecule makes its first and longest excursion it should disturb more molecules than when it makes its last or shortest one.

If the half-wave-length (two feet two inches) contains a certain number of molecules and the last—*the shortest*—excursion of the primitive molecule disturbs them all, surely the first—the longest—excursion, should disturb more molecules than can be contained in the two feet two inches, and consequently the longer excursion should make a longer half-wave-length than two feet two inches and sound velocity should increase proportionately with intensity and *vice versa*. It seems simple nonsense to teach that the vibration or swing of a molecule—no matter what the amplitude may be—can communicate its motion to exactly the same number of molecules for each swing without regard to its displacement or distance of swing.

It is such analysis as the above that makes me disbelieve that sound is transmitted by the molecular vibration of the conducting medium, and I doubt very much whether I am prepared to acknowledge the existence of a molecule, any more than I am prepared to believe in the existence of such a material entity as ether.

THE ANNULAR THEORY.

BY PROF. I. N. VAIL.

No. 11.

A glance at man's primitive Eden, as portrayed in Genesis and much traditional literature, shows that it was not a local garden, but world-wide in extent. That Eden in which lived naked, primeval man; in which grew all manner of trees; in which lived all kinds of beasts, which the Adam named could not possibly have been comprised within the narrow compass of Mesopotamia. To strip the account before us from all inconsistencies we must make Eden—man's primitive home—the vapor-enshrouded earth. In order to show that the prevailing idea is incongruous with sober reason, I will devote a little space to this subject. Let us imagine the earth of to-day enshrouded in alternated vapors, so deep as to hide the body of the sun. In this case the physicists will tell us there would be perpetual summer. All the solar heat would be received by and absorbed into the vaporous canopy, so that by its universal diffusion in the mass, all parts of the earth would be warmed measurably alike. All vegetation, as in a mighty greenhouse, would cease to have the habits it now has, and in course of time the earth would become an ocean of perpetual green and bloom. Perpetual growth and life, and slight decay would characterize the earth.

But man, in that green-house, would likewise eventually fall into the same line of habit. His life would be prolonged, just as that of the plant. In the same environment he would grow but not mature. It is well known that it requires the unmodified action of the solar beam to vivify and fructify all organic nature. To ripen for reproduction requires the maturing power of pure, direct sunlight. It is very plain, then, if man in Eden was protected by annular vapors he could not ripen and bear fruit to the same extent he now does. Fruit-bearing, in all nature, is the march to death, and I am then forced to conclude that man, in a tholoform or canopied enclosure, marched more slowly to his end in death, and that the more perfect that protecting canopy was, the nearer did man approach immortality on earth. I say, then, that the annular philosopher *must come to this conclusion* independent of any legendary knowledge. Whether there be a particle of truth in the Eden narrative or not, implacable law in world-evolution demands annular conditions, and one of those conditions is an Edenic clime; and an Edenic clime means *long life* under annular vapors—shut in from the chemism of the solar beam. But what must we think of that narrative when it declares most impressively that, throughout the interdiluvian period, man lived eight or nine hundred years? What shall we think of the impression given to man that man was deathless in Eden? Say what we will these reminiscences had a foundation in fact, and when we turn to the concurrent testimony in mythology, among so many races, we certainly find no inducements to abandon our theory.

Now, on the other hand again, I say that if

the declaration in this Hebrew narrative be true; if man ever lived to be 800 years old, he *lived under a canopy* that protected him from the actinism and ripening power of the solar beam. That is, if man possessed that great longevity as stated, the *earth was over-canopied by annular vapors!* Whence this dovetailing evidence? We have simply come to this point in our investigation: If the Hebrew narrative be true, the earth once had an annular system, and, on the other hand: If the earth had an annular appendage the Hebrew records of Genesis are true. But I wish it borne in mind that we have scarcely entered the threshold of these inquiries, as I now turn temporarily from the Edenic narrative to secure valuable testimony further down in time.

I want, now, to show that the "deep" over which "darkness" brooded, and over which the spirit of the Deity hovered, was the *celestial deep.* I have elsewhere said that it is unphilosophic to claim that the "Spirit of God moved upon the face of the waters" located on earth; for, all races looked to the sky as the Deity's home. This claim is most abundantly supported in the following: "In the sixth-hundredth year of Noah's life, in the second month, on the 17th day of the month, on the same day, *all the fountains* of the *great deep were broken up*, and the windows of heaven were opened, and the *flood was on the earth* forty days and forty nights."

Now, it is plain that if that *deep* was on high it was "broken up" or annihilated as a celestial deep by a mighty down-rush of waters, and if located on earth it was not "broken up" (for *it* yet remains); which conclusion will the reader take?

Again, if that deep was broken up on high, that very act must have opened up to view the *skies*, or *heavens beyond it*, and a flood of light is then thrown upon the declaration that the "*windows of heaven were opened*" *at that time*—why this dovetailing of facts?

I say, then, if there ever was a day in which the heavens were thus opened, it was the opening of the annular canopy, and I say, too, if there ever was a day when such a flood of waters fell upon the earth for forty days and nights, *those waters came from an annular canopy*, for there is no other competent source.

Again, the "breaking up" of a "deep" produced the "flood" of rain! That is, that deep was the source of an avalanche of waters, just such as have left their way-marks throughout all the ages of geologic change. Did such descending floods come from on high or from beneath?

Now, let us remember that there were "*Waters above the firmament*," and that they remained there till the *heavens* "*were opened*," or cleared, for if they had been opened before they could not have been opened at this time. Hence it is conclusive that the waters above were the same that rolled away at this time, and opened the heavens. That is, the "great deep" whose "fountains were broken up" were the "waters above the firmament."

There was a day, long passed and gone, when man saw the magnificent curtains of the "great deep" roll away forever. New-born skies looked down through windows that never closed again. Fountains poured out their last libation. The sun came into view. Earth felt the inevitable change again for the last time. Man entered at once into a new environment, and in a few generations his longevity was reduced to three-score and ten years, from this cause above.

But now let us view the scene from another side. It is as plain as the noonday sun that if the "fountains of the great deep were *broken up*," or, which is the same thing, if the "windows of heaven were opened" the earth's annular vapors had disappeared; and the sky now being clear and the sun having its full power, many phenomena that could not obtain during the existence of that canopy would now come into view for the first time. Winds and storms, before held in control, would now begin their eternal round. And is it not a little remarkable that at this very time, when the rains ceased, "God sent a wind over the earth" and drove back the waters. Any one can see how this first wind we hear of in this ancient record could accomplish this in the estimation of man, when he remembers that the trade winds and, perhaps, all phenomenal currents, began their round when the sun first came in as the grand monarch of the earth. And now I come to the consideration of the chief evidence of our hypothetic canopy. If the "great deep" was on high, and the "*breaking up*" of its fountains produced a flood, it seems like the most positive proof that that flood was of annular origin. But if such evidence as I have adduced be unsatisfactory, I will now produce a witness that is most positive and absolute in its testimony. During all the time that an annular canopy existed, such a thing as the occurrence of a rainbow was an impossibility, as any one can see. Never until the sun could shine down through the "*opened*" heavens could a "rainbow form on the clouds." But now we are told that when that deep was broken up the rainbow *was placed in the heavens.* But if the bow appeared then for the first, it is positive proof that the sun then came into view through annular vapors. We can not, by any means, avoid this conclusion. Everything, then, from the very first intimation of "waters above" simply terminates here, at the great deluge and "fountains broken up," and heavens opened—at the sun and bow in the sky. I challenge the world to produce a man that can begin to satisfy all these conditions without annular aid.

And, finally, let me wind up this article with one more link of evidence, and we will then be prepared to go back to the Eden narrative for a royal feast.

While the heavens are clear as they have been since the "great deep" disappeared, every one of my readers must see that there can never be another deluge from annular waters. Those fountains have been destroyed, and a flood from that source is a physical impossibility. It must also be seen that that source is the only one that could possibly be broken up so as not to be the cause of another flood. But this narrative states that even Jehovah has promised man He will never permit the waters to become a flood any more. Has He promised that the "deep" on the earth shall not become a flood any more? No! It has become floods again and again in historic times. Has He promised that the clouds shall not flood the earth? No! They have done it many times within the memory of man. Has He promised the earth that never more shall

the waters of the "*great deep*" *on high* become a flood? He has! emphatically. He has declared and proclaimed to every tenant of earth that the day and ages of annular floods have ended, and every part of nature knows it, and knows, too, that no other floods *have* ended. So long as man sees the rainbow, then, he knows the skies are clear of *annular vapors only!* The bow has thus become Nature's emphatic SIGN that the earth shall be forever free from a flood from an annular fund of waters, and *it can be a sign or token of safety from no other.* And yet this narrative tells me that *God made the bow a "token" of safety.* Then I say that bow is an absolute and infallible sign that the great deep was the "waters above the firmament," and that the earth once had an ANNULAR SYSTEM.

Elsinore, Cal.

EVOLUTION.

BY REV. DR. JAMES A. BUCK.

Dear Dr. Hall,—After the overwhelmingly destructive criticism in your "Problem of Human Life," it seems presumptuous in any other to say anything on the subject. But as evolution has still its advocates even in some of our most prominent religious papers, I write to call attention to your masterly refutation, and also to add a few thoughts of my own. And as the skirmish line to feel the enemy goes before the great army, so I will put my own thoughts first.

"After its kind." This is my plea. These words or their equivalent occur ten times in five verses of the first chapter of Genesis. What is their import? They must mean very much to occur so often in a record so condensed. We maintain that these words, while they refute evolution as taught by scientists, make the creation of all species most substantial and enduring.

There are few words in modern literature more misleading than the word evolution. There is evolution and evolution, a true and a false, and much evil results from confounding one with the other. When the word is used to show the wonderful changes from germ life to full development of all things in the air, on the earth and in the sea, it means, of course, what has always been known by the word growth. But growth is not evolution as taught by Darwin and Hæckel, the fathers of this term in modern science. Darwin, while he acknowledges the creation of one or more species, denies the creation of all species, and still more God's imminence and providence in their propagation and preservation. He everywhere maintains that higher species have been evolved from lower species by natural selection and survival of the fittest? Hæckel is the author of spontaneous generation and denies both God and creation? With these writers Christian thinkers can have no sympathy, and no more to do than Samuel had with Agag, as One infinitely greater than he had to do with the Levites and Pharisees of old. If we must war a deadly warfare, we must use deadly weapons. "War to the knife" should be our motto when dealing with such flagrant enemies of truth and righteousness; for the teachings and drift of all such men is not Divine, but just the contrary.

But what about Theistic evolution with which some Christian ministers are most strangely infatuated? If its advocates mean the same as has always been known by creation and Providence, why not say so? Why use the misleading and infidel and atheistic word evolution? Is it so captivating? Why if of Juda do they use the language of Ashdod? But to bring my subject to a conclusion, or to close up the skirmish line and to bring on the main action, how does Moses say man was made? For this is the crucial question, or should be so, with all Christian theorists. What was his beginning and what has been his continuance? Has it been "after his kind?" Was he made by flat and immediate creation, "perfect" and "very good?" So says Moses. Or was he made by evolution, through an anthropoid ape, and through countless ages, from a moneron or slimy cell at the bottom of a pond or lake? Or was he made a mere animal, and suffered to remain so for an indefinite period? No! no! Moses tells us that "God made man in his own image and after his own likeness," viz., he was made "holy, just and good," and as wise, great and glorious as infinite skill and infinite power could create him to be man. But if there was the first Adam, what more can be said of the second Adam? Both were "perfect" and "very good;" one by creation and the other by generation. But alas! though "God made man upright, he hath sought out many inventions," and among them, few stranger than his attempt to belittle himself, and to account for his origin by any system of evolution.

And to make absurdity still more absurd, let those who believe in Theistic evolution tell us how long Adam was in "a deep sleep"—while God took a rib from his side, and evolved Eve in all the perfection of her grace and beauty? For she must have been a creature of marvelous attractions to be worthy as a help-meet for Adam in his pristine greatness and glory.

But alas! How are the mighty fallen! Yet man, though fallen, is always and everywhere still man, "the noblest work of God." He is in all time and everywhere man, "after his kind," possessing much of his original greatness, and thanks to God Most High, through the intervention of the second Adam, the Lord from heaven, he may regain all and more than he lost.

So much for my views on evolution, upon which very much more might be said. But if any of your readers want to see the subject most thoroughly handled, I refer them to the concluding chapters of your "Problem of Human Life Here and Hereafter." This famous book, of which some 70,000 copies are in circulation, is really, I may say, three books in one. But it moves like a three-fold army converging into a consolidated phalanx to storm the opposing citadel. The "Problem" is so far victorious, unanswered and unanswerable. We have said it is three books in one. The first four chapters treat of the new Philosophy known as Substantialism. The fifth and sixth meet Tyndall, Helmholtz and Mayer, and overturns the wave theory of sound. The seventh, eighth and ninth are a refutation of Hæckel, Darwin and Huxley, and in the tenth and eleventh the author shows the difficulties and absurdities of scientific evolution in any sense—Theistic or Atheistic. I have all Dr. Hall's works, and have read and studied them with much care, and can vouch for him as an original and profound thinker.

Washington, D. C.

PROF. VAIL'S ANNULAR THEORY.

We can not help calling the attention of our readers to the remarkable series of papers now appearing in the MICROCOSM from the pen of our excellent contributor Prof. Vail. Whatever old-time geologists may have to say in reply to the professor's startling positions and arguments, one thing is certain, that no such novel, original and exciting geological discussion has ever before, at least to our knowledge, found its way into print, as that which we have the exclusive privilege of giving to the public.

If any prominent geologist of the current school of science shall think himself able successfully to explain the dovetailing of scientific facts, natural analogy and biblical expressions, as set forth by Prof. Vail, on any other hypothesis than that of the annular system of our earth during pre-historic times, we shall be very glad to give him the opportunity of so doing as soon as the professor's series of papers shall be concluded. At any rate we do not hesitate to declare, so forcibly have Prof. Vail's papers impressed us, that we take no little pride in placing his annular theory on record in these pages along side of the Substantial Philosophy.

"SWIFTLY ADVANCING"—"VERY MUCH FASTER."

BY THE EDITOR.

The fact that the entire framework of the Substantial Philosophy is based upon the assumed fallacy of the motion-theories of science, and the further fact that all these theories confessedly stand or fall on the truth or falsity of the wave-theory of sound as the mother of all other motion-theories of science, is our excuse for so continually and persistently assailing that theory in the pages of the MICROCOSM. For plainly, if the wave-theory of sound can be shown to be incorrect, there is not a physicist any where who would not admit the motion-theories of heat, light, magnetism, electricity, etc., to break down under the same class of arguments. And if these motion-theories shall thus fall to the ground under the blows which we are leveling against the wave-theory of sound, then manifestly the substantial theory of all force follows as the only conceivable alternative, since any phenomena-producing cause in nature if not motion must be an objective entity. Any other conclusion is unthinkable.

Still further, therefore, to impress scientists with the inherent fallacy of the wave-theory of sound, we have selected the words in our heading as the text for a few brief remarks. This language as is well known is the phraseology employed by writers on acoustics to express the character of the motion of a tuning-fork's prongs as compared to that of a clock-pendulum. Prof. Tyndall, in his standard work on sound, says:

"Imagine one of the prongs of the vibrating fork *swiftly advancing*, it *compresses the air* immediately in front of it, and when it retreats it leaves a *partial vacuum* behind, the process being repeated at every subsequent advance and retreat. The *whole function* of the tuning-fork is to *carve the air into these condensations and rarefactions.*"—*Lectures on Sound*, p. 62.

Prof. Helmholtz teaches the same doctrine in regard to the supposed swift movement of the prongs of the tuning-fork as compared to that of the pendulum. He says:

"The pendulum swings from right to left with a uniform motion. . . . Near to either end of its path it moves *slowly*, and in the middle *fast*. Among sonorous bodies which move in the same way, only *very much faster*, we may mention *tuning-forks.*"—*Sensations of Tone*, p. 28.

This idea—that the prongs of a tuning-fork or the strings of musical instruments strike the air with great velocity in order to produce the "condensations" essential to sound-waves—was the universal teaching of acoustical writers up to the time of the first issue of the "Problem of Human Life," since which time, as a suggestive fact, not one writer in Europe or America has printed a word on the subject.

That doctrine of the "*swiftly advancing*" *prong* or *string* was the soul and essence of the wave-theory of sound; for what nonsense would it have seemed to the young student of physical science to teach him that the mobile and unconfined air could be driven into condensations and rarefactions by a body having a very slow travel, however many times it might move forward and backward! Hence these writers, in order to guard against such a logical conclusion on the part of students of acoustics, have always taken particular pains to tell them that the travel of the prong or string is a "swift" motion and "very much faster" than that of the swinging pendulum, when in fact the fork sounds audibly while its travel by actual measurement is more than a million times slower than that of a clock-pendulum. (See MICROCOSM, Vol. III, page 154.)

This original discovery, first announced in the "Problem of Human Life," was elaborated by the author in the MICROCOSM by a new method of actually measuring the velocity of the prong's travel, even after it had been audibly sounding four minutes—a thing never supposed to be possible up to the time of that discovery. But not being a mathematician, we reported our discovery to Capt. R. Kelso Carter, Professor of Higher Mathematics in the Pennsylvania Military Academy, who pronounced it one of the most important and original acoustical discoveries ever made. He then

proceeded at once to determine the velocity of the prong's travel by this new method of measurement from the time it is first bowed to the close of its audible swings (four minutes), with the result as stated and given in the MICROCOSM.

How Tyndall, Helmholtz, Mayer, Rood, Sir William Thomson and Lord Rayleigh must have felt can only be imagined when they learned for the first time in their lives from this demonstration, that instead of the prong "swiftly advancing" and traveling "very much faster" than a pendulum, it actually can be heard sounding when traveling 25,000 times slower than the hour-hand of a clock!

They must have seen from this astounding measurement that the entire air-wave system of sound-propagation had vanished into something thinner than Prof. Tyndall's scientific smoke of brown paper. Yet not one of these writers has had the philosophical manhood either to acknowledge the fact, or to attempt to overturn our demonstration, for the reason that any open attempt, as they well know, to question the substantial correctness of that measurement or defend the wave-theory from its crushing effect, would be to inaugurate a logical cataclysm of discussion that would sweep their acoustical text-books out of existence. Hence silence to them was literally golden. Notwithstanding their silence, however, it is well known that the revelation thus made in regard to the almost infinitely slow travel of the tuning-fork's prongs, hurled consternation into the ranks of all thoughtful physicists from one end of this continent to the other.

But silent and sullen as have been the English and German physicists on this startling announcement, they have at last been forced, *nolens volens*, before the glaring foot-lights of popular investigation. The scathing criticisms of the wave-theory as set forth in Dr. Audsley's lectures before appreciative London audiences, have succeeded in calling out replies from numerous advocates of that theory at the conclusions of his lectures, with all sorts of imaginable attempts at evading the destructive force of his arguments. They now seem to see for the first time that something desperate has to be done if their undulatory cause is not to be ingloriously lost. To let the charge pass unnoticed, that all the great physicists of the world up to 1877, when the "Problem of Human Life" first appeared, were ignorant of the fact that the prong of a tuning-fork produces sound when traveling a million times slower than a clock-pendulum, they now see would be to stamp with doubt and unreliability all the works on acoustical science up to that date. Hence, for example, these critics of Dr. Audsley excitedly declare at the close of his recent lecture that he had evidently misunderstood the authors from whom he had quoted, and that the "swiftly advancing" of Tyndall and the "very much faster" of Helmholtz, instead of meaning a swift travel of the prong, only meant "a *very much greater frequency of vibration*" than that of the pendulum of a clock!

Plainly these critics had to say something in reply to this "swiftly advancing" argument or at once abandon their theory, and this ridiculous assault upon Tyndall and Helmholtz as incapable of understanding the true meaning of words was manifestly the last ditch of the wave-theory.

But as Dr. Audsley had not time to answer them, we shall now bring them to a public trial that will settle them "very much faster" than they then fancied possible. To do this let them try to analyze the two passages quoted at the commencement of this article in the light of their shallow interpretation, and see if they can make "*swiftly* advancing" by Tyndall and "very much *faster*" by Helmholtz mean a "*greater frequency* of vibration" than that of the pendulum? What sense, for example, would there have been in Tyndall's lecture had he meant to teach as these critics insist: "Imagine one of the prongs of the vibrating fork" *frequently* advancing; "it compresses the air immediately in front of it, and *when it retreats*" from *frequently advancing* "it leaves a partial vacuum behind" *this great frequency of vibration*, "the process being repeated at *every subsequent*" *frequency* of "*advance and retreat*," etc.!

It passes comprehension that learned critics do not know the difference between "swiftly *advancing*" and "*frequently vibrating*," especially when Prof. Tyndall immediately adds *retreating and leaving a partial vacuum* as distinct from the "swiftly advancing" which condenses the air. But almost anything may be expected from men who can accept the wave-theory of sound without being able to detect any of its glaring absurdities.

Then next let these critics try to prove Helmholtz a similar dunce in the use of language by giving a similar interpretation to his words. Thus: "The pendulum swings from right to left with a uniform motion. . . near to either end it moves *slowly*," that is, with infrequency of vibration, "and in the middle fast," or with *great frequency of vibration*. "Among sonorous bodies which move in the same way but *very much faster*," that is, with *very much greater frequency of vibration* "we may mention tuning-forks!"

The result of this simple analysis of the words of these two highest living authorities on sound forever settles the question that, up to the revelation made in the "Problem of Human Life" and the MICROCOSM, the wave-theory was based upon the mistaken idea of physicists that the prong and string must necessarily travel swiftly in order to produce the "condensations" essential to sound-waves. As this essential phase of the theory is here incontinently wiped out, all rational excuse for further teaching that theory has ceased. Will professors of physical science in our colleges have the manliness to acknowledge the force of this reasoning?

MATTER AND FORCE.

BY THE ASSOCIATE EDITOR.

It is seldom in the course of any investigation that we find two elements which are so closely subjoined and connected with each other, yet so absolutely different in their elemental bases, and so completely independent of each other for existence as those mentioned in the caption of this article.

It is a universally admitted scientific fact that the existence of the material world in its *tangible* shape is due to the action of force, and that the peculiar material formations which are manifested are given their particular characteristics by the action of the different forms of force. It is not the purpose of this article to dispute this fact, but rather to defend it. Our purpose being more to point out a constitutional difference between matter and force, and to show that while the two principles are joined together in universal and almost infinite relationship, nevertheless as pure matter and force they are not to be confounded, nor are they to be considered as primarily dependent in any sense upon each other.

While these two elements in their interlocking alliance represent the complete and eternal constitution of the universe, and by their combination or coalition are each endowed with the properties or characteristics which give them their differing molecular structures, and consequent usefulness or uselessness in the economy of natural requirements, yet were they by any means separated from each other neither would be annihilated or cease to exist, but would simply be relegated back to its primeval condition of crude matter or crude force.

Thus, while there is an intimate relationship and seeming interdependence between matter and force, the dependence is only apparent, as the two elements being by nature different, are possessed of the virtue of separate self-existence. One is material, the other is immaterial, and while the material is dependent for its various phases and ramifications in the *tangible* universe upon the immaterial, and the immaterial dependent for its opportunities of manifestation upon the material, yet matter *per se* is not the resultant of force action, nor is force the resultant of any form of material action.

It is clear that this must be the position of the Substantial Philosophy with regard to these entities: for, to consider matter to be entirely a secondary condition of the universe—but an emanation from force—is at once practically to deny the existence of the immaterial realm, making it instead an infinitely attenuated condition of material existence, from which matter is simply the condensation, resultant from the continuous action during ages of time; while, on the other hand, to make force dependent for its existence upon material action would be to strike from under Substantialism the very corner stone upon which its superstructure has been reared.

From substantialists, therefore, this doctrine of a distinct line of demarkation between matter and force as substantial and independent elements in their originally crude states, may expect no semblance of disapproval, but from the generally accepted schools of scientific and philosophical teaching, whose whole systems have been founded and carried out on the supposed dependence of force upon the previous existence of matter and contrarywise, such a claim can hardly expect to be favored with even a suspicion of mercy.

Between two otherwise antagonistic schools of philosophers, there seems to be a harmony in that they regard the phenomena of matter and force as entirely dependent one upon the other for its existence, the magnitude of their dispute when reduced to its essence entering apparently upon the superior claims of either the matter or force phenomenon to prior existence.

The undulatory scientists, to whom belong Tyndall and Helmholtz, regard force universally to be simply the resultant of the molecular motions of matter which, as has been shown, had no existence before the material motion began, and can have none when the motion ceases; while, on the other hand, we have the idealists numbering among their school Hume and Spinoza, who, for their dictum, declare that *matter* has no reality, relegating it to a similar state of dependence upon force by their teaching that it exists only in the sensuous perceptions and conceptions, which sensuous actions are universally admitted to be simply properties of mental force.

If both these schools of teaching be correct the inference is unavoidable, that the universe is a myth, an empty state of nothingness, for if the position of the idealist be true that matter is dependent for its existence upon the activity of mental force, then according to the equal truth of the position of Tyndall, Helmholtz, Mayer and all other authorities on Natural Science, there can be no such thing as force, since force of all kind is dependent upon the previous presence and agitation of material molecules. When brought to their fundamentals either of these positions is as correct as the other, the difference between them being only caused by whether they take the matter or force as the starting point of physical being. So much has been said in the past volumes of this journal proving the absurdity of both these positions that we will not here occupy space by a repetition, but will go directly to the effects which this principle of a separate and distinct existence of the material and immaterial departments of the universe will have upon the present theories of the natural forces.

There is no good reason that we can see on the basis of consideration that there are in the constitution of the universe two factors, matter and force, equally independent of each other, equally important and equally extensive, why

in their peculiar realms of existence they should not have equally the same conditions, the same manifestation of properties, and the same general reign of laws differing only in being suitable to their particular requirements.

There is without doubt a structure of particles in the constitution of force as well as in matter, and as in dealing with material substances such expressions as weight, thickness, transparency, etc., etc., are simply relative terms which convey to the mind the differences between the various forms and conditions of material existence, so undoubtedly in the immaterial realm there are analogous relative differences, and thus the consequent opportunities for comparisons, which we believe upon a better understanding of the conditions prevalent in this important part of God's domain will reveal to us properties and qualities which will vie with the material portion in number, variety and adequacy in fulfilling the natural *forcial* conditions.

This line of reasoning followed to its legitimate outgrowths, would naturally lead us to the apprehension of a world immaterial in its nature, and where immaterial but substantial existence was possible in the full exercise of all the faculties of mentality and consciousness, where we could possess the same functions of living and thinking as at present, modified only by elimination of the conditions necessary to terrestrial affairs, and the addition of those required by a more ethereal, but nevertheless a positively proven, real state. We will not, however, in this article enter into this branch of the subject, but will leave it for the consideration of our readers, promising in the future to venture a few thoughts and suggestions in connection therewith, confining this paper more particularly to an examination of the physical forces of nature in their connection with material phenomena from the standpoint above hinted at.

If it can be demonstrated that there is a resemblance between the world of matter and the world of force, in that both could have had independent existences in their primeval stages, as matter, however attenuated, and as force, however sublimated, it is reasonable to suppose that the developments achieved by one along its particular line would also be possible to the other in its line. Therefore, as all the phases of matter are simply properties, qualities or conditions of originally crude matter acted upon by an extraneous source, so also is it reasonable to suppose that all the various phases of force are simply properties or conditions of an originally crude force in much the same sense as brittleness, opacity, ductility, malleability, etc., etc., are simply properties of matter, and that when we speak of heat-force, sound-force, electric-force, etc., we shall understand them to be simply conditions or properties of the force-element, by which certain conditions are produced, and not original force-creations generated at the particular moment of their exhibitions. In the same sense as matter is undeniably dependent upon the action of force for its various conditions, so force is unquestionably dependent upon material conditions for its manifestations. The arrangement of the particles in a certain manner as in the vibrating tuning-fork, and an opportunity for the action of force is provided which indicates itself in the manifestation of sound, while should the same piece of metal be placed under other conditions the indications would be in the shape of the electric, calorific or magnetic properties of force.

The tangibility of matter, as also the peculiar structures through which one body is gold, another silver, another coal, another diamond and another water are, of course, dependent upon the action of some one or several combined phases of force, and in the same manner the manifestation of force, as also its peculiar conditions which exhibit at one time sound, at another light, at another heat, electricity, magnetism, cohesion and adhesion, are dependent upon the conditions provided by matter.

We can bring about the manifestation of any force that we desire, simply by arranging the material conditions in such a manner as previous experience has taught us will produce it; for example: we know that any two metals of differing potentials, placed together in any liquid, even water, will bring about the manifestation of electrical force. And by the same observance of material conditions we can produce heat, sound, light, cohesion, etc., etc.

In nearly all such cases the conjunction of force is essential to produce the material conditions, and in the majority of instances such assisting force properties disappear in accordance as the new property is produced. But this does not necessarily prove that there has been a conversion of one form into another, but may be taken just as logically and more reasonably to demonstrate that the material conditions having been altered, its particular property being no longer provided with opportunity for manifestation in much the same sense as the material property of brittleness is often dissipated by the introduction of new structural conditions, while the new force property which appears simply demonstrates that soil has been provided for it. Force, in its crude or indefinite state, is everywhere present ready for constant action under all the material conditions provided, while under the differing material conditions, it manifests itself in its differing properties. All these properties arise from the same original, crude force at work, with the only difference that the work being done has taken a definite shape.

(Continued from page 14, vol. viii.)

What is Sound? The Substantial Theory *versus* The Wave Theory of Acoustics.

BY GEORGE ASHDOWN AUDSLEY, F.R.I.B.A.

I feel I have said very little on this great subject, and that little very badly; but I must now leave argument in words for argument in experimental demonstration. Time will, however, only permit of a few experiments, and that in the direction of showing you upon what very shallow arguments and wrong conclusions the wave theory of acoustics has been supported by its greatest advocates. As I pass on you will see how perfectly the theory of *substantial sound force* accounts for each and every phenomenon.

By way of an introduction to my first experimental demonstration of the nature of sound, let me direct your attention to the different teaching of the old and new theories of sound.

According to the wave theory we are taught that sound-waves, mechanically generated by the vibrating or exploding body, are capable of mechanically moving, shaking or breaking other bodies against which they strike; whilst,

according to the substantial force theory, we are assured that sound force, however great its volume may be, is absolutely incapable of moving a cobweb, or any body whatever which is not in vibrational sympathy with that sound force. Or, as Dr. Hall puts it, "The differences between theoretic air-waves, according to the current theory, and pulses of sound force according to Substantialism, is this: the air-waves are supposed to be purely mechanical in their operation, striking any and all objects in their way with the same force according to resisting surface. On the contrary, pulses of sound force are supposed to act on no material object that is not in vibrational sympathy with them, any more than substantial rays of magnetism will act on a piece of wood or other body not in magnetic sympathy. There is no more necessity of assuming air-waves to be sent off from the vibrating instrument to beat against the tensioned string, diaphragm or flame, to cause its motion, than there is of assuming that the magnetism which lifts the distant iron bar does it through some action exerted upon it by the connecting atmosphere. If the immaterial but substantial force of magnetism can produce physical displacement of a ponderable body at a distance, why can not substantial but immaterial sound force do the same under a different law of nature?"

Now for our first experiment.

If you turn to the opening pages of the leading English text-book on acoustics, Professor Tyndall's "Sound," you will find, in the paragraphs devoted to the "Confinement of sound-waves in tubes," a very remarkable experiment described—the experiment I am now about to show you, just as Professor Tyndall performed it in the Royal Institution before a scientific audience, and then as I think it ought to be completed so as to get out its full teaching. Professor Tyndall thus clearly describes his remarkable experiment: "The weakening of sound, according to the law of inverse squares, would not take place if the *sound-waves* were so confined as to prevent its lateral diffusion. By sending it through a tube with a smooth interior surface we accomplish this, and the wave thus confined may be transmitted to great distances with very little diminution of intensity. Into one end of a tin tube, fifteen feet long, I whisper in a manner quite inaudible to the people nearest to me, but a listener at the other end hears me distinctly. If a watch be placed at one end of the tube, a person at the other end hears the ticks, though nobody else does. At the distant end of the tube is now placed a lighted candle. When the hands are clapped at this end, the flame instantly ducks down at the other. It is not quite extinguished, but it is forcibly depressed. When two books are clapped together, the candle is blown out. You may," continues the Professor, "here observe, in a rough way, the speed with which the *sound-wave* is propagated. The instant the clap is heard the flame is extinguished. I do not say that the time required by the *sound* to travel through this tube is immeasurably short, but simply that the interval is too short for you to appreciate it. That it is a *pulse*, and not a *puff* of air, is proved by filling one end of the tube with the smoke of brown paper. On clapping the books together no trace of this smoke is ejected from the other end. The pulse," concludes the Professor, "has passed through both smoke and air without carrying either of them along with it."

Now, I have no wish to be disrespectful, but I can not help asking the simple question—if any sane man can accept Professor Tyndall's experiment as a proof of the wave theory of sound, or believe his explanation of the whole matter?

I shall now perform the experiment before you exactly as Professor Tyndall performed it before his audience in the Royal Institution, in direct support of his favorite theory of sound; and then I shall conduct it as I think it ought to have been performed on that occasion, but was not, probably because its results would in no way have supported the wave theory.

Here is a tube similar in form to that used by Professor Tyndall, but much shorter. I prefer to use a short tube because the tests I subject the whole question to are very much more severe and conclusive with it than with a 15-foot tube. I place a lighted candle, with its flame immediately opposite the smaller orifice, and on clapping my hands at the other end the flame instantly "ducks down." Now, on clapping two books together the candle is blown out. Such were the results obtained by Prof. Tyndall; but is there a single person present on this occasion who believes for one instant that *sound* had anything whatever to do with either the disturbance or the extinction of the flame? Surely not. Yet Professor Tyndall assured those who witnessed the similar experiment in the Royal Institution that both effects were caused by a *sound-wave* —"a pulse and not a puff of air." We can not help thinking that the distinguished lecturer paid a very poor compliment to the common sense of his hearers, whilst he taxed their gullibility to the utmost. I need not waste time with the part of the original experiment which ended in smoke, but may pass on to my version of the experiment.

I relight the candle and place it, as before, opposite the small, conical end of the tube; and on the flame becoming perfectly still, I proceed to test the effect, not of simply disturbed air as in the previous case, but of powerful and true *sound force* upon it. I now take this horn, which is capable of yielding very loud and sudden sounds—much louder than any that can be produced by clapping books together—and placing its bell directly opposite the larger end of the tube, I produce several varieties of sound, loud and soft, short and sustained, yet to none of these does the candle flame "duck down" or show the slightest disturbance. Here, notwithstanding that the air at the bell of the horn is necessarily disturbed by that blown into the instrument from my mouth, we have no sudden concussion, no puff of wind, as in Professor Tyndall's *sound-wave* version of the experiment, but simply *sound* pure and simple; and this *sound*, or *sound force*, passes through the short tube and through the flame without finding anything in sympathy with it, and accordingly, without disturbing anything. Now what can the wave theorist say regarding Professor Tyndall's original experiment and my extension of it? Is it not self-evident that if the former supports the *wave theory* with its mechanically set up air-waves, the latter hopelessly refutes that theory? But even Professor Tyndall's experiment goes in no

way to support his theory, simply because it was a sudden gust or puff of compressed wind which literally blew the candle out, and not sound of any kind. Any one with a grain of common sense can see this, and it seems absurd insisting on the fact.

I have here a more perfect piece of apparatus, devised by myself, for the purpose of proving, in the first place, that vibrating sonorous bodies, while sending forth sound, do not disturb the air to any appreciable distance from their surfaces, and, in the second place, that the sound they send forth is incapable of moving or in any way affecting the lightest substances, or any substances or bodies whatever, which are not in perfect sympathy with the source of the sound.

The tuning-fork has been selected as the sound-producing body, because it is the favorite instrument in the hands of the acoustician for proving the existence of sound-waves, and for illustrating the mechanical action of those waves, as I shall show when I come to speak of sympathetic vibration and interference of sound. The remaining portion of the apparatus consists of a wooden tube, open at both ends, and furnished with small glass windows in the center of its sides. Suspended within and between these windows is a strip of gold-leaf, almost filling up the air-way of the tube. The tube has a long slot cut in its lower side so that it can be moved over the prongs of the vibrating fork; or, what is more convenient, the fork can be moved, after being bowed, into the tube. Allowing the gold-leaf to hang perfectly still, I set the large fork into full vibration, and then push it into the tube until one of its prongs is quite close to the gold-leaf screen. If we are careful not to disturb the air, we shall fail to observe the slightest flutter or movement of the leaf. Why is this? The wave theorist is bound to maintain that all the while sound-waves are being generated by the vibrating prong, and that they are sent off, with condensations and rarefactions, 4 feet 4 inches long, at the uniform rate of 256 in each second of time, and at the velocity of about 1,120 feet a second. The puzzle is how these waves—potent enough, in Professor Tyndall's estimatiou, to blow out a candle—manage to pass directly through the sensitive gold leaf screen without moving it. Here I might say, in the language of our greatest poet, "I pause for a reply."

As we are taught by the undulatory theory of acoustics that the sensation of hearing is caused by sound-waves or mechanically set up air-waves striking against the tympanic membranes of our ears and bending them in and out, it is highly desirable that we should, at this point, consider this important question connected with our sense of hearing, and strive to arrive at something like a true and logical conclusion anent the office and action of the ear.

The function of the ear is thus described by Professor A. M. Mayer, America's greatest wave theorist. He says: "Sound is the sensation peculiar to the ear. This sensation is caused by rapidly succeeding to-and-fro motions of the air which touches the outside surface of the drum-skin of the air. These two-and-fro motions may be given to the air by a distant body, like a string of a violin." After briefly describing the structure of the ear, the Professor continues: "Let us consider how this wonderful little instrument acts when sonorous vibrations reach it. Imagine the violin string vibrating 500 times in one second. The sounding-board also makes 500 vibrations in a second. The air touching the violin is set trembling with 500 tremors a second, and these tremors speed with a velocity of 1,100 feet in a second in all directions through the surrounding air. They soon reach the drum-skin of the ear. The latter, being elastic, moves in and out with the air which touches it. Then this membrane, in its turn, pushes and pulls the little ear-bones 500 times in a second. The last bone, the little stirrup, finally receives the vibrations sent from the violin string, and sends them into the fluid of the inner ear, where they shake the fibers of the auditory nerve 500 times in a second. These tremors of the nerve—how we know not—so affect the brain that we have the sensation which we call sound." We are further assured by this eminent scientist that the description "just given is not that of a picture created by the imagination." We shall see!

I feel that it is somewhat rash on my part to enter on so complex a subject in this short Paper, for it would require at least a full Lecture to do it justice. It is, however, quite necessary that it should be touched upon on the present occasion for the better understanding of my arguments.

It is probable that the illustration given by Professor Mayer may not at first strike one as containing any element of impossibility or absurdity, and if the tympanic membrane was merely taxed to vibrate with one uniform motion, at one uniform rapidity, and to transmit only one sensation or impression to the auditory nerve and brain at one time, we might, perhaps, pause before boldly questioning the truth of the whole matter. But let us think for a moment of what the tympanic membrane is called upon to do in accordance with the imperative demands on the wave theory of sound, and our reason at once starts out in open revolt at the mechanical impossibility it is asked to recognize as fact. Have you, musicians, in listening to a grand Symphony, performed by an orchestra of a hundred instrumentalists, tried, whilst you heard the united harmonies of all, and whilst you easily followed the sounds of each class of instrument engaged, to realise what your tympanic membranes were called upon to do according to the popular scientific hypothesis? If not, do so, and let your reason and common sense lead you to a true conclusion.

As I have given you the views of one great American scientist on tympanic vibration as caused by a single violin string vibrating 500 times in a second, let me now, in preference to any imperfect words of my own, give you the views of another American authority, Professor G. R. Hand, on the other aspect of tympanic vibration. "Substantialism is thundering at the gates of Popular Science, and demanding a re-examination of the facts and proofs of the undulatory theory of sound. Tympanic vibration opens the portals of her secret chambers and extends a cordial welcome to her auditorium. We enter for a few moments, and take hasty cognizance of the beauties and inconsistencies that press themselves upon our consideration, as the ear-drum labors with herculean efforts to convey intelligent sounds to the auditory nerve, according to the

popular theory. Now hold your breath, and pause, and look, and listen, as you mentally interrogate Dame Nature at every point.

"You see the little drum-skin posted at the vestibule to introduce the visitors into the *sanctum sanctorum*. It is required to bend its flexibilities and complacently bow each visitor into the audience-room, though they come thick and fast as hail upon the unprotected window. Hark! The solemn notes from the lowest audible pitch of organ-pipe gravely demand admittance, and the muscular elasticity of our little sentinel is taxed to its minimum capacity to admit the troopers, with a genuflection or audiflection for each sound-pulse at the rate of not less than sixteen per second.

"Simultaneous with these, a troop more numerous, and more active and persistent, demand an audience, as notes of a higher pitch, borne upon miniature sound-pulses, demand an introduction. Our little sentinel is now compelled to fly around and bow say 440 times in a second, whilst these are entering. You say this requires activity. Yes, it does. But remember, that while bowing 440 times per second, he is at the same time bending at the rate of sixteen times per second. But this is not all. The sounds of a full orchestra strike upon the ear at the same time, and the notes of various pitch, running through several octaves, are distinctly, audibly heard in beautiful harmony; but every note requires a different rate of vibration, and yet all at the same time, until perhaps a score of different rates of vibration are manipulated at the same time.

"Now we begin to feel a kind of melancholy sympathy for our little sentinel, who is compelled to practice upon possible impossibilities, in the vain attempt to stretch, and contract, and bend, and perform hundreds of gyrations per second, and at scores of different rates of velocity all at the same time. . . But the wave theory of sound compels submission to these absurdities and impossibilities, and while that bears sway our little sentinel must continue in this abject slavery.

"It is not out of order to question the right or assumption, or the authority of sending out these vocal and instrumental emanations in cavalry squadrons, mounted upon atmospheric waves or sound-pulses, to besiege our auricular organs in such a barbarous mode of attack. Almost any other member of the body would go to pieces or paralyze under the pressure of the unequal struggle against such an incessant and multitudinous bombardment.

"Thousands are assembled in a large hall. Hundreds of instruments of various kinds are playing in full orchestra. Thousands of voices are filling the air with all the notes within the compass of the human voice. We put on our philosophic glasses and see the sound-waves in endless variety emanating from these thousands of sonorous sources in all directions, from every center, at different amplitudes and wave-lengths, meeting each other, crossing each other, at right angles, acute angles, obtuse angles, horizontally, vertically and obliquely, impinging upon each other, dashing, surging, retreating, by impulse and reaction like a thousand wild animals turned loose in a menagerie, and yet amidst all this jarring and confusion each storm-tossed wave going with accuracy and unerring certainty, unchanged and pure, straight from its source to every point where an ear might be, and unloading its sonorous cargo all in good condition." The Professor concludes by saying: "If science desires to rejoice in unexceptional garments, she had better look to her wardrobe and repair these rents, or else replace her tattered duds with more reliable and scientific vestments."

Speaking of the musical sounds, the voices of men and women, the noises of rustling garments, gliding feet, clinking glasses, and so on, which fill a ball-room, and which "give rise to systems of waves, which dart through the mass of air in the room, are reflected from its walls, return, strike the opposite wall, are again reflected, and so on until they die out," Professor Helmholtz remarks: "And yet as the ear is able to distinguish all the separate constituent parts of this confused whole, we are forced to conclude that all these different systems of waves co-exist in the mass of air, and leave one another mutually undisturbed. But how is it possible for them to co-exist, since every individual train of waves has at any particular point in the mass of air its own particular degree of condensation and rarefaction, which determines the velocity of the particles of air to this side or that? It is evident," says Helmholtz, without hesitation, "that at each point in the mass of air, at each instant of time, there can be only one single degree of condensation, and that the particles of air can be moving with only one single determinate kind of motion, having only one determinate amount of velocity, and passing in only one single determinate direction."

I may assure Professor Helmholtz that, on mechanical grounds alone, any other condition of things would be impossible, and we have only to imagine the point spoken of to be the tympanic membrane, to see at one glance the absolute breakdown of the wave theory.

Professor Tyndall says: "The same air is competent to accept and transmit the vibrations of a thousand instruments at the same time. When we try to visualise the motion of that air—to present to the eye of the mind the battling of the pulses direct and reverberated—the imagination retires baffled from the attempt. Still, amid all the complexity, every particle of air is animated by a resultant motion, which is the algebraic sum of all the individual motions imparted to it. And the most wonderful thing of all is, that the human ear, though acted on only by a cylinder of that air, which does not exceed the thickness of a quill, can detect the components of that motion, and, by an act of attention, can even isolate from the ærial entanglement any particular sound." It is somewhat difficult to reconcile the teachings of these two eminent scientists, and I certainly have no time to attempt the task. A very few words must now suffice to dispose of the ear question.

It can be gathered from what I have just quoted and said, that to produce in our sensorium the sensation of hearing there must be external air-waves capable of setting up a mechanical action of a corresponding nature in the tympanic membrane of our ear. Under the wave theory, therefore, such air-waves must be capable of exerting some measurable force. On this subject I ask the wave theorist this first question: Can he measure the force

of an air-wave sent off by the tuning-fork's prong whilst vibrating the $\frac{1}{17,000}$th of an inch at each full swing, or, say, the large distance of $\frac{1}{80}$th of an inch in a second of time? And, further, I ask him if he can honestly believe that the drum-skin of his ear, the chain of bones behind it, and, lastly, the entire apparatus of the inner ear, is made to vibrate in and out 256 times in a second by the sound waves from a fork vibrating $\frac{256}{17,000}$ths of an inch in that time? Should he answer in the affirmative I can only recommend him to study mechanics.

From what has been said you will no doubt have been impressed with the more than marvellous delicacy and sensitiveness of the tympanic membrane of the human ear; for to do what the wave theory calls upon it to do—namely, to move to-and-fro in a hundred different degrees of velocity at the same instant of time, and, by so doing, to convey a hundred different sensations to the brain at the same instant of time—it needs must be endowed with more than marvellous delicacy and sensitiveness. But are you and the wave theorists prepared to learn that, instead of being a tightly stretched, fine and exquisitely delicate skin or membrane, the so-called drum-skin of the ear is not a tensioned diaphragm at all, but a loose or flaccid mass of tissue, incapable of receiving or transmitting any sound-wave vibrations whatever, and that it has quite a different office to perform in the animal economy? Such, however, is affirmed to be the fact.

The drum-skin or tympanic membrane is essential to the very existence of the wave theory, for it is against its exterior surface the sound-waves, with their condensations and rarefactions, strike, and surge, and battle, so that a report of their good behavior may be instantly conveyed to the brain. No wave theorist can afford to do without this membrane in the ear, for with its non-existence the wave theory would become a joke in science.

The next important question is this: Is the tympanic membrane necessary to our hearing? The following extract from the first volume of "Dunglison's Physiology," giving a report of a case examined by the celebrated Sir Astley Cooper, will be a sufficient and appropriate answer:

"Sir Astley Cooper was consulted by a gentleman who had been attacked by an inflammation of his left ear, which continued for several weeks. After twelve months, the same symptoms occurred in the right ear; in consequence of these attacks he became deaf, and remained so for several months. The hearing began to return, and in about ten months from the last attack he was restored to the state he was in when Sir Astley examined him. Having filled his mouth with air, he closed his nostrils and contracted his cheeks, the air thus compressed was heard to rush through the *meatus-auditorius* with a whistling noise, and the hair hanging from the temples became agitated by the current of air that issued from the ear; when a candle was applied the flame was agitated in a similar manner. Sir Astley passed a probe into *each* ear, and thought the membrane of the left side *totally* destroyed, as the probe struck against the petrous portion of the temporal bone. The space usually occupied by the membrana tympani was found to be *an opening* or aperture without one trace remaining. On the other or right side also a probe could be passed into the cavity of the tympanum, through an opening one-quarter of an inch in diameter in the center of the tympanic membrane. Yet this gentleman was not only capable of hearing everything that was said in company, but was nicely susceptible of musical tones; he played the flute, and had frequently borne a part in concerts, and he sang with much taste and perfectly in tune."

Commenting on these facts, Dr. D. A. Post asks: "If the wave theory of sound is true, how could Sir Astley's patient hear so perfectly? Is not the *vibration* of the tympanic membrane as essential to that hypothesis as the *sonorous wave itself?* As both membranes in this case were undoubtedly destroyed, will some *undulatory* gentleman account for the sensation of sound in this man?"

I shall leave the careful consideration of these questions to those amongst you who care to arrive at the truth in matters of sound, and need only sum up the conclusions I have come to after long study and thought, thus—The tympanic membrane has never been intended to vibrate or adapted for vibration by means of sound; it is, in fact, not a delicate stretched membrane at all; it is simply a flaccid mass of tendinous fiber designed to protect the sensitive inner organs of hearing from the injurious effects of sudden and very loud sounds, and from foreign matter which might find its way into the ear. In addition to this, it is probable that this screen, which is called the tympanic membrane, may be designed to distribute sound force and so render it more effective. We have no authority, however, for this last supposition, and, accordingly, lay no stress upon it.

It is quite evident that the truth of the wave theory depends upon the existence of a sensitive, vibrating drum-skin in the ear, for what comes of *air-waves* or *sound-waves*, with their condensations and rarefactions, if there is no such sensitive vibrating membrane? And what is to be said when we realise the fact that we can hear when both our drum-skins are destroyed? Let some wave theorist answer.

The wave theorist has still another rather remarkable fact to face and account for. It is well known that persons who are deaf to all sounds through their ears, can hear, to some considerable extent, through the bones of the head. In a lecture delivered by Sir William Thomson, at Birmingham, in 1883, we find this passage: "Hearing is perceiving something with the ear. What is it we perceive with the ear? *It is something we can also perceive without the ear;* something that the greatest master of sound, in the poetic and artistic sense of the word, at all events, that ever lived, Beethoven, for a great part of his life could not perceive with his ear at all. He was deaf for a great part of his life, and during that period were composed some of his grandest musical compositions, and without the possibility of his hearing them by ear himself; for his hearing by ear was gone from him forever. But he used to stand with a stick pressed against the piano and touching his teeth, and thus he could hear the sounds that he called forth from his instrument."

With all these facts before us, I think you

will admit that the science of acoustics, as at present taught, calls loudly for reconsideration and much unprejudiced discussion. If it is true, its supporters need neither fear one nor the other, for the more truth is investigated the brighter it shines.

(To be continued.)

OBITUARY.

We are pained to learn in the following letter of the death of our dear friend Dr. William Taylor, Treasurer of the Pennsylvania Rail Road. In all the vicissitudes of the MICROCOSM he has stood nobly by us, and when the disaster occurred three or four years ago, by our mistakenly entrusting this magazine to other hands, Dr. Taylor was among the very first to come to our aid with a check for $20. He was a noble Christian gentleman (N. C. G.), a title more honorable than any within the power of a university to confer:

"DR. WILFORD HALL, Dear Sir,—My father, Dr. William Taylor, died last night, or I should say at five P. M. yesterday. Knowing that he had a great regard for you and your works, as he read the MICROCOSM up to the last, and knowing that you have contributed a great deal to his happiness in this life, as well as confirmed his views about the life hereafter, I feel it my duty to address you these few lines.

"Yours very sincerely,
"B. H. TAYLOR."

The Koch Lymph Discovered to be Poisonous and Dangerous.

Dr. Loomis, one of the highest medical authorities in New York, just returned from Berlin with a supply of the lymph, writes for the press:

"I remember a case which was brought into the Charité Hospital, in Berlin, with consolidation of one apex and marked constitutional disturbance. Within a week, and after four injections, physical examination showed softening and the formation of a cavity in place of the moderate consolidation. The dyspnœa was intense, respirations reaching sixty per minute. The patient was made rapidly worse by the injections, and when I left the case was hopeless. The result in this case I attribute to too frequent and too large injections. * * *

"Watching the effects of the smallest dose of Koch's fluid one can not but be deeply impressed with the dangers which must naturally attend its use, from the fact that it must contain a most powerful poison, to use which indiscriminately would be criminal. * * *

"A number of deaths following the use of the remedy have been reported in Berlin. One case which I know of was where phthisis was complicated by tubercular ulceration of the intestines. The remedy produced necrotic changes in one of these ulcers, which led to perforation and death."

Dr. Shrady, another high authority and editor of the New York *Medical Record*, writes editorially:

"It is now over three months since Prof. Koch began the experiments with his lymph upon man. This is almost a sufficient time to determine whether consumption in its earliest stages can be cured. Prof. Leyden has treated 127 cases, Dr. Guttmann 75 cases and Prof. Gerhardt 79 cases. All these are, in addition to the cases first treated, directly under Koch's supervision. Among these 281 cases we hear of four deaths, while Dr. Guttmann announces four cures. Most of the remaining cases are simply 'doing well.'

"If any experienced physician were to treat 281 cases of phthisis in the very initial stage, by methods already known, there is very little doubt that much better results could be obtained, even within two or three months, than a simple one per cent. of cures. So far, therefore, it must be conceded that Koch's lymph has shown no special remedial power against pulmonary tuberculosis."

DR. AUDSLEY'S WORK IN ENGLAND.

Next month we will print a personal letter from this enthusiastic worker in the cause of Substantialism, in which the reader will find much food for reflection. Also we will print our reply to Mr. Woolhouse from the London *Musical Standard*, written at the request of Drs. Audsley and Pearce. The work in Great Britain, we are pleased to say, goes bravely on, and converts to the new theory of acoustics are reported in every letter. The truth is, there is no resisting the onward crusade which our uncompromising lieutenants are waging at the very door of Tyndall.

UNIVERSITY SCHOLARSHIPS.

According to our promise in the last month's MICROCOSM, we here print the names of those who have subscribed $100 for the support of a scholarship in the new "Wilford Hall University," when founded.

For the details of this project see the MICROCOSM for November, 1890:

Prof. Henry C. Cox, Chicago, Ill.
James I. Bowles, Shelbyville, Mo.
J. W. Baker, Media, Pa.
B. Wyatt, Spottsville, Va.
Rev. Dr. J. A. Buck, Washington, D. C.

SAMPLE TESTIMONIALS.

Such an endorsement as the following would be heralded throughout the world if Koch's lymph instead of our Health-Pamphlet had been the means employed:

"Dumas, Ark., Dec. 10th.

"Dear Dr. Hall,—Enclosed find money for which send your Health-Pamphlet to Mr. M. G. Pennington. One lady to whom I sold a pamphlet was dying with consumption, and is now getting strong, has a vigorous appetite and sleeps well. She is now stout enough to scour the floor and even do most of the family washing.

"Truly your friend, A. M. Robertson."

Mr. J. L. Bourland, a merchant at Bishop, Cal., writes, Dec. 13th:

"All those who have purchased the pamphlet from me are as a rule the more intelligent of our community, and as they are all pleased, their influence after a fuller trial will be all the recommendation I want here for the sale of the pamphlets. Your treatment worked wonders for me. Every one speaks of my improved health, and although I am nearly fifty-seven years old, I feel like a boy again. I work fourteen to fifteen hours a day and improve right along. Have gained nineteen pounds since I commenced the treatment. Constipation and kidney trouble were my ailments. Sincerely wishing you success, I am, truly yours, J. L. Bourland."

Rev. W. I. McKenney, pastor of the Monument Street M. E. Church, Baltimore, Md., writes:

"My Dear Doctor,—I have been wanting for some time to write you about the Health-Pamphlet which I have been using for more than a month. It is a perfect marvel. The relief which I experienced was so conscious, instantaneous and lasting as to be incredible outside of actual experience. I sincerely believe this to be a solution of a large part of the ills that flesh is heir to. I feel that I am conferring a favor on suffering humanity by circulating the pamphlets. Please send me some of your literature for advertising them. I want to let my suffering friends know about it. Yours gratefully,

"W. I. McKenney, 1031 E. Monument St."

Press of H. B. ELKINS, 13 and 15 Vandewater Street, New York.

The Microcosm

A MONTHLY JOURNAL OF SUBSTANTIALISM AND COLLATERAL DISCUSSIONS.
THE ORGAN OF THE SUBSTANTIAL PHILOSOPHY.
A. WILFORD HALL, Ph. D., LL. D., Editor and Proprietor.
(Author of the "Problem of Human Life," "Universalism Against Itself," Editor of the *Scientific Arena*, &c., &c.)
ROBERT ROGERS, S. L. A., Associate Editor.
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FORCE AND MOTION.
BY THE EDITOR.

The more we reflect upon the two principal words at the head of this article, and their relations to the material world and the phenomena of the physical universe, the more astonished do we become at the want of logical discrimination on the part of the advocates of the present motion-theories of science.

We have recently had the pleasure of a long and interesting conversation with one of the most intellectual investigators of all phases of scientific phenomena we have ever met. In fact, there is no aspect of scientific research within the reach of our imagination, with which he does not seem to be familiar. There is no physical law, the necessity of which would occur to the mind of the profoundest philosopher which he has not formulated and for which he has not at his fingers' end and his tongue's end a rational explanation, as would appear at first glance. Yet this intellectual giant—this marvel of philosophical profundity—is totally at sea on the subject of *force* and *motion* and their relation to the material universe. He does not seem able, with all the reasoning that can be presented to his mind, and with all the intuitive fitness of things which his own powerful intellect should have suggested, grasp the common-sense idea that the *motion* of a body, instead of being the force which causes the body's displacement, is in fact but the *effect* of the application of some form of mechanical force as the cause of such motion.

If, for example, he sees a magnet lift a piece of iron from a distance, he at once tells us that the *motion* of that piece of iron in its change of position was the force or mechanical cause which produced the change. In a word, he seems utterly confused in attempting to distinguish between cause and effect in the displacement of material bodies.

How such mental confusion can prevail in an intellect so highly trained and so capable of the most occult investigations, surpasses our comprehension, especially when a child, that just begins to reason, must see that the *force* which moves a body and the *motion* which results from such application of force must, as cause and effect, be entirely distinct.

That writers on questions of physical science should have discussed this subject confusedly, —confounding cause and effect, —is not so much to be wondered at especially as they had at the time of writing formed no adequate conception of *force*, though immaterial as a *substantial entity*,—as real as is the material body it displaces. Hence we have such works as "Heat as a Mode of Motion," by Prof. Tyndall, and similar published views of light, magnetism, electricity, etc., by Sir William Thomson and others. But that a trained scientific thinker and critical writer on the physical laws can not see this almost self-evident distinction after his attention has been called to the subject and its necessity pointed out, is so disappointing to our mind as almost to invalidate every other scientific conclusion he may reach however plausibly argued out.

In fact, a man who will persist in confounding the *motion* of a body with the *force* which produces the motion, or in other words making it the cause of itself, must not blame any thoughtful mind for doubting the correctness of every other scientific result he may claim to have reached, however plausible such result may appear.

As a concomitant of this illogical habit of confounding motion and the force which causes it, it is a singular fact that all advocates of the motion-theories of science claim to believe in the molecular or atomic theory of matter. Not only do they claim to believe that matter consists of final molecules or ultimate atoms which preclude all concept of further divisibility, and which are many of their diameters apart, but they insist that these atoms or molecules are in continual vibration, as their normal condition, and that this inherent vibratory motion, at different rates of swing and at different am-

plitudes of oscillation, is what constitutes the different manifestations of natural force such as heat, sound, light, electricity, magnetism, cohesion and gravity.

Some of these physical philosophers claim to believe in an inter-molecular material *ether* separating these atoms, while some hold to the idea, as far as we can gather from their theorizing, that nothing but motion exists between the ultimate atoms of material bodies and by which they are kept apart.

It matters little which of these views is held, their absurdity and untenable character are equally demonstrable.

If the so-called ultimate atoms of gross matter are kept apart several diameters, and the spaces between them filled by a material substance called ether, then the ultimate particles of this ether, admitted to be matter, should have equal spaces between them, keep up a like vibration, and be kept apart by a still finer inter-atomic substance whose still more ultimate (?) atoms should have similar interstitial spaces with similar diversified rates of vibration, etc., etc. Thus the so-called "ultimate" atoms of each new inter-molecular substance necessitates another still finer interstitial substance to keep its atoms from coming into contact, reminding us again and again of Dean Swift's ingenious suggestion, that

> "There never was a flea so small
> But has other fleas to bite 'im;
> And these again have lesser fleas,—
> So on *ad infinitum*."

But should the absurdity of this "ultimate" nonsense ever impress itself upon motion-theorists and cause them to postulate *motion* itself between the vibrating molecules as all there is to keep them from striking each other, then they involve themselves in the still more glaring absurdity of keeping the ultimate atoms from coming into contact by the very process that naturally should cause them to strike; for surely their *motion*, instead of causing them to stop should keep them going till they struck something to make them stop. No greater absurdity was ever presented to our mind than this self-contradictory assumption that the *motion* of a body *stops* it, when it is only the resistance of motion, or more properly, the resistance of the *force* that produces motion which can bring the moving body to rest or change its direction.

If nothing but motion keeps a body moving and nothing but motion stops it, how can the body thus stopped be again started by its own motion till it begins to move? This is a conundrum we should like to have some modern scientist answer.

It takes but a moment's reflection to see that this molecular theory is self-contradictory, since one phase of it teaches that while the molecules are kept from coming into contact by this resisting power of motion, their constant collisions as the result of their rapid vibration are what generate heat, light, electricity, magnetism, etc. But if the molecules collide they must in the nature of things soon come to a state of rest, whatever was the original cause of their motion, thus requiring a new impetus. Surely their motion, which ceases to exist at the instant they come to rest, can not again start the molecules till the motion again comes into existence by the molecules moving.

The truth is, any theory, involving the ultimate atoms of material bodies and their inherent vibration as the force which produces their motion, must stultify itself whenever brought down to a logical analysis.

The assumption that motion is the normal condition of matter in its ultimate atoms, is an absurdity so self-evident that it is flatly contradicted by our senses. This very theory admits the normal condition of all visible and tangible bodies to be that of rest and not motion. What a *petitio principii*—what a preposterous begging of the question where proof is all-essential—to assume blindly that as soon as matter is so reduced in size that it is no longer visible—then *presto!* its natural property of inertia is lost and its normal condition is changed from a state of *rest* to one of inherent *motion* without any force to start it to vibrating save its own *motion*, which of course has no existence till the matter begins to *move!*

If these illogical theorists will not admit this reasoning without tangible and substantial proof, let them break their boulder in two and see if either part will come any nearer moving or changing from a normal state of rest than did the whole boulder. Then let them divide it again and again, and so on ten thousand times, or till the particles are barely visible to the naked eye, and when they see that each particle still maintains the same normal condition of absolute rest, unless disturbed by some extraneous force, let them put on their thinking-caps and do what they probably never before did in their lives—*reason*. Let them then get the best microscope in the world and after pulverizing the visible particles of the boulder to impalpable dust, a single particle of which has to be magnified fifty-thousand fold before it becomes visible under the lens, they will still see that there is no sign of vibration about it, but that absolute rest is its normal condition precisely the same as with the entire boulder weighing a pound.

What superficial perversity, therefore, to assume that this same matter, which in all its visible stages of subdivision is in a state of rest as its normal condition, must change its nature

and its essential property of inertia as soon as it gets out of sight by still further subdivision, and commence vibrating without any force to put it into motion, save the motion which it can only have after it is started into motion by some extraneous force!

The truth is, the idea of ultimate molecules of matter not touching each other, and of their inherently continuing in vibration, is an assumption so weak that we marvel how any logical thinker could ever accept it.

Porosity of matter, on the contrary, or vacant spaces between its parts, we know to be a fact, and in some forms of matter much more so of course than in others. But its parts must touch in places nevertheless, or the mass could not cohere and would necessarily fall to pieces. And even though it may touch in absolute contact in thousands of places, it will not even then cohere unless cohesive force is in full play upon its separate particles, as witness a mass of dry sand.

The man who should insist that the particles of sand filling a quart measure do not touch each other or come into absolute contact because there are interstices between them, would be no wider from the truth than is the scientist who assumes that a mass of material molecules can be held inseparably, as in case of a boulder, with absolute spaces between them of many times their own diameters. To be obliged to combat such absurdities as these, especially with otherwise intelligent investigators, who, it would seem, ought to know better, is enough to try the patience of a scientific Job.

One man asks how it is possible for a body to contract or expand by cold and heat, except by its particles becoming nearer together or separating more widely apart? This difficulty is sharp at both ends. If an "ultimate" molecule is still *matter*, as the motion theorists admit, would it not expand by heat and shrink by cooling? If so, do not *its* constituent particles separate more widely apart and come nearer together? If so, how can it be an *ultimate* molecule?

The fact is, if a molecular scientist could corner one of his so-called "ultimate" molecules, and then place it under a microscope of sufficient magnifying power, he would see it as large possibly as his own illogical head, and would find it composed of millions of other particles, each one as far from being indivisible as was the one he was magnifying and superficially supposing to be *ultimate*. Any one of these particles of a molecule would show the same proportionate expansion by heat, could we note the changes, as would the original boulder weighing a pound.

There is really, as Prof. Tyndall says, no such thing to the intellect as great and small. Size is only comparative and not absolute in any sense. To a mind capable of comprehending infinity a particle has no less absolute size than a planet. Each is infinitely small as compared with infinite space, while a molecule in the present theoretic sense is infinitely large when compared to an infinite point. Let physicists learn this lesson, and then learn to be modest when talking and writing about the ultimate molecules of matter.

THE ANNULAR THEORY.

BY PROF. I. N. VAIL.

No. 12.

Plainly we are now justified in assuming a positive attitude in advocating the annular philosophy. There is no avoiding the overwhelming evidence of the Noachian flood. Neither can we avoid the fact that far back in time and yet within the scope of tradition, an appalling and far sweeping debacle of rushing waters came down from that source and fountain of "all waters and rivers and streams"—the *Great Deep*. The philosopher and scientist must admit this, for it is the only foothold he can find within the realm of natural law. There is not a reasoner who can look over the wide scope of diluvian legends from profane and sacred sources and say there is not a bottom fact from which they *sprang*. I say that none but the uninformed and mentally blind would dare record the assertion that the earth has not, within the memory of man, been swept by a deluge "vast beyond conception." The only trouble has been to find a competent source.

Now when we turn to the vast ocean and reflect that every drop of those mighty waters once hung suspended in the firmament as the "fountains of the ocean" and grand "source of all waters," and also reflect that those waters could not have descended except in vast instalments extending over long periods of time, we may settle confidently upon the fact that such deluges were not only philosophic in every sense, but inevitable.

Looking a little further, I hold that we have the most emphatic evidence that the oceanic waters have been *vastly augmented since man came upon the earth*. That the ocean is fully thirty fathoms deeper to-day than it was just before the deluge. I can not now detail this evidence and must refer the reader to my published writings. With all these things before me, I am bold to say that the earth once had an annular system, and will give any man one thousand dollars who will prove that such was not the case.

The "fountains" of Homer's "Okeanos" and the Hebrew "Great Deep"—the "waters above the firmament"—have been "*broken up*." There is no possibility of another deluge. The rainbow has come and will shine forever, as a "token" or sign that the "waters shall never more become a deluge to destroy the earth."

My readers, surely, can now see that in Edenic times the earth was invested in a canopy of vapors. But so sure as this earth was so invested, it was a greenhouse world again and for the last time. During that time the world took another grand leap forward. For untold

centuries the earth was warm and capable of supporting life to the very poles. The mammoth and his compeers luxuriated in lands now locked in eternal ice. These animals, as now admitted beyond a doubt, are to-day sealed up in vast numbers in polar glaciers, *which once were snows.* They have been found with the contents of their stomachs undigested, nay, with vegetation partially masticated lodged in their teeth, their flesh untainted and even the pupils of their eyes preserved, which things prove, beyond the shadow of a doubt, that a *sudden* and tremendous down-rush of *snows* from the earth-investing canopy involved them in sudden death. Vapors that fell in medial latitudes as a mighty flood of waters, necessarily fell in the polar world as stupendous avalanches of snow. The manner and condition in which these animals are now found will admit of no other conclusion! The same annular snows that, away back in geologic time, towered mountain-high and became grand radiating sources of continental glaciers, at the time of the deluge, accumulated again and for the last time. Turn where we will, we find witnesses testifying to the fact that the Eden world possessed a *greenhouse canopy and a greenhouse clime.* I could fill hundreds of pages with such testimony, so that to-day it is inexplicable how the world has grown so old and intelligent man lived thus long without naturally falling on this rock. The only natural mode of world evolution.

We will now turn our attention once more to the Eden world, and with this positive testimony gathered, we can no longer have a doubt that in the terrestrial heavens of that day magnificent bands and streamers rolled incessantly. I only ask the reader to admit this doubly proven fact, and we will proceed to banish every mystery from Eden's realm and prove it again and again.

I will ask the reader to fancy himself or herself stationed on the surface of either the planet Jupiter or Saturn. The former surrounded by a mighty canopy of annular vapors. His bands, streamers, lines and varigated clouds must now be seen by the philosophic eye placed *beneath them.* The former surrounded by a perfect annular system, which the astronomer of a future day will look for in vain, must be seen by the observer on Saturn's surface. Or if it is preferred to remain on earth, we will imagine Jupiter's magnificent canopy of vapors rolling in matchless grandeur around the earth. First remember that in that attenuated mass of vapors the sun is pouring his fervid beams. All the heat and light that the planet receives are simply locked in the vapor mass, and like a cloud located away out in space, it would simply be a brightly illuminated mass, shining down upon the earth with a modified mellow light, and one skilled in the science of optics will readily understand how the universal diffusion of the rays would make it a canopy of light long before the sun could be seen. And said optician can easily prove that this sunlight would be carried, according to the laws of diffusion and diffraction, *all around the planet,* so that while the sun was in the "*underworld*" of the ancients, the *midnight canopy shone* down on the earth as with the light of a thousand moons.

The midday sky was a brilliant tholos of light, and the midnight sky was a flood of light, only less brillian so that in reality it was *eternal day in Eden.* That is, day and night did not alternate as they now do until after the deluge. And now we can understand why immediately after the deluge the God of Nature said that henceforth day and night should *continue to alternate forever* (see Gen. viii, 22). We can also understand why it was repeatedly said in Gen., 1st chap., the "evening and the morning" both were "day." They were both coalesced into one day. And there was no night there to record. All the "darkness" "was upon the face of the Great Deep" on high. If "God called the light day," then the "greater light" was day and the "lesser light" was also day! And if the "darkness" was on the deep and called "night," then the night was that upper darkness! just such darkness as we see to-day on the planets Jupiter and Saturn as black annular bands! and just such as must have streamed out as night-black bands against the bright canopy of Eden. Then the "two great lights" were emphatically the lights of eternal day.

With all the light and heat of the sun, poured into and stored up in Eden's canopy, the earth was actually wrapped in a heat-generating shroud and greenhouse heat naturally accumulated, and this explains why man dwelt "naked" in Eden. And this affords me the opportunity to say: if man ever dwelt naked on earth it was a warm world, free from the storms and tempests of to-day, and *must* have had a protecting roof of vapors. And all these conditions point to an age of perpetual summer or spring. That is, to a time when the seasons did not alternate, and this explains why the Deity, immediately after the canopy fell and permitted a change, said "so long as the earth lasts summer and winter should not cease," *i. e.*, should always alternate.

I trust my readers will, at this point, pardon a digression, to allow me to call their attention to the fact that the astronomers of the Lick observatory have discovered that the so-called canals seen several years ago by the great Italian astronomer, Schiaparela, on the planet Mars, are vapor bands in the atmosphere of that planet. In other words, that the remnants of an *annular system are to-day floating in the atmosphere of Mars.* It is the fulfillment of a prediction that I made more than ten years ago, that such a discovery would be made. It is a grand and felicitous step toward the inevitable demonstration that all worlds evolve under the ministration of annular law. Another step forward will be the discovery that all the outer great planets are in the same condition. Critical observation will detect the polarwise decline of all these planetary bands, and then another step will lead to the conclusion that the *sun has an annular system in an occular state of formation.*

Elsinore, Cal.

THE ATONEMENT.

BY REV. J. I. SWANDER, D. D.

The teachings and work of Christ can be clearly understood and correctly valued only as they are viewed and studied in the light of His person. It is true that the sacred Scriptures testify of Him, and that His works bear testimony to His Messianic character; yet the word written and the miracles wrought contain in themselves no power of authentication which they did not receive from the Son of righteousness with healing in His wings. All that Jesus began to do and to teach, whether

such teaching be by His own word of mouth, or by the written word of inspired men, or by the proclamation of the Christian ministry, can possess no real force, except as such force is derived from *Him* whose substantial life is enshrined in the economy of God's revelation to man for the purpose of man's emancipation from the power of death.

Christ's person is the principle of the atonement. What He did and taught and suffered, and what He now continues to do and teach have virtue and value only as they are the outflowings and onflowings of His Messianic fullness. He must, therefore, be the Alpha of any proper and profitable inquiry as to the nature, extent or application of the atonement. An attempt from any other point of view leads to that senseless chattering of mechanical magpies of which the modern theological wilderness is full. Because Jesus is our peace He was able to break down the middle wall of partition; because He is the life of the world He is able to bring about a reconciliation of the world to God by the death of the Cross.

A book has been written and much has been said of late about "the Cross in the light of to-day." Very well. Progressive theologians have no objections to a view of the Cross in the light of any age in the world's history. It is certainly not required of us that we take our view of the atonement exclusively as it was apprehended and the doctrines thereof as they were formulated by the Fathers of the early Church, the scholastics of the Middle Ages, or even the Reformers of the sixteenth century. If the present age affords any theological advantages over any one or all past ages, we wish to be distinctly classed among those earnest searchers after the truth who are both willing and anxious to avail themselves of the superior benefits to be derived therefrom. Turn on "the light of to-day," gentlemen, turn on the light, those of you who are searching for a heavenly star in the flickering and fluttering light of the world's tallow-dip. Let all its feeble rays be focused upon the Cross, but do not forget that the Cross must shine and be savingly seen in its own light, and that it has no light whatever, except that which it receives from the constitution of the theanthropic person who was the hero of its tragic scene.

One of the earliest theories of the atonement, viewing everything pertaining thereto as centering in the death of Christ rather than in His person, held that the tragedy of Golgotha was primarily a fulfillment of a contract with Satan. The devil was looked upon as having a mortgage on the race, and some of the Church fathers supposed that the death of Christ was not only a bruising of the serpent's head, but also a satisfactory settlement of the serpent's conceded claim upon the services and the spoils of humanity. This was a mistake. Satan's power over man was by usurpation. True, man had sold himself for nought, but alienation of divinely invested rights on the part of the one party, and seductive fraud on the part of the other, left no room for binding sanctity in any such questionable transaction. Sound and honest theology is always in favor of giving the devil his dues. This is done in the humiliating confession that when man sold himself for naught he plunged himself into an abnormal condition of his being. Man, therefore, needs restoration more than the devil is entitled to restitution. In other words, man needed to be rescued from the unjust and unlawful exercise of Satanic power. Hence, the Son of God assumed and took part in the flesh and blood of the race that through death he might destroy (not satisfy) him that had the power of death, that is, the devil, and deliver them who were subject to Satanic bondage.

The teaching of Anselm (1033), which ruled the theology of the Reformers in shaping the confessions of the sixteenth century, and which has governed much of Protestant thought for nearly 400 years, was a move in the right direction, but it has not yet come to Mount Zion as now seen in the light of a more organic and substantial theology. The Anselmic theory represents God as being considerably concerned about His essential honor, and consequently full of anxiety to display His consistency in dealing with the abstraction of human sin as that was supposed to stand related to the problem of man's redemption. This view contains an element of truth, and yet it is defective in the absence of that theological synovia which every organic joint supplieth. It would be inconsistent for God to do a thing for the primary purpose of showing his consistency. Besides, in the fall of man God no more lost in essential honor than the devil gained in righteous power. The old theology is correct in teaching that God will have his justice satisfied, and that, therefore, we must make this satisfaction by ourselves, or by another; yet much of it came short of the full measure of truth by ignoring the organic connection of Christ with the human race, and consequently with each member thereof. Sound theology insists upon the vicariousness of Christ's atoning sacrifice upon the Cross; and yet not in such sense as to imply or concede its possibility were not both parties partakers of the same generic nature. It also emphasizes the fact that the atoning value of the offering made by Christ lies primarily in this, that *in His own person*, whether in Gethsemane or on the Cross, He positively and perfectly offered *Himself* in the full and free exercise of His will, and from a principle of love to both God and man, with a clear consciousness and definite aim that His obedience unto death should result in nothing less than the glory of God in the salvation of the world.

A proper view of Christ's atonement lays stress upon His sufferings, especially those at the end of His life, but yet not in such sense and to such extent as to lead to the conclusion that God saves the world by the merit of misery alone. When viewed in the light of the Redeemer's effulgent person, the Cross confronts our rational faith with the revelation of a deeper truth. Its atoning wealth and virtue consist in the personal *sympathy*, as well as in the agony, of that Great Heart whose benevolent pulsations produce the throbbings of the universe, and without which the wine-press of Calvary would never have opened into a cleansing and refreshing "fountain in the House of David." In the absence of such personal interposition and exercise of love in obedience unto death the Cross would have been left of none effect.

Viewed in this proper light, it is not difficult to see that the atonement, as grounding itself in Immanuel's love and obedience unto death, moved forward and upward to its fuller manifestations in all the cardinal events of His subsequent history. Christ's person involved the principle of the atonement. The angels on Bethlehem's plains were better theologians

than to overlook the fact that "Peace on earth, good-will to men" was folded already in the swaddling bands of the infant King who apparently had nothing but a tear-drop for his scepter and a virgin's arms for His throne. That incarnate mystery was the personal embodiment of the atonement, and in that embodiment there was the sure *Word* of prophecy and promise that the middle wall should be broken down, and that our assumed humanity should "pass the crystal ports of light to dwell in endless bliss." From the manger on, through all the time He lived on earth, the atonement was evolved in every forward and upward step of the historic Christ. Otherwise Jesus of Nazareth could not now be reckoned as the Christ of history in any proper sense. But such a character He is indeed. The atonement was born with Him at Bethlehem; with Him it grew as Himself, "increased in wisdom and stature and favor with God and man;" with Him its qualities were subjected to a thorough test in the wilderness of temptation; He carried it with Him to the Cross; thence He advanced with it through Hades, conquering principalities and powers until He made a show of them openly in His resurrection, and as He subsequently went up with a shout to complete His mediatorial work in the full glorification of our humanity at the right hand of God.

Furthermore, the atoning Christ, the atonement of Christ and the individual who believingly receives the person and work of Christ are distinct and yet inseparable. It is in such mystical union that *redemption*, wrought out in the person of the Second Adam, becomes the personal *salvation* of each true believer. The kingdom of God is thus received, not as a mere doctrine or a formulation of abstract truths, but as the organic fullness of Him in whom alone there is a *newness of life*. The atonement becomes thus so organically and completely interwoven with the very fibers of the believer's essential being as to justify God in looking propitiously upon the face of His Anointed in each and every ransomed soul of man. Christians are not all and always conscious of the indwelling presence of "the Lord from Heaven, the quickening spirit," because life is deeper and more real than consciousness, and experience is but one form of life's manifestation. This presence of the atoning Christ in the Christian is the principle of life by which he is already quickened and made free from the law and force of sin and death, and placed in such a process of sanctification as will terminate in his full consummation of redemption and bliss in the glorious resurrection at the last day, and his full atonement with God among the saints in heaven.

The foregoing view of the subject now under discussion implies that Christ's life is a present and veritable substance in the world for the purpose of the world's reconciliation to God. Under any other view the entire reality of the Christian system must continue to hang in the scales of infidel controversy and doubt. If Christianity be not life, if that life be not a substance, and that substance be not a present force in the world, then it must follow in logical reasoning that the so-called Christ of history is a myth, and that the Church (if indeed there be a Church) for the last 1800 years has been doing a questionable business upon a very questionable stock in trade. If the Church of Christ is not the fullness and bearer of his substantial life in the world for the purpose of neutralizing the death-forces now at work in fallen humanity, then, for one, we are ready to confess that the promises of the Bible are based upon the most stupendous fraud ever palmed off upon the inhabitants of our planet or embraced by the credulity of miserable man. In short, there would be no sort of sense in a religion, world-saving in its claim, and yet consisting of nothing but doctrinal schemes, ceremonial mummeries and unsubstantial abstractions. (See our "Substantial Philosophy," chap. xiii.)

The reader may say: "Yes, but Christianity is spiritual." Granted. But is the spiritual any less real than the material or physical in the universe of God? Is God less real or less substantial than the work of His hands? Can a substantial stream flow from a fountain of infinite nonentity? Has not the Church taught for 1500 years that the Son of God is of "one substance with the Father?" Was the Son of Mary a gnostic phantom? Did He vanish out of being when the cloud received Him out of sight? Was not His disappearance from the men of Gallilee on Olivet His real ascension to the throne of the invisible world? Could there have been any complete atonement without such real transition? Was it not expedient that the Christ should thus pass into the supersensuous realm of being in order to fill all things and communicate Himself as the bread which He gives for the life of the world? And who would wish to eat bread that contains no substance? Bread without substance is no better than a stone? Neither one contains the nutrient principle of life. Wise men do not spend their money for that which is not bread, neither do they give their religious labor for that which satisfieth not the rational demands of a truly Christian and Biblical faith.

If Christ be not the substantial bread of life, then let the Church stop fooling the children by administering empty ceremonies. Why all this ado about transubstantiation and consubstantiation, if, indeed, there be no veritable substance in, with or above the communion of saints? If while we were enemies we were reconciled to God through the death of His Son, why do we think it strange that, being reconciled, we should be *saved by His life?* And if the life of Christ be not substance, then there is no substance, either material or immaterial, in the universe, and Compte was right in holding that there is no universe except that of abstractions, no religion except that of harmony between dreams, and no science other than that of the phenomena of absolute nothingness. But the French philosopher was wrong; and they only can be radically right and symmetrically firm who acknowledge and embrace the fundamental principle discovered and pointed out by the Substantial Philosophy, that nothing in the universe can produce a positive effect or act as the cause of an observed phenomenon, except that which exists as a real force-substance; and the highest form of such substance is that which animates and perpetuates the Kingdom which ruleth over all to the glory of the King through whom we have now received the atonement.

"THE INVISIBLE WORLD."

The editors of the MICROCOSM have kindly granted me the use of this space to answer numerous inquiries concerning my forthcoming new book. The following are among the

facts and probabilities: The manuscript is now undergoing its final revision. The work will be offered to the public during this year of grace, 1891. Excepting the catechetical form, the volume will be much like "The Substantial Philosophy" in its size, shape and mechanical make-up. The principle of Substantialism is more thoroughly investigated and more variously applied than in my former treatise upon the subject. The title of the book will be "THE INVISIBLE WORLD." It will contain about 352 pages bound in cloth. Those who subscribe in advance will receive a copy by mail for $1—the regular price will be $1.50. No money is expected before the book issues from the press. In the meantime my first volume, which is now in the sixth edition, will be sent by mail free to all whose orders are accompanied with a postal note for sixty-five cents.

J. I. SWANDER.

Fremont, Ohio.

LETTER FROM DR. AUDSLEY.

To the Editor of the MICROCOSM.

My Dear Sir,—Observing the interest you take in my doings in England in advocating the Substantial Theory of Acoustics, it has occurred to me that both you and the readers of the MICROCOSM might like to know how matters stand and how things are going.

When I first thought of bringing the new theory forward in England, I decided to open my crusade in the musical rather than in the purely scientific world.

I felt certain that I should find more openness of mind and less prejudice amongst educated musicians than I could reasonably hope to find amongst mathematicians and scientists, who had so long and publicly posturised as the high priests of the undulatory theory of sound and the other motion theories of science. I am perfectly satisfied with the steps I took, and with the results of my labors in the musical world.

You are issuing, as you know, in your columns the *first lecture* ever delivered before a European audience, on the "Substantial Theory of Acoustics"—the lecture I had the honor of delivering before the distinguished members of the "Musical Association," of London, on April 7th of the present year. This lecture was listened to most earnestly, and made so great an impression that I was subsequently invited to deliver a second lecture, in continuation of my subject, during this session. The theory has, however, been gaining ground through the lectures of my friend Dr. Charles W. Pearce and my own exertions, and I am now invited to deliver *two lectures* this session before the "Musical Association." When a society of distinguished English musicians gives up *two* entire meetings to the consideration of such a subject as the "Substantial Theory of Sound," there is indeed a hope for its future in England.

On Oct. 13th I received a pressing invitation from the "National Society of Professional Musicians" to deliver a lecture on the Substantial Theory at its meeting on Nov. 8th, and, although the notice was a short one, I prepared and delivered a lecture of two hours' duration to a large and appreciative audience; and although there were several well-known wave-theorists present—who came to scoff—not one rose during the congratulatory discussion to question my arguments against and my condemnation of the wave-theory.

Alluding to this lecture, let me quote passages from letters I subsequently received from Dr. Pearce—on Nov. 11th he writes:

"Every congratulation upon the splendid lecture you gave on Saturday, and its manifest effect upon the audience. That locust argument is *conclusive*, and one of the best pieces of clear-headed reasoning I ever heard. . . . Dr. Hopkins and I were obliged to leave quietly (immediately after the vote of thanks to the chairman had been passed) in order to catch our train at King's Cross. The doctor was *immensely* pleased with your lecture, and hopes to hear you again. I told you from the first that *musicians* would welcome Substantialism; and I do not believe I wrongly gauged their opinion in the matter."

Again on Nov. 20th, Dr. Pearce writes: "Every congratulation upon your telling paper on the Substantial Theory of Sound read before the N. S. P. M. the other evening. I am more than ever convinced that wave-theorists have daily increasing difficulties to overcome: and these difficulties will have to be faced manfully and removed honestly (not by shuffling evasive replies and clouds of mathematical dust) before people gifted with ordinary common sense can ever rely upon the undulatory dogma again.

"I do not believe that any other paper of such a length as yours (nearly two hours) would have been listened to with as much attention as yours commanded. All the principal members of the Society remained until the very end—indeed, only three of your large audience left before the conclusion of your paper, and these did so with evident reluctance. My dear old friend Dr. E. J. Hopkins, who walked to the train with me, said he could have sat there for two hours longer, the paper was so *extremely* interesting. It may be perhaps premature to say you are making *converts* of our best and chiefest English musicians, but to an unprejudiced eye it looks like getting very near such a result.

"I fully expected a well-read man like Mr. W. H. Cummings would have come down upon you with some convinced argument on the other side; but his part in the discussion can only be truly described as *sympathetic* to a very large extent. Indeed, he didn't say a word against you or Dr. Hall! Then our chairman, Mr. C. E. Stephens, the strongest living opponent of the Day Theory of Harmony—*he* seemed altogether on the side of Substantialism and the opinions of the scientist, Mr. Hovenden (Mr. Cumming's friend), seemed entirely to corroborate your own ideas. You will doubtless remember, too, that when I read my paper on the Substantial Theory before Mr. Prout's Society, at Hackney, the only scientist in the room was on my side. Mr. Herbert Sims Reeves (a son of the great tenor singer) was asking for a copy of my paper the other day— and Mr. Eyre, the organist of the Crystal Palace, also sent for one, but I have not heard their opinions yet, save the very friendly one that they know me too well to expect I should write nonsense on any subject connected with our Divine Art. My dear Audsley, it is my firm conviction that the wave-theory would go to pieces to-morrow if all the musicians in England turned against it. It has been forced upon them by people who have traded upon their credulity and non-acquaintance with mathematics. Only let us have the true theory in some plain and simple form which will give a reasonable and com-

mon sense explanation of ordinary acoustical phenomena, and the imaginary, boisterous, turbulent musical sea of conflicting ærial billows, waves, breakers, surf, foam, bubbles, and all the rest of it will vanish like the 'empty pageant of a dream.'

"I am still looking forward to that Text-Book of which you once spoke to me."

From these passages, from the pen of one of our most talented and highly respected musicians, you can gather a fair idea of the present state of affairs—and a very hopeful one I venture to think.

On Dec. 1st I received a pressing invitation to deliver a lecture on the Substantial Theory at the annual conference of the "National Society of Professional Musicians," at Liverpool, in January. The invitation contains these words: "The new theory is exciting great interest amongst musicians, and I can promise you the warm thanks of the Society if you will most kindly bring the subject forwards." This invitation I unfortunately can not accept.

I am now preparing for my work in 1891; and in January I deliver my second lecture before the London "Musical Association," a report of which shall be duly sent you. I feel very hopeful that the crusade against false science, so well begun, will bear fruit of great promise in the coming year.

Fraternally yours,

Chiswick, London, W. G. A. AUDSLEY.
Dec. 15th, 1890.

"SWIFTLY ADVANCING" ONCE MORE.

BY THE EDITOR.

Last month we printed an editorial on the very slow motion of a tuning-fork's prongs while audibly sounding, and showed that this motion, which is millions of times slower than that of a clock-pendulum after the fork had been sounding four minutes, could actually be measured by a new method we had discovered some seven or eight years ago.

A very critical friend at Toledo, Ohio, called us to account for having misrepresented, as he claimed, the speed of the prong, particularly at the commencement of its vibration, or the loudest part of its sound. He insisted that its motion was so swift, though he had never tried it, that it would undoubtedly knock a grain of sand or other hard object clear across the room where we were sitting, if such object could be dropped against the prong at its position of swiftest travel.

Of course, as he insisted, in such event the prong must advance "swiftly" just as Tyndall and Helmholtz claim, since it would be impossible for the prong to drive away the grains of sand at a velocity greater than that of its own swing.

We agreed to this conclusion, and the test was accordingly made with a ut-4 fork, mounted on its resonant case, which we have just imported from the manufactory of Kœnig, of Paris. This fork we bowed and started into its greatest possible vibration, while our assistant dropped bird-seed and various other small grains upon its surface near the end of the prong, or at its point of greatest oscillation. And, will the reader believe it, the greatest distance such grains could be driven by this "swiftly advancing" prong after numerous trials was less than *one inch and a half vertically, or six inches horizontally.*

The truth is the largest fork, with ninety-six vibrations a second and a travel, at its start, of one-eighth of an inch, would only go at the average velocity of twenty-four inches in a second. Then counting the swiftest part of this travel as *one-third* greater than its average travel, as proved by the conical pendulum and as admitted by Professor Mayer, of the Stevens Institute at Hoboken, N. J.—the highest authority on sound in America—and we have this "swiftly advancing," even at its greatest velocity of swing, only thirty-six inches in a second, instead of that almost of a rifle-bullet, as acousticians have generally imagined.

But this, remember, is at the very start of the swing of a fork of the widest amplitude of travel; whereas in a single minute after the start its swifest swing is reduced more than fifty-thousand fold, or to a velocity of less than the 1,000th of an inch in a second. (See MICROCOSM; Vol. III., page 154.) Yet Tyndall and Helmholtz, without the slightest discrimination as to whether the fork has just commenced, or has been sounding four minutes with a demonstrated velocity of only one inch in two years, tell their confiding students to "imagine one of the prongs of the tuning-fork *swiftly advancing*"—"very much faster" than the movement of a pendulum! Such is a fair specimen of the average estimate to be placed upon the text-book teachings of modern science.

ANOTHER REPLY FOR ENGLAND.

[By request of Dr. Audsley we have sent the following reply to Mr. Woolhouse to the London *Musical Standard*.—EDITOR.]

MR. W. L. B. WOOLHOUSE ON THE NEW THEORY OF SOUND.

Editor of the "Musical Standard":

Sir,—My attention has been called to an article in your paper of December 23d with the above heading. Mr. Woolhouse, as I am informed by friends in London, is prominent as an exponent of the current theory of acoustics. This being so, I am requested to send you a brief reply. I do this, not because of any imaginable cogency in the points he attempts to make against the new Theory of Sound, but solely to enlighten those who may possibly regard him as an authority. Evidently he so regards himself, judging from his words:

"*As one professing to be tolerably conversant with this theory in all its details*, I beg to state that the undulatory theory is by no means an arbitrary conception or in any respect a matter of opinion, but the entire theory is a true and logical deduction founded exclusively on the well-known and universally admitted elementary laws of motion," etc.

Now, it would be entirely natural to expect one who professes to be conversant with the undulatory theory "in all its details" not to perpetrate a most glaring blunder in stating its first and elementary principles, with which any beginner in acoustics is familiar. Take, for example, first, his explanation of a few so-called "laws" as a "logical deduction founded exclusively on the well-known and universally admitted elementary laws of motion." He says:

"A body in motion *not acted upon by any force*, will move in a straight line with a uniform velocity."

This, to begin with, is a solecism of the baldest kind. A body can not be in motion unless it is acted on by a moving force. Should a body be in motion, by whatever propelling energy started, and that force should cease to act on it, the moving body would come instantly to rest, unless some other force should step in and take up the work, such as gravity, for example, thus giving the body a motion in another direction.

A ball fired from a gun has stored up in it the force of the ignited powder which gave it the impetus, and it would not go one inch from the mouth of the gun only as that force continues stored up in it, thus overcoming the resistance of the air and counteracting the vertical pull of gravity.

Our common word *momentum*, or the *inertia of motion*, is but another name for this stored-up force, and manifestly if no other force or resisting substance of any kind should tend to impede or divert the ball when thus started, it would go on forever, and this stored-up force with which it is charged would never leave it. How beautifully this correct view of motion and momentum illustrates the universally admitted law of the "conservation of force" or the "persistence of energy;" and how conclusively does it prove that Mr. Woolhouse has no correct conception of the elementary laws of force and motion with which he professes to be conversant in all their details!

His next misapprehension of the laws of force and motion is in these words:

"When any force acts upon a body in motion *the change of motion which it produces is the same in magnitude and direction as the effect of the force upon the body at rest.*"

Now there is not a beginner in any philosophy class who does not know that a body in motion under one force, if acted on by another and equal force in an opposite direction, would come to rest; and if acted on by an equal force at right angles to its motion, it would take a diagonal course between the two directions, instead of taking the direction of this added force the same as if struck by it at rest, as Mr. Woolhouse erroneously asserts.

In his next law he says: "When *pressure* communicates motion," etc., just as if any body ever received or could receive motion without "pressure" either by pulling or pushing! Let Mr. Woolhouse, before he attempts further to expound the laws of force and motion, bring a little pressure to bear on his intellect and then let the readers of the *Standard* know what kind of motion was ever communicated to a body at rest that did not require the "*pressure*" of force. Possibly, judging from his loose way of expressing himself, he thinks that if he should move a body by *pressing* his finger against it, there would be no force involved in the operation. How little does he seem to know that behind his finger, which of itself has no pressure or action whatever, there is a real, substantial, vital force, controlled by the equally substantial mental force which produces all the pressure in putting such inert body into motion!

This slipshod way of stating things runs all through his exposition of the physical laws. Hear him as he expounds the "wave-length" of a vibrating string:

"*Twice the length of the vibrating string is the wave-length*, and there is a complete alternating transmission as regards form over this *double length* during every vibration."

Helmholtz shows that a tensioned string may have in its one single length, as many as a dozen distinct undulations or wave forms, and any acoustical text-book illustrates it by suggesting the holding of one end of a stretched rope in the hand with the other end fixed. These writers show how a quick jerk will cause a dozen undulations or wave-lengths to run along the single tensioned rope.

But this high authority, as "one professing to be tolerably conversant with this theory in all its details," insists that it takes these dozen undulations and as many returning ones to constitute a single "wave-length" in a stretched string!

Or possibly he may refer to the theoretic wave-length of sound-propagation as "twice the length of the vibrating string" which produces the sound, as it is difficult from his language to determine exactly what he does mean by wave-length. If this is so, it is a still worse blunder, since the so-called wave-lengths of sound depend entirely upon the pitch of tone, and the pitch depends upon the tension

and weight of a string of a given length. Plainly, a string two feet long may have any wave-length from five to twenty feet according to tension and weight, while *twice its length* has nothing whatever to do with the problem.

A string of a given weight and length may have a thousand different vibrational numbers according to varying tension, each number giving a different pitch of tone and each pitch causing a different theoretic wave-length; for according to the wave-theory the length of the waves depends on the number of vibrations per second divided into the velocity of sound per second in feet and inches. Thus the high D of the piccolo flute has a wave-length of only about 3 inches, while the lowest note of the double bass has a wave-length of 28 or 30 feet. Yet Mr. Woolhouse insists in all cases according to his "law," that "twice the length of the vibrating string is the wave-length" whatever its tension or pitch. This is a new phase of acoustical science.

Now it is not at all surprising that a man, having such confused ideas concerning the elementary principles of the wave-theory, should hardly be a competent exponent of a theory of sound with which he does not profess to be conversant in all its details, and which he even rejects as unworthy to be called a theory. Hence his total misapprehension of the substantial theory of sound.

He even charges that the author of this theory insists that so-called sound-waves and water-waves should be "perfectly analogous in all respects, and that the same theoretic results should apply to all of them," when it is a fact that this is the exact position of Prof. Helmholtz, the highest authority on sound in Europe, and which the substantial theory combats as absurd "in all its details."

But facts were evidently not what Mr. Woolhouse was after, his manifest aim being to create a prejudice against the new theory of sound regardless of its scientific demonstrations. Lest he should never have read the "Sensations of Tone," by Helmholtz, here is what that great physicist says in his own verbatim words:

"The *process in the air is essentially identical with that on the surface of water.* . . . The process which goes on in the atmospheric ocean about us is of a *precisely similar nature.* . . . The *waves of air* proceeding from a *sounding body* transport the tremor to the human ear *exactly in the same way as the water transports the tremor produced by the stone.*"—*Sensations of Tone*, pp. 14, 15.

One other point only and I will leave Mr. Woolhouse to the critical mercy of the rising young scientists of Great Britain. He says:

"The *strength* or degree of *loudness* of the sound will depend on the extent and consequent amplitude of the vibration. But the *carrying power will depend also very much upon the musical quality before mentioned.*"

This pretended distinction between the *loudness* and the *carrying power* of a sound is a barefaced invention without the slightest meaning in science, and which has recently been urged to avoid the annihilating fact that some of the loudest sounding bodies, such as that of the locust, which can be heard a mile, have an almost imperceptible vibration, and consequently produce very little action on the air, while powerfully vibrating bodies, such as tuning-forks held in the fingers, making a hundred times greater disturbance of the surrounding air, can not be heard ten feet away in a still room.

Of course this fact demonstrates that the loudness of sound is not produced by the air-disturbance caused by the sounding body, but comes almost entirely from the sonorous property of the instrument that liberates this force, as I have shown in my January letter to the London *Musical Opinion* in reply to Dr. Sedley Taylor.

No answer can be made to this state of facts. Hence the attempted distinction between the *loudness* and the *carrying-power* of different sounds.

No purer quality of sound exists, as Helmholtz admits, than that of the tuning-fork. Why does it not have "carrying-power?" Simply because it is not *loud.* Why is it not *loud?* Simply because it has little "*carrying-power.*" The *loudness* of a sound at its source simply and in every case determines its *loudness* at a distance, or in other words its *carrying-power* which means the same thing; and this attempted distinction without a difference is the straw which the wave-theory is grasping to keep it afloat for a few days longer.

A. WILFORD HALL.
Editor of the MICROCOSM, New York.

THE CHASM FILLED.

BY THOMAS MUNNELL, A. M.

For many centuries an impassable gulf has been admitted in the scientific mind between the physical and spiritual hemispheres. Between the ponderable and the imponderable there lay not a *terra incognita*, but a *nihilum incognitum*, a region not only unexplored, but on account of its supposed utter emptiness, unexplorable even in thought. It was simple space uninhabited by anything visible or invisible, tangible or intangible, upon which no philosophy had ventured even a working hypothesis. The very best thinkers had never suggested any twilight relation of things where it might be neither day nor night and yet something substantive. It seemed to all that on one side of said chasm there was a steep declivity, an abrupt ending of matter and an equally abrupt beginning of nothingness; and on the other side an abrupt termination of nothingness and a steep acclivity of the spiritual. Strange that such a thought should ever

have been entertained, since it has long been known that nature seems to have left no such deficiencies between any of her great kingdoms. Twilight itself might have suggested a better thought, and man himself being a connecting link between the physical and spiritual universes. But these and many other hints in nature not having been utilized, *sound, light* and *heat* being classified with none of the great entities of the world, had to be put quite out of existence also, and labelled as three "*motions.*" which means three *nothings.*

Heat and motion being with wave theorists convertible terms, latent heat must mean latent motion; that is, latent heat is potential heat, and latent motion is potential motion, each of which becomes active by some external force. Heat may be excited by friction of one piece of wood, metal, or even ice against another, but the sun's rays have no hard substances by the friction of which heat could be excited unless it be the particles of one atmosphere or the particles of hydrogen gas in the solar photosphere. Then if heat on earth is nothing but motion, the same must be true of the sun, whose surface heat is 18,000° F., more than 180 times as great as that of our hottest summer days. This difference must be caused, according to the wave theory, by the different degrees of excitement in the wave motions of light. But this is unscientific and absurd, because were there no *latent heat* in the substances rubbed against each other, no *heat* could be *developed.* Hence the coldest substances develop the least heat not because molecular motion was not excited by friction, but because heat being an entity, there is less of it in the colder substances to be developed. Dr. Hall showed years ago by a new law in physical science, that the quantum of heat in air does not increase by condensing the air as some contend, but that the air being condensed into smaller space, its inherent temperature was naturally raised as the bulk of air was diminished; but if there were no substantive heat in air it was plain that said temperature could not be increased, but rather would be diminished, since pressure tends to quiet all undulatory motion, and so would *reduce* the heat. Not only so, but if light, sound and heat are all motions, pressure sufficient to stop all their quiverings would necessarily destroy them all. On the contrary, sound increases in intensity with such condensation which shows either that sound does not consist of wavelets, or else, contrary to all reason, said wavelets roll higher and become more and more boisterous as pressure increases. This is unthinkable and ought without another argument to settle the question forever.

But what about combustion if heat is nothing but motion. Does the sun's photosphere of 18,000° Fahrenheit consist of nothing but *quivers* of light and heat—quivers whose amplitute is only $\frac{1}{24.000.000}$ of an inch? But if these quivers are nothing, one of the simplest principles of arithmetic must be abandoned, namely, that no number of noughts or cyphers can ever make even a unit. A decillion of cyphers could never amount to a unit. Yet Mr. Tyndall & Co. teach that the more noughts there are in the column the larger the footing, for as said before, the intensity of heat depends either upon the number of wavelets struggling at the point of combustion or upon the inherent, potential and therefore substantive quality of heat itself. If they accept the former, then not only all our volcanoes and city conflagrations, but our sun and all suns and fires in the universe are unspeakable effects without any adequate cause—without *any* cause adequate or inadequate—and therefore heat is a substantive, entitative *thing.*

The Substantial Philosophy is strangely deep and comprehensive. Tap the fountain where you will and the living waters flow. If its future should be as all-convincing and satisfactory as it now promises, "every valley shall be filled," and the heretofore frightful gulf between the material and the immaterial will be completely bridged, for when Substantialism shall have peopled that intermediate space with magnetism and all its associates that seem to inhabit "No Man's Land," the transition will be easy enough and unavoidable to that still higher grade of thought that will fill the chasm between the finite and the infinite intelligences. However useful this philosophy may be to science, it is no less so to religion, for it is always looking upward as the Disciples looked after their ascending Lord, and makes all believers feel that

"Though in a distant land
Yet we're not far from home."

1. That heat can not be developed by motion, by friction, by concussion, by chemical action, nor by any other means if there is no latent thermal entity to be developed. Friction may bring it to the surface provided there is any heat in the material to be brought there, and the same may be said of concussion.

2. Combustion can not be accounted for nor caused by mere motions, be they ever so numerous and violent. Heat, a nonentity, develops electricity, and electricity, an entity, develops heat, a nonentity. "*Apelles Judœus credat, non Ego.*"

(Continued from page 27, vol. viii.)

What is Sound? The Substantial Theory *versus* The Wave Theory of Acoustics.

BY GEORGE ASHDOWN AUDSLEY, F.R.I.B.A.

I must now touch, but very briefly, on the phenomenon of sound known as *sympathetic vibration.* If time permitted I should have been glad to enlarge on this subject and to have performed some experiments with stretched strings, but, as matters stand, I must content myself with the single illustration of the sympathetic vibration of the tuning-forks.

Sympathetic vibration has always been held as a strong argument in favor of the existence of both air-waves and sound-waves, but I fail completely in discovering one connecting link between such vibration and mechanical sound-waves. The wave theory teaches that, in the case of the sympathetic forks, the sound-waves sent off by the fork which has been bowed or otherwise set into vibration pass through the air and, impinging on the motionless steel prongs of the other and, perhaps, distant fork, set them into corresponding vibration. The action is purely a mechanical one, for we are assured that the silent fork is set in motion by reiterated blows or pushes of the sound-waves. Such an idea is so contrary to reason and fact that I have to exercise some patience in speaking on the subject. You have already heard enough about the microscopic vibrations of the tuning-fork's prongs to satisfy your minds that no such mechanical action as air-waves, with

condensations and rarefactions of the air, can possibly be set up by them; and my gold-leaf experiment has incontestibly proved that the vibrating fork does in no degree disturb even a confined column of air at the distance of one inch from its prongs. Under these circumstances, therefore, it is quite evident that sympathetic vibration must be due to some other force than these impotent and non-existent air or sound-waves, and that this force is the *sound force* of the Substantial Theory of Acoustics as already explained. Now for just one experiment.

I have here two forks in perfect unison, and I shall be glad if any gentleman present will carry one to the extreme end of the room, and, holding it in his hand, satisfy himself that it is absolutely silent. Let the fork be held so as to touch nothing and be free to vibrate. I now bow the remaining fork before you, and then I instantly damp it. My fork is silent; but that held in the hands of the gentleman at the far end of the room is now sounding quite audibly to his ears, and to yours also if you will hold the opening of the resonant case to your ears.

Will any wave theorist affirm that this effect has been produced by vibrations in the form of air-waves generated and sent off by the fork I bowed? Surely not! Look at the solid steel prongs of the fork, which weighs fifteen ounces —bear in mind the fact that the prongs of the bowed fork only moved about the $\frac{1}{10}$th of an inch in each complete swing at the most—and then look at the distance, and the many obstructions between the two forks. Does it not now strike you that there is some hitherto unknown and unrealized *force* in *sound*—a *force* akin to the other forces of nature, such as electricity and magnetism? At all events, do not throw the idea aside as unworthy of your calm consideration and earnest investigation.

I am of opinion that sympathetic vibration or sympathetic generation of sound forms one of the most remarkable and noteworthy phenomena of acoustics; and as there can be no question of the great importance of sympathetic vibration as a teacher and as a guide to a right understanding of the nature of sound, it is strange, to say the least of it, that so little stress is laid upon it in our text-books on the science of acoustics. For instance, in Professor Tyndall's "Sound," only about two and a half pages are devoted to the discussion of "sympathetic vibrations." I have observed in all text-books on acoustics that there is a studied avoidance of all matters that seem to favor any hypothesis rather than the accepted undulatory one, and I conclude, as wave theorists find themselves on rather shaky grounds in attempting to account for sympathetic vibration, they say as little on the subject as possible. How different is their treatment of what is called "interference of sound," a pet subject with all wave theorists, for the very existence of the wave theory depends upon its acceptance and full recognition as an established phenomenon of sound. Yet *sympathetic vibration* is a self-evident fact in nature, whilst the so-called "*interference of sound*" has never yet been satisfactorily demonstrated to exist. This I shall prove to you by some of the most notable experiments brought forward by wave theorists—experiments of the tin tube, books and candle calibre—to prove the interference of, and, accordingly, the existence of, *sound-waves.*

Sympathetic vibration deserves to be much more carefully investigated than it has ever been; and, as I know from experience, it presents a most fertile and interesting field for study. Enough is known to assure one that the investigation will reveal some very curious and astonishing results and effects.

Allow me now to show you an experiment which is not mentioned by Tyndall, Helmholtz, or Mayer, or in any work on acoustics known to me. The result of this experiment is, perhaps, one of the most wonderful in the entire range of sound force demonstration. I attribute the silence of the text-books regarding this experiment to two things—firstly, to the fact that it is little known; and, secondly, to the fact that it is almost a hopeless task to explain it on the wave theory, however ingeniously the argument may be framed.

The piece of apparatus I now submit for your inspection is called, for want of a better name, the "acoustical turbine," or, in the language of Dr. Kœnig, "*Roue de réaction acoustique.*"

It consists of four small canister-shaped vessels of aluminum, closed except at their projecting necks. These vessels are resonators, accurately tuned to the note C^4, of 512 vibrations per second. The resonators are attached or suspended to the extremities of four arms, also of aluminum, provided at the crossing with a little agate cup, which rests upon a sharp steel point attached to a small stand. By this simple arrangement the suspended resonators are perfectly balanced and revolve with the greatest ease. The remaining part of the apparatus consists of a tuning-fork, C^4, perfectly in accord with the resonators, mounted on a resonant case.

The experiment is performed as follows: Placing the resonant case with its open end directly opposite the "turbine," which of course is perfectly motionless, I set the fork into vibration by bowing it at short intervals so as to keep up the discharge of sound force, and immediately the "turbine" commences to revolve and gradually gains speed until it moves round with considerable rapidity. The resonators move with their closed and flat ends foremost, carrying their open necks behind them, and they will move in no other way under the influence of sound force. If I set the turbine revolving in the opposite direction and then bow the fork, it will be observed that a diminution of speed instantly takes place, then the "turbine" comes to a stand-still, and then it slowly resumes its true motion. There is one important fact which must be mentioned —namely, that the apparatus will move with no fork which is not in perfect unison with the note to which the resonators have been tuned.

Attempts have been made to account for the action of this curious apparatus under the wave theory, but, to my mind, the reasons advanced are altogether insufficient, even if I believed in the existence of sound-waves. According to Drovák, who has written on the subject in *Poggendorff's Annalen*, the revolution is caused by pressure within the resonators upon their closed ends. He argues that there is a node at the closed end of each resonator, and that the mean pressure of air in this node is superior to that of the air in repose. In the resonator the node is found at the bottom, and if the air in the resonator vibrates sufficiently to produce at the node, and, accordingly, close to the bottom, a mean pressure greater than the external air at repose, the reaction is there

produced. This seems reasonable at first thought, but it will not stand careful analysis or investigation. Probably the ordinary wave theorist would claim that the revolution of the canisters is caused by the reiterated dashing of sound-waves or air-waves against them, just as he claims that the action of the sympathetic fork or of the tympanic membranes of our ears is caused by that same reiterated dashing. Should such air-waves and such mechanical dashing against the canisters exist, how comes it that the canisters revolve in the wrong direction? If we take a small card and quickly move it, so as to send off true air-waves, we find that, as the closed ends of the canisters present the largest surface to the action of the air, the turbine revolves in the opposite direction to that it takes under the influence of sound.

It is self-evident that in this interesting machine we see the effect of a mysterious cause—a wonderful illustration of sympathetic vibration, and evidence of the power of sound force which science has hitherto unacknowledged.

We are well acquainted with the marvellous powers of electric force, exerted upon objects at immense distances from its immediate or active source; and we know that a powerful magnet can stretch out its substantial but invisible hands, and pass them through solid obstructions, such as glass, wood and metals which are not subject to magnetic influence, and lift or move ponderable bodies which are in sympathy with magnetic force, placed at considerable distances from its poles. But we are certainly not prepared to explain how the electric and magnetic forces do these wonderful things. So it is with natural sound force. We see in the sympathetic vibrations of tuning-forks and strings, and in the movement of the "acoustical turbine," evidences of a natural force operating in just as mysterious and subtle a manner as we observe electric and magnetic forces operating upon objects and substances in sympathy with them, and we can not be expected, in the present state of scientific knowledge at least, to grasp the reason of one phenomenon more than another, whilst it may be in our power satisfactorily to prove how they are not accomplished.

Some time ago I submitted the problem of the revolution of the "acoustical turbine" to Dr. Hall for his consideration; and in his reply are the following remarks:—

"Let it be distinctly remembered that substantial but immaterial pulses of sound force do not act at all on material bodies, however light and easily moved, *unless their vibrational tension puts them in synchronous sympathy with that of the sounding instrument.* Hence, unless there were something connected with the four arms of this wheel having a tension in sympathetic synchronism with the substantial sound-pulses emitted by the C^4 fork, it is manifest that such pulses would produce no effect on the wheel one way or the other. But here is the fact that unlocks the whole mystery. The air column or chamber in each of these resonators is in exact sympathy with the C^4 fork, and has the same vibrational number; but as these air columns can only be reached in full power by the sympathetic force at the ends having the open necks, hence the substantial sound-pulses from the fork and its resonant case acting exclusively against that end of the air-chambers must necessarily drive the resonators in the direction which they do."

I leave this important subject of sympathetic vibration and movement with considerable reluctance, but it is imperative for me to move on to the consideration of the so-called *interference of sound*—a class of phenomena which has always been held in high favor by wave theorists as presenting unanswerable proofs of the existence of sound-waves, and accordingly of the truth of the wave theory.

You have all heard or read of this phenomenon of interference of sound, but have you all accepted the teaching of our acousticians on this matter as gospel? I hope not. I have both the assurance and the boldness to stand before you, the accomplished members of the most distinguished musical association in the land, and say that there is no such thing in existence as *interference of sound*, as taught in our text-books on acoustics. Before I proceed farther, let me ask you one question: Have you ever seriously realized in your minds what the musical effect of a full orchestra would be if there was such a thing as interference of sound, as taught by Professor Tyndall and the other great wave theorists?

Amongst the many misdirected and misrepresented experiments made by acousticians perhaps none are more amusing than those which have been brought forward with the view of proving the interference of sound. I shall briefly direct your attention to two or three of these experiments, and if they can be shown by any one to clearly indicate the interference of sound-waves, and therefore the existence of sound-waves, I shall willingly abandon my opposition to the wave theory, and admit my error in advocating the theory which holds sound to be, like electricity, one of the primordial forces of nature.

Turning to the pages of the leading English text-book on sound, we find these statements: "When two unisonant tuning-forks are sounded together it is easy to see that the forks may so vibrate that the condensations of one shall coincide with the condensations of the other, and the rarefactions of the one with the rarefactions of the other. If this be the case, the two forks will assist each other. It is, however, also easy to see that the two forks may be so related to each other that one of them shall require a condensation at the place where the other requires a rarefaction; that the one fork shall urge the air particles forward, while the other urges them backward. If the opposing forces be equal, particles so solicited will move neither backwards nor forwards, the aerial rest which corresponds to silence being the result. *Thus it is possible by adding the sound of one fork to that of another to abolish the sounds of both. We have here a phenomenon which, above all others, characterizes wave-motion.*"

The same authority tells us how this *silence* is to be produced. He instructs us to place the two forks half a wave-length apart, and to set them in vibration, and he then asks—"What must occur? Manifestly the rarefactions of one system of waves will coincide with the condensations of the other system, the air (beyond the second fork) being reduced to quiescence. . . . The action here referred to is called *Interference.*"

Now I unhesitatingly affirm that there is not one atom of truth in the statement made, and I defy any experimenter with two forks, or, indeed, with any two sounding bodies, to produce silence in the manner so clearly laid down.

Here are two unison forks, made by the greatest manufacturer of acoustical apparatus who has ever lived, Dr. Kœnig, of Paris; let any one produce silence with them, placed in any relative position, whilst they are both in vibration, and I shall acknowledge the law of interference. I can not do it, and I say it can not be done. So much for text-book teaching.

(To be continued.)

QUERY DEPARTMENT.

[From this on we shall introduce into the MICROCOSM a department of queries, and solicit pertinent inquiries on scientific and philosophical matters which we will endeavor to answer.—EDITOR.]

Dr. Hall,—Will you please answer the following (if it be worthy of an answer)?

Suppose a train, running on a straight road, carries a loaded cannon, the muzzle pointing in the same direction as the train's travel. Suppose the possibility of the train running at the same rate that the ball travels when discharged, would the ball fall at the mouth of the cannon?

Again, suppose the cannon pointing in the opposite direction, the train having the same speed of travel, and the cannon discharged; would it fall to the ground at the mouth of the gun, or what would be the result?

Please answer, if the question be worthy of consideration, in the MICROCOSM and oblige a reader. J. H. CARNES.

REPLY TO THE FOREGOING.

We take pleasure in answering the problem presented by the Rev. Mr. Carnes: 1. The ball fired from the cannon in the direction of the moving train would have added to the velocity of the train the normal speed produced by the powder, minus the difference in the atmospheric resistance caused by this added velocity of the train. In other words, a train moving 1,000 feet a second with a cannon on board firing a ball in the same direction with a normal velocity of 1,000 feet a second, would cause the ball to travel over the ground at a velocity of 2,000 feet a second, minus the augmented resistance of the air already referred to.

2. But should the cannon be fired in the opposite direction, the velocities being the same, the ball would drop to the ground at the place where it was when fired, the speed of the train exactly neutralizing or equaling the projectile force of the powder. Possibly, however, the ball might travel a short distance beyond the spot over which it left the gun on account of the less resistance of the air in consequence of the moving train.

To prove that this answer is substantially correct, a person on the top of a moving freight train can throw a stone along the surface of the cars about an equal distance in either direction; but should he stand on the rear car and throw a stone along the track in the direction opposite to that of the moving train, the velocity of the stone, in relation to the track, would be less than normal to the extent of the speed of the moving train. And if it were an express train, moving as swiftly as a stone can be thrown by the hand (100 feet a second), the stone would drop directly to the track at the spot where the thrower stood when the stone left his hand.

Dr. Hall,—Will you please explain why the shadows cast by objects under an electric light are sharp and clear cut in outline, while those cast under gas or sunlight are soft in outline, that is, the edges seem gradually to weaken or blend with the light? MRS. M. S. ORGAN.

In answer to the foregoing we say that it is entirely owing to the difference in size of the different light-centers. In the case of shadows cast by the arc-light, the lines are intensely sharp because the spark is almost a mathematical point—not so large as the head of a common pin, thus allowing no portion of the light to shine around the edges of the object. Such shadows are always observed to be very black, especially where no other lights are in proximity.

But where the light-centers are of considerable size, as in the case of gas flames, they will shine around the edges of objects producing what is called a *penumbra*, or partial shadow, so that no well-defined edge of a true shadow can be observed.

If the object be very small in comparison to the gas-flame, such as a pencil, and be held close to the broad side of the light, no perceptible shadow will be cast, because the real shadow is obscured by the lapping around the pencil of the penumbra. But turn the gas-flame edgewise to the pencil, in the direction of its length, and you will at once see the shadow well-defined and nearly as sharp as that of an arc-light if the flame be a very thin one.

A NOVEL PROJECT.—BATHING IN MID-OCEAN.

BY THE EDITOR.

As the facilities for ocean travel, under modern improvements and advances in mechanical appliances, have nearly all the advantages for comfort obtainable on land, why may not the captain of some first-class steamship so arrange his vessel as to provide the facilities for ocean bathing on suitable occasions in mid-ocean, or half-way between New York and Liverpool?

The project has occurred to us of so constructing a first-class steamer as to connect with it a bathing platform to be swung and lowered from the side of the ship into the water to a suitable depth to allow passengers the privilege of a mid-ocean bath.

Let suitable days which may occur in summer or during warm weather be selected when the ocean is perfectly calm, aud a couple of hours' delay be devoted by the captain to bringing his ship to a stand-still thus affording

a luxury so novel and interesting, as well as healthful and exciting, as to pay for the detention and the pains necessary to this end.

In case such a device and provision should be adopted by transatlantic and transpacific steamers, no passenger who is ever attracted to sea-side resorts on land but would go provided with proper bathing attire as part of the ocean outfit, especially in summer voyages.

The steamer thus prepared to furnish mid-ocean bathing, would of course be provided with suitable life-preserving jackets for passengers, so that those who might desire, either male or female, could take a grand swim around the vessel, with an abundance of life-boats ready at hand to furnish any assistance required.

We look forward to this novel luxury in the not far distant future as one of the special attractions of modern ocean travel, particularly during warm weather. What sea-captain shall be first to adopt it?

AN UNPARALLELED SUCCESS.

It is not possible for any person outside of this office or unacquainted with its correspondence, to form even a shadow of an estimate as to the success in a business way that has attended the introduction and spread of our Health-Pamphlet.

We have never, since that pamphlet was first announced in this paper, asked a single person to purchase it, but have advised hundreds personally and thousands by letter not to buy it, but wait till they had evidence from personal friends as to the unmistakable value of the new treatment before trying it.

Not one person, we venture to believe, within the last year has sent the $4 for this remedy, as set forth in the Health-Pamphlet, only as he or she has become convinced of its value *through the testimony of some one in whose word implicit confidence could be placed.* And we here assert that more than nine-tenths of all the sales made since the first order was received nearly two years ago, have resulted from one person telling another of the health-treasure he or she had found either in personal conversation or by letters written to distant friends. Yet up to this date nearly 300,000 copies of this little book have found their way into families who are now practising the treatment prescribed while regarding it as the greatest boon of their earthly existence.

And even now hundreds of applications a day for this pamphlet, personally and by letter, come to us accompanied with the money, all of which are burdened with this same plaint—that some friend had told them of the great benefits received from this simple remedy without medicine. And so wonderful has been this spontaneous and unceasing demand that it is now regarded by those in the secret as the business and hygienic miracle of the nineteenth century.

We do not make this statement as an advertisement at all, but to let our numerous personal friends at a distance—who are numbered by the thousand—know that our long delayed triumph over adversity and dark fortune has come at last, and with it a corresponding triumph of Substantialism over the principles of false science. This will be abundantly shown as never shown before in the next number of the MICROCOSM.

Those interested in such reading, if not subscribers for the MICROCOSM, should send their names at once with 50 cents for the present volume (VIII.), including the three back numbers.

Whether or not they are subscribers, no reader should fail to send for the December number and our special Extra which will be sent free. A *postal card* will be sufficient to make known this desire. Address the Editor as on first page.

A SIGN OF THE TIMES.

It is certainly a hopeful sign when such scientific men as Sedley Taylor and Mr. Woolhouse, of England, can be forced from their silence and induced to attempt a defense of the wave-theory of sound and incidentally of the other motion-theories of science, as seen in this and in the December numbers.

We are glad to announce that we have just received a long communication from Sedley Taylor purporting to be a reply to our review of his arguments as printed in the December number and in the January *Musical Opinion* of London. We shall take pleasure in answering, in the next number, everything he says worthy to be dignified as an argument.

We are now beginning to hope that Dr. Audsley may yet succeed in smoking out Prof. Tyndall himself, after he shall realize the demoralization that is taking place among the rank and file of his wave-theory disciples.

PROF. HAECKEL'S MATERIALISM.

Thoughtful religionists all over the country are beginning to ask themselves seriously as to what is to be done to meet the materialistic views of Prof. Haeckel. He insists that if the motion-theories of science are true—namely, that sound-force, heat-force, light-force, etc., are but the vibratory motions of material particles,—then life-force, mind-force, soul-force and spirit-force must be nothing more nor less than the varied motions of our brain and nerve molecules; and as motion ceases to exist the instant the particles moving come to rest, he thereby demonstrates, if modern science be true, that the soul and spirit cease to exist at our mortal dissolution, and that *Death ends all.*

We have printed numerous articles in the MICROCOSM and *Scientific Arena* showing that nothing but Substantialism affords the slightest rebuttal of Prof. Haeckel's disastrous argument against human immortality. Chief among these articles is one by the Associate Editor in the first number of Vol. VI. of the MICROCOSM. Eld. Thomas Munnell, regarding that article as absolutely unanswerable, and believing as he does that every Christian teacher should avail himself of its benefits in this age of materialistic degeneration, has written the following letter to the editor of the *Christian Standard*, Cincinnati, Ohio, which we commend to the reader:

BALTIMORE, Md., January 15, 1891.

BRO. MCDIARMID, Ed. *Christian Standard:*

Dear Sir,—Allow me to call your special attention to the enclosed leaf from the MICROCOSM, No. 1, Vol. VI., by the Associate Editor of that periodical. It seems to me that the call therein made upon Christian teachers and defenders of the Christian faith demands most careful consideration; and knowing no one more capable of writing an unbiassed review of the question therein treated than yourself, I mail it to you hoping to hear from you in the *Standard*. The phenomenal growth of *Substantialism* both here and in England among scientists will justify any notice you may have time to give it. I have written Dr. Hall that I think he may expect to hear from you in due time. Yours as ever,

THOMAS MUNNELL, 1007 Hopkins Ave.

The Microcosm

A MONTHLY JOURNAL OF SUBSTANTIALISM AND COLLATERAL DISCUSSIONS.
THE ORGAN OF THE SUBSTANTIAL PHILOSOPHY.
A. WILFORD HALL, Ph. D., LL. D., Editor and Proprietor.
(Author of the "Problem of Human Life," "Universalism Against Itself," Editor of the *Scientific Arena*, &c., &c.)
ROBERT ROGERS, S. L. A., Associate Editor.
Address all communications to A. WILFORD HALL, 23 Park Row, New York.

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THE GREAT FREQUENCY OF VIBRATION: DOES THIS HELP THE WAVE-THEORY?

(Reply to Prof. A. B. Wood.)

BY THE EDITOR.

In the January MICROCOSM we discussed the question as to whether or not the vibrating prong of a tuning-fork *swiftly advances,—very much faster than the movement of a clock-pendulum,*—as supposed by all previous writers on acoustics in order to produce the "condensations and rarefactions of the air" constituting sound according to the wave-theory.

We proved that all these acoustical writers were mistaken, and that instead of "swiftly advancing" as taught by Tyndall and Helmholtz,—the highest living authorities on the subject,—the fork actually produces audible sound after it has been sounding *four minutes* and when its swings have been reduced to the $\frac{1}{64,000,000,000}$ of an inch each, making the whole distance of travel only the $\frac{1}{128,000,000}$ of an inch in a second, or at a velocity, counting the swiftest part of its swing, *of less than one inch in two years!* This was the result of a careful mathematical calculation and measurement on the part of Capt. R. Kelso Carter, Professor of Higher Mathematics in the Pennsylvania Military Institute, as reported by him in the MICROCOSM, Vol. III., page 154.

Of course this tremendous demonstration against the acoustical teaching of modern science has completely silenced the batteries of the great authorities so far as the "swiftly advancing" prong or string is concerned, and Prof. Wood, as we will immediately show,—one of the most critical advocates of the wave-theory we have ever read—admits that Tyndall and Helmholtz have been completely beaten and proved to be in error in this supposed swift travel of the prong.

But as a dernier resort, and the only plank left to keep the current theory from sinking out of sight, Prof. Wood, in harmony with his demoralized brethren in England, now under the fire of Audsley and Pearce, claims that this almost infinitely slow motion as now demonstrated is balanced by great frequency of vibration, or by the great number of to-and-fro movements of the prong in a second; and that whereas a single motion of a body at a very slow velocity, as all writers admit, would not compress the air and send off a pulse, yet a great many of these same slow motions, back and forth, would send off air-pulses or condensations and rarefactions in the shape of sound-waves.

But we will not further forestall the reader by anticipating Prof. Wood's argument, but will now give verbatim all he has said in support of this position so essential to the life of the wave-theory, after which we will annihilate every position he has taken. Here is his letter, and we ask every reader to study it carefully, for on this argument alone now hangs the life of the wave-theory of sound:

CLYDE, MICH., Jan. 21st, 1891.

Dr. A. Wilford Hall, Dear Sir and Brother,—The copy of the January MICROCOSM you sent me, I received with thanks. I am interested in your discussion of the theory of sound. Having graduated in the Latin scientific course from Michigan University, I feel competent to enter with you into the investigation.

Your article, page 24, *clearly beats Tyndall and Helmholtz as to the rate of motion of the prongs of a tuning-fork. That side might as well admit their error. There is no "swiftly advancing" about it.*

But there *is* a *swift change of motion* from one direction to the other, as you will admit; several hundred changes in a second is a swift change. Although this is not the meaning of Tyndall's "swiftly advancing" fork-prong, yet it really accomplishes what he sought to demonstrate—an *inequality* of *density* in the air.

The *pressure* of the fork-prong upon the air as it advances in one direction leaves a little space behind it where the pressure is not quite so great—and thus the *wave* is created—for the particles in the compressed portion will rush back into the space of *less* compression.

Whether this last happens or not, the *compression* made by the advancing prong will *expand again*, and these movements once set up will continue till equilibrium is again restored—just as one wave made on the surface of a pond creates several waves that move off

over it. Whether the movement creating the wave is *slow* or *swift* makes no difference with the wave's velocity. If you were just to reach a disc under the water and lift the water *slowly* the motions of the wave would be the same. It is not the *swiftness* or *slowness* with which the compression in the air is made, but the single fact of its *existence* that insures a wave. And the velocity of the wave after it is formed depends, not on the velocity of the disturbing cause but upon the internal constitution of the fluid. A wave on the water moves no faster when raised by a *swift* stroke than when raised by a *slow* one. It is the *pendulum* motion of the particles.

Sound we call air-*waves*, but it is more properly called air-*pulses*, as Tyndall has it. The motion of a particle of water in a surface-wave is a *circle*, while the movement of a particle *within* a substance is an excursion back and forth in a *straight line*, not *up* and *down*, as you have it so many times.

The *rate* of motion of the pulse is not at all governed by the rate of motion of the *disturbing* cause, and the rate of motion of the particle is not the rate of the *wave* at all; because as a particle advances towards others those *move on* almost as soon as the first particle *starts*. So the motion is propagated through a thousand times as fast as *each particle* moves. It is the *pendulum*-motion of the particles that makes it impossible to hurry up a wave. Each substance has its own rate of pendulum motion —depending upon its molecular constitution— and a wave set up by simply moving a few particles *nearer* to others by a *slow* or a *quick* motion is propagated afterwards at the *pendulum rate* of the particles, which is not at all affected by the slow or *swift rate* of the consecutive pulse.

Hence, if you *have* proved Tyndall to be in error as to the rate of motion of the prong of the tuning-fork, you have not affected the main idea at all. A motion of 256 times in a second is certainly enough to create *slight compressions*, which is all that is wanted. These compressions recovering themselves create the waves. Once originated they move on like waves on the surface of a pond, though with a *straight* motion of the particles instead of a round motion.

No, the "travelling swiftly" of Tyndall's tuning-fork prong you have *disproved*, but you have not thereby affected the proof of the *wave-theory*. * * * A. B. Wood, M. S.

The remainder of his long letter deals in criticisms of Dr. Audsley's lecture, but with arguments even of less plausibility than is exhibited in the foregoing. Let us now examine this strongest possible presentation of the argument based on the rapid vibration of the prong and the possibility of its condensing the air into so-called sound waves.

Prof. Wood admits that the greatest mathematical investigators of modern times have egregiously blundered in supposing the vibrating body to have a *very swift travel* as the essential foundation of all their other mathematical calculations by which it were possible to show that the air could be driven off in condensed pulses.

He also admits or is compelled to admit, that at the very height of this mathematical blundering we were the first to convict these so-called acoustical experts of their essential mathematical mistakes which virtually exposed their incapacity to reach any correct mathematical conclusion growing out of this same travel of the vibrating prong. Plainly, if the greatest mathematical minds on earth had become so blinded and muddled by the wave-theory and its inherent want of coherence as to base their chief calculations concerning the supposed "carving, condensing and rarefying" of the air upon this superficial blunder, which it required only the common sense of a layman to detect, how is it possible to place the slightest confidence in their after calculations of the sending off of air-pulses which had their only supposable origin in this ridiculous mathematical mistake of the "*swiftly advancing*" prong?

We could safely leave the whole argument right here for the common-sense student's deliberation, with this self-evident disparagement of all the mathematical calculations concerning air-pulses ever published in scientific books, and with its fatal nail hopelessly clinched by Prof. Wood's forced admission that the entire scientific world has been *beaten* by a man who makes no pretensions to mathematics. But we do not purpose letting Prof. Wood and his confreres escape so easily. There is too much plausibility in some of his points for us to let pass, and not to put into the hands of young substantialists here and now, and once for all, the weapons with which to annihilate these fallacies in coming generations.

The Professor says, "but there is a *swift* change of motion from one direction to the other," etc. There is no such thing. Why not use language correctly, if we wish to reach correct ideas? "*Swift*," when correctly employed, relates only to the *velocity* of a moving body, and not at all to the number of times it may change its direction! The prong has a great *frequency* of change in its direction; that is true, but not one of these changes is *swift*, since its travel in any direction is admitted to be very *slow*, even at its greatest speed.

A body may change its direction very often —hundreds of times in a second—while moving slower than a snail, turning to the right or left, stopping before each change; or it may even change to the opposite direction, and then again go forward; but so long as its travel in any one of these directions is the same snail-like velocity, with no "swiftly advancing about it," as Prof. Wood admits, there can manifestly be no more condensing effect upon the air by any one of such directions by

which to send off a pulse, than by the *start* or finish of one long motion, the body moving at the same snail-like velocity.

A physical investigator who is incapable of seeing this, has just the right sort of a mental caliber to accept the wave-theory with all its monstrous incongruities, including its "swiftly advancing" prong—"very much faster" than the movement of a clock-pendulum.

Since the "Problem of Human Life" was published, thirteen years ago, many of the ablest mathematical investigators of acoustics in this country and Europe, who had heard the news of our demonstration of the exceedingly slow travel of the prong, and who were so committed that they disliked to give up the wave-theory, have, however, publicly admitted that a continuous slow motion of a body through the air, such as the movement of a pendulum or the motion of one's hand a foot in a second, *would not compress the air or send off a pulse*, since the fluidity of the air would permit it to slip laterally around the sides of such slowly moving body and thus produce an equilibrium of the disturbance without producing a condensation, the same as if the body moved in an *incompressible fluid*.

But, like Prof. Wood, they have insisted, as the only salvation for the wave-theory, that if this same slow motion shall be divided up and frequently changed in direction, without any greater velocity of travel at each of these motions than before, then *presto*, the moving body will accomplish by a short travel what it failed to accomplish by a longer one of the same velocity! Is it possible that such scientific nonsense can be accepted by any cultivated and properly balanced intellect?

Among those who have made the above-named admission is no less a scientist than Prof. G. G. Stokes, F. R. S., Professor of Physics and Higher Mathematics in Cambridge University, England, and who occupies the identical chair filled by Sir Isaac Newton. In an address delivered by him before the Royal Society in 1884, as discussed fully by us in the third volume of this journal at page 219, Prof. Stokes says:

"Suppose a person to move his hand to and fro through a small space, the motion which is occasioned in the air is almost exactly the same as would have been if the air had been *an incompressible fluid*. There is a mere local reciprocating motion, in which the air immediately in front is pushed forward, and that immediately behind is impelled after the moving body," etc. [See this whole quotation and a lively discussion of it at the page above named.]

Now if the hand moving slowly through, say, one foot, as this great authority admits, merely displaces the air in consequence of its mobility "the same as if it had been an *incompressible* fluid," then in the name of reason would the first sixteenth of an inch of this same motion of the hand, at no greater velocity, produce a condensation of the air if the hand were stopped? Would a small fraction of this motion do what the whole of it fails to do? And if the first sixteenth of an inch of this slow motion does not compress the air while the hand continues moving, since the whole of it merely lets the air slip around, would the *stopping* of the hand at this first sixteenth of an inch cause a compression when its *entire travel* would not do it?

Then suppose the hand, after moving a sixteenth of an inch at this velocity of a foot in a second, were to stop and instantly turn back and retrace this sixteenth at no greater velocity, would that sixteenth of slow travel condense the air any more than in going the other way? Is any professed physicist so dull of comprehension as to try to maintain such an unmechanical position? And if two such changes of direction, under the same velocity of travel, will no more condense the air or start a pulse than if it were "incompressible fluid," would a hundred or five hundred similar changes of direction, each at this same uncondensible velocity, do any better?

Yet marvelous to record, Prof. Wood, after graduating from the Michigan University, has not the perspicacity to see through this preposterous absurdity which is now the only remaining support of the wave-theory of sound. But he is in good company, and might for ought we know possess the requisite qualifications to occupy the historical chair of Sir Isaac Newton in that greatest university on earth, at least, so far as the teaching of modern physics is concerned.

But look at it! If Prof Stokes is right,—and he surely would not have made the admission could he have helped it,—that a slowly moving body like the hand, moving through the air a distance of a foot in a second, will no more condense it or send off a pulse than if the air were an incompressible fluid, what must we conclude as to the same hand compressing the air while moving through it no swifter than the hour-hand of a clock? And if this slow motion, divided up into sixteenths of an inch, would come no nearer compressing the air than the long motion at the same rate of travel, as we have just demonstrated, what must we conclude as to the untenable character of the wave-theory when we consider that the prong of a tuning-fork, after sounding four minutes, only travels, by the clearest mathematical measurement, at a velocity 25,000 times slower than that of the hour-hand of a regulator clock!

Does Prof. Wood believe that a prong, traveling at this velocity in a continuous motion through a distance of a foot (which would take it *sixteen years*), must condense the air in front of

it rather than merely displacing it as if it were "an incompressible fluid?" Yet he does insist, in defiance of his own reason and at the behests of the wave-theory, that the same prong, traveling at the same velocity in short excursions, does actually cut and carve the air into condensations and rarefactions, sending them off at a velocity of 1,120 feet a second. We could thus logically dismiss the wave-theory as a shapeless wreck, crushed under the blunders and forced admissions of its ablest advocates. But we shall not yet dismiss Prof. Wood.

And right here let us help the professor to a little light in the way of an exposition of the physical laws, which evidently has not occurred to his mind, simply because during the last seven years he has not been a reader of this magazine. Had he been, he would have learned that no condensation can take place by a body passing through the free air until its velocity exceeds the property of mobility. And in case of a very high velocity, such as that of a rifle-bullet, any condensation produced will only send a pulse a distance proportioned to the size and velocity of the moving body in relation to this same property of mobility.

Any condensation of the free air by a small body passing through it, could only be propagated as a pulse to a very limited distance, before this same property of mobility would dissipate it and produce absolute equilibrium.

Prof. Wood will learn, if he reads the late December number of this journal which we have sent him, that no condensation of the air whatever can occur by the swiftest motion possible to be produced by a sounding body; and that bodies which vibrate farthest and strongest, such as tuning-forks, which can not be heard a dozen feet away when held in the fingers, do not produce a millionth part the sound of an insect which does not produce a hundredth part the vibratory disturbance of the air caused by the fork.

If he shall read the back volumes of this journal, he will learn that he is also all at sea in regard to the law governing water-waves. In the foregoing letter he asserts that water-waves will travel at the same velocity over the surface whether the movement of the body producing the waves be swift or slow. This shows how little he has seen of the MICROCOSM or of the "Problem of Human Life." In the latter work we have shown that the velocity of water-waves depends entirely upon their size, and their size, other things being equal, depends entirely upon the velocity of the body striking or leaving the water and starting such waves. Large ocean-waves will travel a hundred feet a second, while tiny waves on the surface of a pond will not travel one foot in a second.

We can lift a pound boulder, attached to a cord, out of the water so slowly as to produce no perceptible waves whatever. Then we could lift it so as to produce waves that would travel one or two feet in a second; then we could easily give the boulder such velocity of motion as to produce waves that would travel eight or ten feet in a second.

We thus prove that Prof. Wood knows absolutely nothing about the matter he is so learnedly discussing. A system of waves on the surface of water is not made by the displacing body at all that starts them. A stone dropped into a pond, or a stick pushed into it, displaces water to the amount of its bulk, thus lifting a ridge of water around the spot where it enters, and that is all it does or can do so far as the production of the waves is concerned. The force of gravity then steps in and pulls down this ridge of water and in doing so presses up another not quite so high. It then pulls down this latter ridge pressing up another, and so on for many minutes after the stone has done its work and is at rest on the bottom of the pond.

The speed of the system of waves over the surface of the pond depends always upon the height of the first ridge pulled down by gravity, and this depends upon the size and velocity of the body entering or leaving the water.

Prof. Wood should have let water-waves alone as he has fatally overturned the wave-theory of sound by thus introducing true waves which always travel with a velocity proportioned to their size or amplitude of swing; whereas his bastard "sound-waves" in air are supposed to travel at exactly the same velocity whether they be long or short, big or little, close together or far apart!

The whole burden of the song of our correspondent thus breaks to pieces by its inherent want of the cohesiveness of scientific truth. His waves on the surface of water stultify his pretended air-pulses as we have seen, while we have also shown that no matter whether he assumes 256 small motions of a prong or one long motion, the former can produce no more condensing effect on the air than the latter if both move at the same velocity of travel. And as we have proved a score of times in these volumes that the fork can sound audibly when the swiftest part of its travel is a million times slower than that of Prof. Stokes' hand, which he admits can not condense the air at all, why should not Prof Wood give up the theory and acknowledge himself beaten since he has so generously and frankly admitted in behalf of Professors Tyndall and Helmholtz? Do this, professor, and we will hasten to receive you into the fold of Substantialism with open arms. [See our

editorial on "The Transmission of Pulses," MICROCOSM, Vol. III., page 188; also our article on the "Final Argument for the Wave-Theory," page 310, Vol. IV.]

WHAT IS LIFE?

BY ISAAC HOFFER.

Webster defines life to be "that state of plants and animals, or of organized beings, in which the organs are capable of performing their functions." In man he defines it as "that state of being in which the soul and body are united." Herbert Spencer says "life is the continuous adjustment of internal to external relations." Bichart, a French physiologist, defines it to be "the sum of functions which resist death." There is an utter want of satisfying explanation in all these definitions. They only vaguely touch on some of the effects and results of life, and fail altogether in defining it. These abortive attempts to give a comprehensive definition of life show that our most learned men know so little of their own life that they can not give a definition that fairly defines it. Some scientists and philosophers hold that life is a chemical principle inherent and potential in matter, and that it (life) has its source, its origin and its developing power in material substances. That under certain conditions matter may of its own accord become a living substance, and gradually assume definite forms; at first simple and without much apparent vitality, like the lower orders of plants and animals, but gradually and during long ages new and more complex forms are evolved out of the older ones. Changing circumstances and surrounding conditions are given as the cause of the transmutation of species; and heredity is credited with the perpetuation of distinctive kinds of plants and animals; so that during countless ages plants and animals, including man, have been evolved out of the common matter of this earth, through the inherent properties or powers contained in this matter.

This theory would make life a mere chemical process, in which matter is the *active agent* and the *substance* acted on, and life the *effect* of the action; so that life would be only a resultant action and not an entity.

While it is impossible for man to know the ultimate essence of any thing, it ought to be possible for him to know something about his own being. He ought to know whether that which gives him power to be a living, sensitive, moving being, whether that which gives him apprehended and known existence, is a realty, or whether it is only a chemical bubbling of some accidental combination of certain material substances. I ought to know whether the acting moving power in my body, and the sense by which I know that power, and know how to sustain and apply it—whether all that distinguishes me from dead matter—is something in itself, or whether it is only an organic performance emanating and resulting from the molecular composition of my body.

Is it a scientific, a philosophic, or even a rational, conclusion, that life—the vital principle, the essential and absolutely necessary power to make matter a living substances, bring it into an organic combination, and form an organism in perfect accord with the transmitted vital principle—that such a power is only a molecular action, and that the result produced is a causative entity? Can a power that produces a result be the effect of the result it produced?

The universal and unexceptional experience is, that matter is changed and transformed into living bodies *by imparted life;* and there is not a single well authenticated instance on record *where matter evolved life and formed a living plant or animal.*

The chemical theory which makes passive matter an active agent is contrary to all known laws of vital action.

If two grains of corn, one with a sound germ and the other with the germ injured, in which the material constituents and the molecular organization are the same, are planted, the former will grow and the latter rot, showing that the chemical agent, if that term is preferable to vital germ, was not part of the matter, but that something else was—something that contained all the potency of life, all the energy, direction, form and power to transform the matter of the grain into a living growing plant of corn, with the power to continue its development and perpetuate the corn—life. Whether we call this life-process chemical or vital action, matter certainly was not the active agent.

In a sound egg the homogenious white and yellow matter is, through vital energy, converted into bones, flesh and feathers, and transformed into a living bird; but if this vital energy is destroyed, with the shell of the egg and all the other parts undisturbed, then chemical action sets in, and the result is something entirely different from a living bird. It presents the difference between vital and chemical action in a way that can not be mistaken.

The great mistake generally made in the examination of questions like the one under discussion is, that the action or mode of action, the effects and results, are all that is taken into consideration, and are treated as if they were the active agent and moving cause. Apparent or partial truths very often lead to great general errors, for theories based upon such premises may appear plausible, and yet must of necessity be wrong in their foundation. It is an apparent, and in part an actual, truth that a locomotive is the power that pulls the train of cars, and that it is an absolute necessity for securing and applying the power to pull the train; but the actual and whole truth is, that the motive power is in the steam, and that the locomotive is only the machinery for utilizing this power. So it is true in a general sense that the material body is a living body, and manifests all of life that we can see; but the body can not be the life, for when the life is out the body is dead. Nor did the body evolve the life, for the life was first and formed the body.

Because vital energy disassociated from matter can not be visibly and tangibly represented to the mind, is no evidence whatever that this energy is not an entity, and has not certain powers and characteristics. The power that draws a needle to the common horse-shoe magnet and holds it there, is an invisible and intangible energy, which is not part of the iron, but had to be introduced into it.

That something, in the vital germ which is not matter, has none of the characteristics and properties of matter, is invisible, intangible, and eludes the most searching tests of

chemistry, and yet takes up matter and imparts to it a new property which makes it living matter, converts this living matter into organized living plants and animals—this something is life. And where this something does not exist, or is not introduced, however favorable the conditions may be, there will be no vital action and no manifestation of life.

That the passive material of this earth should be more of a reality or of an entity, than the active energies which manipulate, characterize, form and transform this material, is like asserting that the thing moved is more of a power than the power that moved it, and is a self-contradiction in terms and facts. There is no rational explanation of the activities in nature possible, except upon the basis that there are entitive, invisible and intangible energies; and that these energies have distinctive forms and characteristics, and the power to impart the same to the matter in which they operate. Upon this basis the phenomena of life can be rationally explained.

If you pick up an acorn you will hold in your hand the life of an oak tree. This life comprises the form, the kind of oak, the power to select the proper material, convert it into living matter, move it into proper position, and transform the whole into a living growing tree. You will hold in your hand an invisible and intangible oak tree in all its perfection awaiting proper conditions to be materially represented.

Hence *life is an invisible and intangible energy of individualized forms and characteristics capable of being materially represented in plants and animals.*

LEBANON, Pa.

THE ANNULAR THEORY.

BY PROF. I. N. VAIL.

No. 13.

One very conspicuous feature at the present time persistently marking the faces of Jupiter and Saturn are their *darkly striated* vapor bands. It is one of the necessary features of every annular canopy, as I have elsewhere abundantly shown.

Formed of the smoky and sooty exhalations that arise from every igneous orb to mingle with its outer vapors, they necessarily characterized the Eden canopy. Now, I want my readers to see these striated bands as primeval man saw them in his canopy, and as transmitted on the vehicle of memory from father to son, to be profusely scattered all over the realm of mythology.

Striations running parallel over the face of a planet would not appear parallel when viewed from beneath the canopy. They would appear to diverge as they mounted from the horizon toward the zenith. All parallel bands, streamers and striæ would, as opticians well know, tower up from the eastern and western horizons as fan-shaped or palmated columns. Like great celestial trees, with briarian arms fixed in the vaulted skies, variagated with every shade and color, from the solar beams transfused from above, what a magnificent canvas met the eyes of the infant race of men!

These majestic bands were actual flowing and rushing streams. They were known by man to be *waters* and the *grand "source of all waters."* They were called "rivers," streams without shores and without channels. Hence the unexplained allusions to "celestial rivers" found so plentifully in all mythologies, deciphered on Assyrian tablets, Grecian, Egyptian and Indian monuments and paintings.

There can be no longer a reasonable doubt that when Nineveh's libraries of stone were stored away grand celestial streams garnished the heavens and encircled the earth. With this thought every mystery of Eden's "rivers" vanish like dew before the sun.

It is plain that if the "Lord God had not caused it to rain," there were no rivers then on earth. The rivers of geologic times had vanished because a canopy had enveloped the earth again. That canopy was necessarily in constant contact with the atmosphere, which continually loaded the air with mists, and this was the only source of water to the plant. This at first thought may seem visionary, but it is a stubborn fact, so sure as law is law. There could be no storms and tempests in a world warmed by the sun through a canopy of vapors.

Man saw streams continually rising, and in the "cool of the day" he saw the "mists" descend, and this alone can philosophically explain the Scripture declaration that the whole earth was watered "by a mist that went up." In the very face of this declaration we are next told that Eden was watered by a "river." Where is there one possible feature in this, if this river was *on* the earth? The difficulty of a river watering a tract of land, except its immediate banks, is insuperable at the outset. And then when we are told that that river went *out* of Eden to water the garden *in* Eden, we know that such could not possibly be the case unless it went *up out of the Eden world and watered it as a mist, or falling vapor.*

Again, we are told that that river "*divided*" as it went out of Eden. Here is a riddle that nothing but the calcium light of the Annular Theory can pretend to solve. I say that no river but a celestial one mounting from the horizon could possibly divide into "sources" or "heads" as it proceeded. Hence Eden's "river" was a celestial stream, or band. All sound reason refuses to recognize any other kind of a stream, since no other could possibly divide into heads or sources as it flowed out of the Eden world, nor could any other water the garden *in* Eden by going *out* of Eden to do so. We have here another of those many annular monuments that no opposition can overthrow.

It would seem scarcely necessary to add to the strength of this position, but it is interesting, and, moreover, very significant, that the very Hebrew term from which the word here rendered "river" is derived, can not refer to an actual river on the earth, for it simply means a "flowing" without reference to either shore or channel, which it would seem to be most correctly applied to flowing or rising *mists.* This feature, then, which has puzzled millions of readers, thus explained, like "Eden's flaming sword" becomes a beautiful philosophical fact, without a shadow of mystery.

Some valuable collateral testimony, as usual, again comes in here. These things, these conditions, from the rainless age to the "divided" "river," necessitates a canopy of vapors, and a subsequent fall of the same (for that canopy is not now in existence), and its fall necessitates a flood, and an eternal covenant, with the bow a token of the same. The four-parted river assumed different names as "heads" or sources of water to the earth; and these very names are

annular in their every meaning and aspect. One of them "encompassed the whole country of Havilot." Another "encompassed the whole land of Ethiopia." How could a "head" or source, still flowing upward of course, "encompass the *whole*" of a country unless it overcanopied it, and as a canopy was a source of mists to it?

In the Euphrates, which was one of the heads, we have the most singular and positive testimony that it was the name of a river *that once encompassed the whole earth*, and that the Euphrates we now know is but named as a memorial of a once celestial stream. I will copy from the "Gods Unvailed": "According to Assyriologists the Euphrates was called the serpent or dragon-god of the life-supporting world-tree! But the life-giving tree of primitive man was the same as the Norse Ygdrasil, the Indian Sana-tree, whose 'roots reached into the underworld,' and whose life-giving branches 'divided and spread out over the whole heavens.' In other words it was the life-giving annular canopy, whose giant bands, like great world-trees, arose from the eastern and western horizons as stupendous pillars, dividing into branches which spread over the heavens and gave the earth all the waters it ever got. This 'tree' was the 'world-ash' of the Eddas; the tree in whose branches grew the 'golden apples' of Juno *or the stars;* the tree which, found in the traditions of almost every ancient people, possessed this peculiarity: *it gave life;* and therefore it was the life-prolonging canopy of annular times. It gave drink and food—nector and ambrosia—to the heavenly gods, which, as I have proven, nothing but annular vapors as celestial 'trees' and 'rivers' could do."

"The serpent-god of the tree of life!" This sentence, copied from Assyrian tablets, is the grand master-key to a world of mysteries, as we will see.

Elsinore, Cal.

SALVATION IN HELL.

BY J. I. SWANDER, D.D., PH.D.

No. 1.

In a former article the writer discussed "Hell" from a theological standpoint. It is now proposed to treat the subject as it is claimed by some to stand logically related to soteriology, or the science of human salvation. In this, our opening paragraph, we feel justified in assuming the correctness of certain conclusions arrived at in our previous paper. Among those conclusions are the following: 1. There is an intermediate state or hades between death and the resurrection. 2. Hades is now inhabited with disembodied human spirits. 3. Those spirits are just as substantial as the bodies they shuffled off when they took their departure to that invisible world.

Passing on to the consideration of the subject named at the head of this paper, we propose to inquire after any possible benefits for the departed that the intermediate state may contain in the way of additional opportunities or facilities for human beings to seek and make sure their calling and election to everlasting life. The question amounts simply to this: In what sense and to what extent is it true that men may go to heaven by way of hell? Is there anything in hell itself that constitutes it a friend to either nature or grace to help us on to God?

Hope is said to spring eternal in the human breast. For this reason man, notwithstanding his sense of guilt and consequent condemnation, is not easily reconciled to any theory or doctrine that teaches a fixed condition of hopelessness in the invisible world. The philosophy which the devil taught in the Garden of Eden is eagerly sought and embraced by many. The popular sermon is kept just far enough away from hell to fit the flexile fancy of the fool. Mitred priests of "pompous rites and fragrant fumes" are cautiously silent concerning those tremendous possibilities that lie beyond the limit of their ceremonial forms. The thinnest webs of sophistry have been substituted for the soundest syllogisms of human reasoning. The jugglery of the modern necromancer is made to invoke the spirits of the departed and to tip the tables of the dupe for testimony that hell is perfectly lovely indeed. In the mean time the sacred Scriptures are taxed and tortured into a meaning that would justify the most unwarranted notions of that great hereafter which is even now very close at hand for every soul of man.

The idea of a hell with beneficial properties has had its advocates in every age of the world. Such ideas were entertained with more or less crudeness and confusion, according as men had not yet advanced very far along the path of civilization and in the light of revealed truth. The doctrine of the transmigration of souls, as held by some, carries with it the idea of expiation and moral advancement for the migratory human spirit until it finally attains to blessedness in the presence of God. The cultivated Greeks and Romans were not strangers to the comforting dream that men who were only moderately wicked in this life would enter, after death, through expiatory punishment and preparatory discipline, into the regions of the blest. The Koran teaches that hell will finally open its dolorous portals and permit some of its inhabitants to pass the crystal ports of light into a paradise of wild delights and sensual pleasures. The Saviour of the world employed language (Matt. xii. 32) which in the opinion of some justifies the belief that forgiveness of some sins will be granted "in the world to come." Some of the early Christian fathers and many of the orthodox theologians of more modern times agree in their rendering of 1 Peter iii. 19, as to make the passage teach that when Christ "went and preached unto the spirits in prison," he offered salvation to some of the inhabitants of hell who had been "disobedient in the days of Noah." In the Apochryphal New Testament, according to the Gospel of Nicodemus, we have a narrative more interesting than authentic by that questionable evangelist. He represents Jesus as having descended from the cross into hades, and while there "visited with invincible power those who sat in the deep darkness of iniquity, and in the shadow of death by sin; and taking hold of Adam by his right hand he ascended from hell, and all the saints of God followed him."

Coming down to more modern times, we find that much of the most popular literature of the world has reconciled itself to God and all eternity upon the assumption that the final restoration of all men to a state of unqualified blessedness is a doctrine of truth. The orthodox Universalists swallow the entire pill without a single distortion of their religious countenances. Others find it convenient to resort

to a "little season" of hell in order to satisfy themselves of the soundness of their views concerning the restoration of all things. Their doctrine is not entirely foreign to that of purgatory in which, according to Roman Catholic theology, the suffering of souls in the intermediate state may be shortened by masses, prayers and works of supererogation on earth. The reformed theologians of the sixteenth century rejected the purgatorial idea under any form. With the rise of rationalism some Protestant theologians began to make not only earnest recognition of the intermediate state by a more advanced and consistent interpretation of the Apostle's Creed, but also to claim it as a part of God's great plan for the redemption and salvation of human beings. Some of the more advanced theological thinkers of Germany saw in it a state of probation for infants and the heathen who were supposed to have no opportunity of choosing Christ on this side of death. This questionable fruit of earnest German inquiry found its way to America. In this country it was soon mingled with New England liberalism, and in the course of a few years of development manifested itself in the troublous teachings of Andover under the form and promise of a second probation. It alleged and emphasized the probability that certain untaught heathen would have an opportunity of choosing and embracing salvation in hades.

The advocates of the doctrine of salvation from or in hell may be distinguished from each other by dividing them into three classes: 1. Those who hold that all will be saved, and that there is no hell except in this present state of human being. These are the orthodox *Universalists*. 2. Those who believe in some kind of an intermediate state, and hold that it is full of sanitary and restorative power for all who enter it without having first made their calling and election sure in this visible world. These may be classed as the *restorationists*. 3. Those who hold that the salvation of each individual is conditioned and determined by his free choice of the good, and alleging as they do that some are taken into hades without first having had a fair opportunity to make a free and intelligent choice of the good, they claim that God's attribute of justice and the equality of His ways afford a sufficient warrant for the belief that all such persons will be accorded an opportunity in the invisible world to choose the way of eternal life and happiness. These are known as the *second probationists*. The term is, however, not thus correctly applied, as such trial of obedience would really be the first probation for all individuals deprived of such opportunity in the present state of being.

The general argument of the future probationists in favor of "another chance" may be truthfully sketched as follows: God is just, and the judge of all the earth is bound by his own nature to do right. In order to be just and right in his impartial dealings with all rational individuals he must offer salvation to all and to each. But some, it is alleged, do not have salvation offered them in this life, and, therefore, the equality of God's ways, no less than the principle of justice that underlies the whole superstructure of his moral government in the universe, requires of him an extension of the sphere of probation into the invisible world, that the "spirits in prison," who had not had an opportunity while in the body, may yet have a chance to determine themselves in a free way for or against the absolute good which of itself involves immortal blessedness to those who make choice thereof and are thus organically joined thereto. These probationists differ from the orthodox Universalists above named, who believe in the salvation of all men—hell or no hell—and, on the other hand, from the orthodox limitarians who hold that death ends all that belongs to probation.

Fremont, O.

(To be continued in April.)

A Brief Defense of Substantialism.—A Critic Answered.

BY THE ASSOCIATE EDITOR.

Our attention has been called to a work published by the late Rev. J. H. Pettengill, A.M., in which Dr. Hall's doctrine of the dual nature of man as set forth in the "Problem of Human Life" is opposed, and we in turn call the attention of our readers to the subject, not so much on account of the strength or value of the objection, as to point out a radical and fundamental error which our critic makes in his interpretation of Dr. Hall's language. We quote verbatim from his chapter on "The Unity of Man:"

"Dr. A. Wilford Hall, in his remarkable work entitled 'The Problem of Human Life,' dashes into the arguments of Hæckel, Tyndall, Spencer and those of that school, like a bull into a china-shop, and fairly demolishes much of their fine wares; but he is quite as weak and open to attack in the position he undertakes to establish for himself. He makes much sport of Hæckel's doctrine, that "life and mind are nothing but the complicated motions of the molecules of the brain and nerves, placed together in a most varied manner," and with the doctrines of spontaneous generation and evolution which are so earnestly advocated by not a few of our popular scientists; but, while he would seem to be arguing for the doctrine of the opposite school, his philosophy is nothing better than a sublimated form of materialism, or the double materialism of the pre-Socratic philosophers, and of Swedenborg, very much refined. He frankly admits that his theory is founded on a hypothesis in the first instance, but it so clearly answers all the conditions of the problem that it must be true. It is this: That man is composed of two organisms, each complete in itself. Both of them are material, but the one is of gross matter, and the other matter in its highest state of refinement, answering, we suppose, to the *fourth* state of matter of which Lockyer speaks, or perhaps more truly, to Aristotle's *quint*-essence. His own language is as follows:

"It is a fundamental law of Nature, that every animated being, including man, is a dual organism, or double entity; the outer or physical structure being the visible and tangible half, while the incorporeal, though invisible and intangible, constitutes the other half, the one being the exact counterpart of the other. (P. 48.)

"This interior organism, could we see it after the body dies, would stand out a transparent *manikin*—with every outline of the human body intact—a perfect representation of our organic form in all its parts, as would a manikin of the arteries, veins and nerves, could they be lifted from the body, without disturbing their relative position. (P. 46.)

"Thus inter-woven and inter-dependent upon each other it is not surprising that a blow on the brain should temporarily paralyze the vital and mental structure, in proportion to the physical injury received; and should such injury prove sufficient to result in a complete dissolution or separation of the two organisms, it is not inpresumable but that the mental and vital entity might remain for some time in a state of entire unconsciousness, or until the effects of the dissolving shock should have a sufficient time to subside. I say this is a reasonable supposition on the view that we are really dual, substantial beings; and then it is equally rational that our interior, incorporeal entity, after recovering consciousness, may actually continue on for-

ever in a state of personal activity, as all religionists must hold, if their religion is to be of any practical value in this world or the next." (P. 37.)

"Because these philosophers can not understand just how the noetic and physical properties in man are combined, or, indeed, how it is possible for the Creator to unite them in one substantial organism, they must needs resort to the hypothesis of a double organism, as though this would solve the whole mystery."

While appreciating seemingly the demolition of Hæckel, Tyndall, Spencer and their school, he seems thoroughly to misunderstand the substantial philosophy of force, life, mind and soul, which was placed on record in the "Problem" as a substitute for these atheistical theories. To call Dr. Hall's philosophy a "sublimated form of materialism" is to show an unacquaintance with the real claims of Substantialism, which is inexcusable in one who pretends to pose before the public as a critic.

The whole tendency of the writings in advocacy of the new philosophy by Dr. Hall as well as by his numerous contributors has been to demonstrate that there are two distinct realms in the order of nature, the material and the immaterial, and that these two realms are not by any means to be confounded as modifications or diversions of each other. The material is not to be considered an emanation from the immaterial, nor contrarywise is the immaterial to be considered in any sense an attenuated or "sublimated" form of the material.

In order thoroughly to grasp the Substantial Philosophy with its principles concerning the phenomena of the physical and mental forces here, together with the doctrine of the existence of the soul and its attributes after this life, it is essential that *this fundamental position of the distinction between material and immaterial conditions* be comprehended. Let this be forever understood, and such objections as we have above quoted, as well as the deductions arising therefrom, will no longer provoke Substantialists by their presumptive inaccuracy. As the statements concerning the "materialism of pre-Socratic philosophers and of Swedenborg" depends upon the misunderstanding just refuted, it is unnecessary to waste space on them except to say that by reference to the bound volumes of the MICROCOSM the identity between Substantialism and Swedenborgianism will be seen to have been completely refuted.

In his objections to Dr. Hall's theory of the dual nature of man which the quotations from the "Problem" represent very fairly, our critic urges our inability positively to prove that such a psychical counterpart of the physical organism exists. If Mr. Pettengill believes in the reality of the soul, he must from necessity believe that it has form, as the term *reality* applied to such a definite thing can not possibly mean a formless mass of spiritual substance; therefore, if some form must be given to the soul, which is simply another name for the immortal part of man, or the "inner man" of the Apostle Paul, why not give it the same form as the material body, having a complete and perfect organism, eyes, ears, arms, mind and all the other attributes which are possessed by the physical body? This understanding is certainly in accord with the Bible, and will render definite many of the passages which are now considered purely figurative and symbolical.

There surely can exist no doubt but that in the next life there will be just as complete an environment for the exercise of all the attributes and faculties which we now possess as we have at present, the only difference being that such environment and faculties will be spiritualized by the elimination of their physical conditions, which would be entirely out of order in the spiritual realm.

It grieves us to see ministers who recognize the fatal effects upon young scientific minds of such doctrines as those advocated by Hæckel, Huxley, Spencer and that school, antagonize through ignorance of its foundation principles the only system which attempts to demolish root and branch upon its own ground such atheistical conclusions.

The chief reason which Dr. Hall's critic seems to give for his dissatisfaction with Substantialism is, that scientific and philosophical aid is not necessary for the demonstration of revealed religion and, therefore, the efforts which it makes to render plain and consistent the mysterious statements of Scripture are entirely impertinent and should receive no encouragement at the hands of religionists. He says, on pp. 23, 24:

"What if we can not understand how the mind and the body can co-exist and act together in one organism any better than the ancients could understand how the earth could float in space without something beside the power of the Creator to sustain it? We can understand it as a fact, if we can not explain the mode."

Such is the premium which this book puts on ignorance and the disparagement it presents concerning the efforts which honest and sincere Christian men are making toward harmonizing the apparently antagonistic doctrines of Revelation and science. If it were realized by the religious teachers throughout the world that the infidelity of past as well as present history is entirely due to the supposed incompatibility between the teachings of natural phenomena, as they effect our lives and our laws of intellect, and the teachings of the Scriptures, judged from the same standpoint, it would be then understood that all efforts made toward breaking down this apparent antagonism by showing the errors of our natural philosophers would be striking at the very bulwark of atheism and unbelief.

The time has now come when there is philosophical work to be done by Christian men, and when the studies of apologetics and natural theology must be given more definite and important places in the curriculums of our theological seminaries. The plain reason is that the scientific literature of the present times is very largely atheistical in its teachings concerning the phenomena of life, mind, soul, spirit and all the other conditions which come generally within the realm of theological consideration. The clergyman who shall stand dumb before the arguments of Hæckel, Tyndall and Huxley will be of very little potency in any intelligent community in the coming future.

The fact which all should appreciate is that God's Text-book is comprised of *two volumes*, one of which we have received through methods ordained directly by Him, the other of which stands open before us in the natural phenomena of the universe. These volumes can not in the very nature of things disagree if correctly interpreted. It is therefore evident that upon the principles of natural philosophy the great work of harmonization must be effected. Why, therefore, attempt any disparagement of Dr. Hall, who has simply foreseen and appreciated this necessity, and has given to the scientist as well as to the theologian the only

philosophy of natural phenomena which is in perfect harmony with itself, and the only system which attempts to provide from a scientific standpoint a reasonable basis for a consistent and harmonious belief in the mysteries of the revealed Word?

(Continued from page 46, vol. viii.)

What is Sound? The Substantial Theory *versus* The Wave Theory of Acoustics.

BY GEORGE ASHDOWN AUDSLEY, F.R.I.B.A.

I have not by any means done with the teaching of this text-book. Turning to page 397 of the last edition of Professor Tyndall's "Sound," we find allusions to certain details connected with the "double siren" of Helmholtz. The most interesting are those relating to an experiment mentioned as proving the law of interference of sound. After pointing out that if the circle of twelve orifices is opened in each of the divisions of the instrument, directly opposite each other, "sounds flow together in perfect unison, the unison being maintained, however the pitch may be exalted;" the professor informs us that this unison is disturbed by moving the upper wind chest, and then adds: "In the case before us, where the circle is perforated by twelve orifices, the rotation through $\frac{1}{24}$th of its circumference causes the apertures of the upper wind chest to be closed at the precise moments when those of the lower one are opened, and *vice versâ*. It is plain, therefore, that the intervals between the puffs of the lower siren, which correspond to the rarefactions of the sonorous waves, are here filled by the puffs or condensations of the upper siren. *In fact, the condensations of the one coincide with the rarefactions of the other, and the absolute extinction of the sounds of both sirens is the consequence.*"

The professor continues—"I may seem to you to have exceeded the truth here, for when the handle is placed in the position which corresponds to *absolute extinction, you still hear a distinct sound.* . . . The reason is this: The sound of the siren is a highly composite one. By the suddenness and violence of its shocks, not only does it produce waves corresponding to the number of its orifices, but the aërial disturbance breaks up into secondary waves, which associate themselves with the primary waves of the instrument, exactly as the harmonics of a string, or of an open organ pipe, mix with their fundamental tone. When the siren sounds, therefore, it emits, besides the fundamental tone, its octave, its twelfth, its double octave, and so on. . . . . Now, by turning the upper siren through $\frac{1}{24}$th of its circumference, we extinguish utterly the fundamental tone. But we do not extinguish its octave. Hence, when the handle is in the position which corresponds to the extinction of the fundamental tone, instead of silence, we have the full first harmonic of the instrument."

I can not pause to comment fully upon the passages quoted, which, however, may be said to present about the loosest piece of scientific reasoning to be found in our text-books. We are first told that "the absolute extinction of the sounds of both sirens" takes place; then we are informed that we "still hear a distinct sound." Further we are told that the fundamental tone is "extinguished utterly," whilst we hear its "full first harmonic." Just imagine the existence of a "full first harmonic." of a fundamental tone where there is no fundamental tone!

Now the phenomenon, if it may be called one, which is observed when the two portions of the siren are so placed as to bring the puffs of one exactly between the puffs of the other has nothing whatever to do with interference of sound, and this fact must be self-evident to the youngest student of acoustics. The true explanation is this. When the circles of twelve orifices are exactly opposite each other, the puffs from both occur together, and a musical sound is produced equal in pitch to that yielded by a single revolving disc of twelve orifices, moving at the same velocity. Suppose the two discs revolve together twenty-two times in a second, the note produced would be C^3 of 264 vibrations. If we now turn the upper portion, or wind chest, of the siren $\frac{1}{24}$th of its circumference, so as to bring Professor Tyndall's *interference* into operation, we certainly no longer hear C^3 of 264 vibrations, but, as a simple matter of course, C^4 of 528 vibrations. The combined discs of the single instrument, fed by the same air tube, now yield, instead of twelve double puffs to each revolution, twenty-four single puffs to each revolution. The mystery is solved, but where is the *interference of sound* and the consequent proof of the existence of sound-waves? In case my brief explanation might not be perfectly clear to you all, I have prepared a diagram of the two siren discs, which will make my meaning evident at a glance.

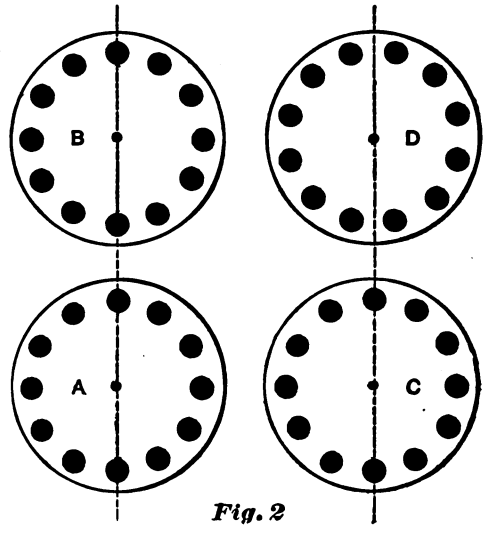

Fig. 2

In Fig. 2, two pairs of discs are shown. The two discs A and B are in the relative position which places the circles of twelve orifices exactly opposite each other (as indicated by the dotted line), when the puffs from both occur together, producing, say, the note C^3 of 264 vibrations. The two discs C and D are in the relative position which places one series of twelve holes exactly between the other series of twelve holes, thus yielding twenty-four puffs at each revolution, and, accordingly, producing the note C^4 of 528 vibrations. The dotted line shows the altered relation of the discs C and D.

Turning now to the section of Professor Tyndall's book devoted to the "Interference of Waves from a Vibrating Disc," we find a most

interesting experiment treated in a rather curious and one-sided manner. The writer remarks: "We are now prepared for a very instructive experiment, which we owe to M. Lissajous. Drawing a bow over the edge of a brass disc, I divide it into six vibrating sectors. When the palm of the hand is brought over any one of them, the sound, instead of being diminished, is augmented. When two hands are placed over two adjacent sectors, you notice no increase of the sound; but when they are placed over alternate sectors, a striking augmentation of the sound is the consequence. By simply lowering and raising the hands, marked variations of intensity are produced. By the approach of the hands the vibrations of the two sectors are intercepted; their interference right and left being thus abolished, the remaining sectors sound more loudly. Passing the single hand to and fro over the surface, you also hear a rise and fall of the sound. It rises when the hand is over a vibrating sector, it falls when the hand is over a nodal line. Thus by sacrificing a portion of the vibrations we make the residue more effectual."

We have here an experiment performed in a decidedly one-sided manner, and an argument which badly wants a little of the light of common sense let in upon it. Before I proceed to my experimental demonstrations, let me assure you that interference of sound, as understood by the wave theorist, has nothing to do with the phenomena of the vibrating disc or plate just described, but that we have to credit *resonance* for all the increase of sound observed.

Throughout this notable experiment of the professor's it must be realized that he supposed the ear to be placed *above* the level of the brass plate, and quite overlooked two very important things—in the first place, that the plate had two sides equally capable of producing condensations and rarefactions; and, in the second place, he quite forgot to test what result would follow to the ear placed over the plate when the hands were applied to the underside of the plate. Now this latter matter was certainly a very grave oversight on the part of so skillful an experimenter, as I shall proceed to show.

I have here a square plate of brass, specially made for this experiment by Dr. Kœnig, and I earnestly ask your close attention to the sounds it will produce, for I am afraid they will not carry far with any degree of clearness. I have also brought a diagram showing one way in which the plate divides itself into vibrating sections and nodal lines when bowed. I shall now divide the plate into the eight sections as shown on diagram Fig. 3, as that is the nearest to the division mentioned by Professor Tyndall, and answers perfectly to illustrate the absurdity of the interference hypothesis. I sprinkle sand over the plate and bow its edge. The sand has arranged itself like the lines on the diagram and you hear the sound it is sending forth from each equal section, now in rapid vibration.

Observe the following effects. As the hand is a clumsy article in so delicate an experiment I have made wooden and cardboard covers to suit all the divisions of the plate. Taking one of the wooden covers I bring it down over only one of the divisions, say, A, and immediately you hear an augmentation of the sound, and as I raise and lower it you hear the sound falling and swelling out. Now leaving the *top* of the plate with its *condensations* and *rarefactions* to take care of itself, I apply the board to the same division on the *underside* of the plate, and you observe that the effect is precisely the same.

You will remember that Professor Tyndall states that "when two hands are placed over

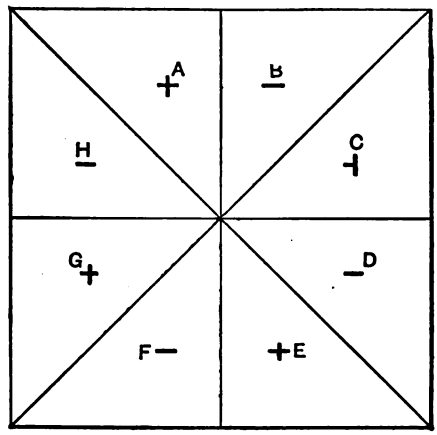

Fig. 3

two adjacent sectors you notice no increase of the sound." Just let me test this. The plate is now sounding, and I cover two adjacent sectors, say, A and B or B and C, or any two in any part of the plate, with the result of a marked augmentation of the sound in each and every case. I do the same underneath the plate with exactly the same result. In fact, it is impossible to cover any two sectors, above or below, without an augmentation of sound.

I now cover any half of the plate—namely, H, A, B, C, or A, B, C, D, and still the sound is increased, and finally I cover the entire square with a similar result.

From these facts it must be obvious to any person with any reasoning powers that the idea of *interference* is a myth, and that the cause of the augmentation of the sound is the *resonance of the air column contained between the board and the surface of the sonorous plate.*

Time will not permit my going into the consideration of the other experiments in support of the so-called interference of sound, and I need only say that every one which has come under my observation is capable of being just as easily accounted for and refuted as those I have alluded to and tested.

In conclusion, I must assure you that many weighty arguments against the truth of the wave theory, and, accordingly, in support of the substantial theory, remain untouched. Chief amongst these is what is known as the "Locust argument." An hour's talking would hardly exhaust this fertile subject, so, with just a suggestion of its nature, I shall leave it for future consideration. "There is a well-known insect," says Professor Henry Mott, "one of the *locustidæ* (a saltatorial family of the order *orthoptera*), whose stridulations can be heard a distance of more than a mile, as attested to by Darwin and others. This insect weighs less than a quarter of a pennyweight, and can, by simply rasping its legs across the nervures of its wings (for this is the way its tone is produced), according to the wave theory, create a physical agitation and displacement of the air which converts four cubic miles of atmosphere into waves consisting of condensa-

tions and rarefactions, the compressed portions of which contain a sufficient augmentation of heat above the normal heat of the atmosphere to add one-sixth to the elasticity of the air and the velocity of sound." I am much tempted to go into some of the very astonishing calculations which have been based on the energy of the locust in strict accordance with the demands of the wave theory, but must refrain and close this paper, which is already much too long.

Commending the entire subject to your dispassionate and attentive consideration, and thanking you for your courteous and patient attention, I conclude.

SEDLEY TAYLOR HEARD FROM.

REPLY BY THE EDITOR.

Our readers will remember our editorial review of Sedley Taylor's attempted answer to Dr. Pearce, as appears in the December MICROCOSM, first article, and which also appeared in the January number of the London *Musical Opinion*.

Dr. Audsley wrote us immediately on reading that article, that no possible reply could be made by Mr. Taylor to our arguments against the wave-theory of sound.

Such turns out to be the fact, since the manuscript answer of Mr. Taylor just received, sufficient to fill four or five pages of the MICROCOSM, deals in all sorts of fault-finding complaints and generalities without even breaking through the surface of our points against the wave-theory. As our controversy is not upon any such trivial side issues as whether or not we were trying to ridicule him by calling him "doctor" and "professsor," of which he complains, but upon the real arguments for or against his theory, we shall come directly to that part of his answer and will deal with him as plain Mr. Sedley Taylor. And we now assert, and will make it good in this reply, that he must absolutely know, unless devoid of all logical ability, that our arguments stand untouched in all their force and bearing. And that the reader may the better appreciate this reply, we beg of him to turn back to the December number and re-read the article referred to.

To do Mr. Taylor justice we shall make ample quotations from his letter, giving the full strength of his argument, and after each extract make our comments. But we can only find room for such of his remarks as relate to our strong points against his theory as set forth in that December article. In attempting to answer our locust argument, on which we are ready to stake the entire controversy, he quotes from Tyndall's book on sound as follows:

> It is to be particularly noted that the augmentation of velocity, due to the changes of temperature produced by the sonorous wave, is totally different from the augmentation arising from the heating of the general mass of the air. *The average temperature of the air is unchanged by the waves of sound.* We can not have a condensed pulse without having a rarefied one associated with it. But *in the rarefaction the temperature of the air is as much lowered* as it is raised in the condensation. (P. 28.)

Mr. Taylor then goes on to argue as follows:

> As the "mass of air through which the sound-wave passes" does not have its average temperature—nor, therefore, its average density—thereby increased at all, the answer to your question clearly is that *no* mechanical pressure has to be exerted upon "every cubic inch" contained in it. Thus Tyndall *did not* "well know" that the amount of increased density in the compressed half of the sound-wave involved consequences fatal to the wave-theory—indeed *he knew the exact contrary.* There was thus no conceivable reason against his mentioning it, and there is no shred of justification for accusing him of cowardice because he did not insert in a popular treatise a *datum*, which the course of his exposition did not happen to call for. * * * But what after all, is this gruesome object from which cowardly Europeans shrank in abject terror, and none but a brave American was man enough to face? In my judgment it is a mere scarecrow. You construct it as follows: Taking the case of the American locust's vocal performance, you examine the amount of increased heat developed in the compressed half of each wave which it emits; quote from Professor Mayer how much increase of density this is equivalent to, and then multiply the mechanical force requisite to produce this increase by the number of waves in the insect's range of sound. You bring out, as result, that each locust must exert a force of more than the mechanical energy of *a million locomotive engines under full steam.* This is, doubtless, as you call it, an "astounding proposition;" but the way in which you arrive at it appears to me at least as astounding as the proposition itself. It consists in simply *leaving out of consideration the diminution of heat caused by rarefaction in the dilated half of each wave*, which is exactly equal to the increase due to condensation in the compressed half. The two thus necessarily undo each others effects, so that the to-and-fro changes of temperature within each wave balance each other, and the passage of a wave as a whole produces no resultant increase of temperature or density and, therefore, *involves the exertion of no "condensing or squeezing force" whatever.* If this correction be introduced into your calculation, your force of a million locomotive engines is at once reduced to zero, and the wave-theory is freed from all responsibility for your "astounding proposition."

We are thus obliged to give this mass of verbiage to get at its single grain of argument, namely, that as each condensation sent off by the locust is followed by a corresponding rarefaction, and as the heat produced in the condensation, by mechanically compressing the air, is exactly balanced by the cold in the rarefaction, therefore the filling of the four cubic miles of air with these condensations and rarefactions at the same time while the locust is sounding "*involves the exertion of no condensing or squeezing force whatever!*"

Is it possible that Sedley Taylor can not see the mechanical absurdity of assuming that because a condensation is accompanied by an incidental rarefaction therefore such condensation or compression requires no force, pressure or squeezing power to produce it? Yet this self-evident absurdity is the dernier resort of Mr. Taylor as the only defense he has left for the wave-theory against our locust argument. Surely that theory must be on its last legs, as we will soon see.

In the name of mechanical law, what matters it if the condensation of a given quantity of air by mechanical pressure involves a consequent rarefaction or partial vacuum behind it, does this destroy or in any way affect the fact that the compression actually required the expenditure of a given amount of mechanical force?

Can not Sedley Taylor—the author of a text-book on physical science—see that instead of such consequent rarefaction neutralizing the fact of the condensation which caused it, such partial vacuum, goes to demonstrate in the strongest possible terms that mechanical squeezing force must have been exerted upon the air to cause the compression which produced this partial vacuum?

Instead of this self-evident view of the case—which any beginner in natural philosophy ought to grasp—this author calls it a "scarecrow," and asserts with a reckless disregard to accuracy seldom witnessed in a scientific critic that the mechanical energy which produces this compression, and which thereby generates heat sufficient to add 174 feet a second to the

velocity of these same atmospheric "condensations and rarefactions, "*involves the exertion of no condensing or squeezing force whatever*"!!!

It is humiliating to a believer in the English speaking race that we have to set a man of Sedley Taylor's pretensions right on so simple a mechanical proposition as this.

Suppose a frictionless piston placed in the center of a cylinder two inches long and of one square inch cross-section, filled with air at normal density and closed at both ends. Can not our critic see, by forcing this piston half-way toward one end—thus doubling the density of the air on that side of the piston—that he exerts a mechanical pressure or "squeezing force" of fifteen pounds? And can he not understand that the rarefaction of the air produced behind the piston as the incidental result of this condensation in no wise lessens or detracts from the amount of this mechanical force of fifteen pounds?

And if similar cylinders were packed close together embracing a cubic foot of air, and numbering 884, can not our critic see that in forcing all these pistons in like manner toward one end of their respective cylinders at one time, as our locust condenses countless millions of cubic inches of air, he would be obliged to exert more than 13,000 pounds of mechanical pressure? And is he incapable of seeing that the 884 rarefactions he would thus produce would not detract a single ounce from the 13,000 pounds of "squeezing" force he would be obliged to exert in moving these pistons as described? Yet this simple problem in mechanics he calls a "scare-crow," and audaciously declares that the moving of all these pistons and millions of others at the same time "involves the exertion of no condensing or squeezing force whatever," because, forsooth, there is a resultant rarefaction occurring behind each condensation produced!

If Mr. Taylor can not see the propriety of this simple mechanical statement of facts, suppose we put him to work upon a common atmospheric condensing pump, embracing ten of these inch cylinders and requiring a mechanical effort of 150 pounds' pressure each time the pistons are moved a distance of half an inch. Now, let our astute critic rapidly keep up this condensing and resultant rarefying process for a few minutes, exerting 150 pounds of pressure at each stroke, and then tell us if he still believes in the wave-theory of sound and that the condensations and rarefactions "*necessarily undo each other's effects*," and that "*no mechanical pressure has to be exerted!*" Let him tell us frankly when he pushes those pistons with a force of 150 pounds, doubling the density of the air and increasing the heat in front of them, if the fact of the rarefactions or the cold behind the pistons tends to rest him any! After working that pump for ten minutes, would he assert over his signature that it "*involves no condensing or squeezing force whatever*" because he produces rarefactions as well as condensations? Out of sheer kindness we will let our critic stop pumping long enough to catch his breath!

As stated in our December article, the extent of this increase of density in the heated half of the wave has never been even hinted at by any writer on sound from Laplace down till it was made known by Prof. Mayer; yet any mechanical mind that has ever given it a thought, must have seen that such increase of density in the compressed half of the wave should be easily measured *from the quantity of heat required to be produced in order to add the sensible and calculable quantity of 174 feet a second to the velocity of these material air-waves.* Surely such sensible additional velocity added to waves of ponderable matter must require a sensible and measurable degree of heat which in turn could only occur by a sensible compression of the air into a measurable augmentation of atmospheric density.

Was it not, therefore, a most remarkable scientific laxity on the part of Laplace, Helmholtz, Tyndall, Taylor & Co., that this calculation, so essential to the wave-theory, based as it is entirely on the mechanical operations of heat caused by atmospheric compression, should not have been given for the benefit of scientific students and investigators? What other explanation can be imagined than that those great physicists feared, if they should name any definite amount of atmospheric compression, or even the minutest fraction of added density of the air by such waves, it might make it *too hot* for the wave-theory? We are heartily glad, however, that one of these writers has had the courage to take this atmospheric bull by the horns.

Now what is the real teaching of the wave-theory? Instead of *doubling* the density of each alternate cubic inch of air throughout the four cubic miles condensed and rarefied by our locust, thereby requiring fifteen pounds expenditure of mechanical force on every alternate cubic inch, this theory now tells us that the compressed half of the air in each alternate cubic inch is increased in density $\frac{1}{5\frac{1}{2}}$ of fifteen pounds wherever the sound of this locust is heard.

No difference, Mr. Sedley Taylor, how often these supposed condensations and rarefactions change places, or how often the heated part of the wave takes the place of the chilled part and *vice versa*, the fact that one entire half of the four cubic miles of air filled by the locust's sound is all the time in a state of mechanical compression with its temperature raised thereby sufficiently to carry forward these waves 174 feet a second faster than they would otherwise go, according to the wave-theory, is the unimpeachable fact that gives our American locust more mechanical strength than all the horses in Great Britain—a fact which holds the wave-theory crushed in a vise from which our critic struggles in vain to free it.

Here again are the exact words of Prof. Alfred M. Mayer, the highest American authority on sound, which Mr. Taylor must not call a "scare-crow:"

"This *compression* gives for the *compressed half of the wave an increase of* $\frac{1}{5\frac{1}{2}}$ *to the ordinary density of the atmosphere.*"—*Article on "Sound," American Encyclopœdia.*

Then all in the world we have to do, in order to ascertain the physical strength of our locust, is to calculate the number of cubic inches in the four cubic miles of air filled by its sound, call one-half of them "condensations" and the other half "rarefactions," and then multiply this one-half of the vast number by $\frac{1}{5\frac{1}{2}}$ of fifteen pounds and we have the exact condensing or squeezing power exerted by the insect upon this mass of air in order to produce the heat calculated by Laplace if there is one shred of truth in the wave-theory of sound. This compressing and squeezing force we found, as given in the "Problem of Human Life," to be more than 5,000,000,000 tons!

But now we purpose making it a good deal hotter for wave-theorists than the above figures indicate. As will be seen by the foregoing, our calculation is based on the comparatively easy mechanical process of producing a condensation where the air is confined in a cylinder, and is thus prevented from escaping sidewise from in front of the piston to avoid compression. While it is a fact that only fifteen pounds of mechanical effort are required in such case to double the density of the air, will Sedley Taylor now kindly bring his remarkable mechanical knowledge to bear and tell us how many pounds of squeezing force or projecting force it would require to be exerted upon an inch piston to compress the free air in front of it in open space to double its density?

Come Mr. Taylor, this is no "scare crow" but a *bona fide* problem in physical science, and an unavoidable task which you shall meet before we let up on you, and which other wave-theorists must not shirk. As you insist that you and Helmholtz and Tyndall are no cowards, and that you could tell us all about these matters if in the line of your argument to do so, now we simply *dare* you to take your lead pencil and figure out how much mechanical force would have to be exerted upon the aforesaid inch piston in free air to add $\frac{1}{818}$ to its normal density which Mayer insists is necessary to generate the heat required by the theory. We mean business and do not propose to be put off by scolding.

Remember that the swiftest travel of a tuning-fork's prong right at the start is at a velocity less than a yard in a second. Suppose you push the inch piston at this speed through the open air, how near would you come to doubling its density? We venture to predict that with all your unparalleled assurance in stating and denying mechanical facts you would not dare to say that such a piston moved at such velocity in free air would add even $\frac{1}{1,000,000}$ of $\frac{1}{818}$ to the normal density of the air as Prof. Mayer believes to be necessary in order to furnish the heat calculated by Laplace.

And here, by the way, how consistent and beautiful is the substantial theory of sound-force in the light of these insuperable difficulties lying in the way of the mechanical or wave-theory, requiring as they do such infinite impossibilities on the part of an insect! And how harmoniously does the liberation of cubic miles of this form of natural force, by the energy of an insect, agree with the liberation of other cubic miles of substantial light-force by the trifling energy of the great Cuban fire-fly! As well claim that this light-producing insect sets in motion four cubic miles of air by its infinitesimal strength, throwing the whole mass into "condensations and rarefactions" in order to fill it with light-force, as to claim a similar impossibility in the production of sound by another insect of about the same size. Yet Mr. Taylor asks for proof in favor of the substantial theory which has every analogy of nature to support it, while he swallows without a wink the monstrous absurdities involved in the teachings of Laplace and Tyndall.

But I must not dwell longer upon this point, and would not have dwelt so long as I have only for the fact that the whole mechanical theory of acoustics dies right here under this apple-tree unless somebody besides Sedley Taylor comes to the front to grapple with this locust argument. Who shall it be?

Owing to want of space the remainder of Mr. Taylor's letter will be attended to next month.

treatment not prove satisfactory, is this: I have already, as a test of its business policy, sold more than one thousand copies of this prescription on the same conditions, *not one per cent. of which has been returned.* In every case, however, so returned, I have promptly through my bookkeeper sent back the $4.

All my local agents are authorized by me to adopt the same conditional method of making sales; they to refund the $4 and draw on me for another pamphlet in case the one returned is damaged.

Any person after purchasing this Health-Pamphlet at the regular price ($4) and testing the treatment prescribed therein, can obtain pamphlets from me for his friends, if the remedy proves satisfactory, at the greatly reduced price to agents by taking advantage of my special offers which will be made known by letter on application.

My object now is to give the widest possible circulation to this pamphlet, and as the only way to make a person read, study, appreciate and carefully test a prescription or formula is to make him pay something for it, hence I am positively certain that I am doing thousands of times more good to the world by selling the Health-Pamphlet at a moderate price than by giving the secret to the public free of charge.

☞ The foregoing article is copied from our March Extra just issued, containing seven pages of the most startling testimonials ever written or read. That Extra will be sent *free.*

OUR ASSOCIATE EDITOR.

We are glad to refer all our readers, but especially clergymen, to a critical review on page 56 of this number, from the pen of Mr. Robert Rogers, our Associate Editor. If this review, with the extracts made from the "Problem of Human Life," shall not put doubting readers right as to the real teachings of the Substantial Philosophy, then it seems but little use to argue the matter further. We are proud to feel, while growing old, that at least a part of our mantle is to fall on the shoulders of one so young and yet so strong.—EDITOR.

DR. AUDSLEY'S LECTURES.

This number of the MICROCOSM closes the first lecture on acoustics ever delivered in England opposing the wave-theory and defending the substantial theory of sound.

The delivery of this lecture by Dr. Audsley, before a critical London audience, is a memorable event in the annals of physical science, and will mark an epoch in the coming ages, when the old theory of sound, as but the mechanical vibrations of the air, will occupy the same position in the educational history of the world, as the ptolemaic system of astronomy now ocupies.

The lecture which is just closed in these columns, however, was but the entering wedge that was destined to split into pieces every motion-theory of science now taught in the colleges of this country and Europe. Other lectures are now being delivered by the same invincible exponent of Substantialism, one of which will be copied in like manner in the pages of the MICROCOSM, in short installments, beginning next month. It is a stinger.

The progress made in these lectures in the way of making converts of prominent acousticians, is most satisfactory to the friends of the substantial cause and most alarming to those whose interests still lead them to insist upon the correctness of the wave-theory of sound.

The most favorable aspect of the revolutionary course of Dr. Audsley is the fact that prominent acoustical teachers and authors of text-books have thereby been called out and induced to attempt a defense of the wave-theory at the close of these lectures. Chief among these authorities is Mr. Sedley Taylor, a professor of acoustics in Cambridge University, and the author of a standard text-book on sound.

The stirring up of this author and teacher has been a most fortunate circumstance for the cause of Substantialism, since his position is such in the scientific world that he can not back out of the discussion as long as there is a plank of his favorite theory in sight above water.

If he is as honest as some of his friends claim, there will be nothing left for him but unconditional surrender, judging from his unenviable position in this number, and especially what awaits him in the next. See our reply.

DR. KOCH'S CONSUMPTION CURE.

The following item telegraphed to the *New York Herald*, is but an indication of the rapid decline which is taking place in the Koch lymph excitement which, but three months ago, was the most prominent topic of discussion ever known to newspaper literature, and which the MICROCOSM was the very first to expose as an unwarranted craze:

LITTLE FAITH IN KOCH'S LYMPH.

[BY TELEGRAPH TO THE HERALD.]

CHICAGO, ILL., Feb. 14, 1891.—Four vials of Koch's lymph were received to-day by a physician of this city from Professor Von Bergman, the Berlin surgeon.

Accompanying the lymph was a note from Professor Von Bergman, certifying to the reliability of the lymph, with the following postscript:—"I must confess, my dear Doctor, that I have very little faith in the therapeutic value of Dr. Koch's lymph. I recall now only one case, of the many I have seen, where there was beneficial result, and that was a case of lupus."

The letter also states that the German physicians have abandoned the lymph as a curative, excepting for patients who come to Berlin from a distance and demand that they be treated with it.

A few days later the *Herald* heads a long review of that discovery in the following startling words:

Professor Koch's lymph a disappointment.
Its discoverer's claims for it are proved by experimentation to be unfounded in several particulars.
Valueless as a diagnostic.
Neither does it cure consumption, and it is by no means the specific it was originally declared to be.

When our article on the probable ineffectiveness of Koch's lymph for the cure of consumption appeared in the December MICROCOSM there were many regrets expressed by friends of this journal that its editor should thus

prematurely have taken sides against this discovery at its very announcement, and right at the time when the whole medical world were going wild over the supposed discovery of a sure cure for consumption.

In that article, however, we did not jump at conclusions, nor condemn the lymph hastily or blindly, but gave solid reasons why Koch's process could not successfully reach the diseased condition known as tuberculosis.

We knew what consumption was in our own personal experience, more than forty years before, and in the experience of a brother younger than ourself who had died of that disease.

We knew further by the same personal experience what it took to cure that disease as a radical remedy, one which would go right to its foundation or cause. This experience taught us, as pathological science should teach every one who reasons logically, that consumption though seated in the lungs has its primary cause in the impurities which float and circulate in the blood.

We saw distinctly outlined in the discovery we made forty-two years ago, and which we applied to our own case, the true, and in our judgment the only rational therapeutical process or system of treatment which would strike at the very root of that disease, and without drugs of any kind eradicate the tuberculous germs from the circulating fluids of the body.

As we explained in our Koch editorial referred to, and as we give in detail in our Health-Pamphlet, so strong was our faith in the practical value of the discovery then and there made that not a single day was allowed to be lost in putting it into practical operation. And we were overwhelmed with joy to see that our non-professional diagnosis of our symptoms and that our predictions as to the results of the treatment from the start were verified to the letter.

From that experience we have come to know beyond a shadow of doubt that real tuberculosis can not only be *arrested* by the process then for the first time introduced as a systematic treatment, but that it can absolutely be *cured*, as our own individual case demonstrates.

We have the satisfaction not only of thus knowing its unparalleled value to those afflicted with that fatal form of disease, but we have the proud satisfaction of knowing that it was then new to the medical and scientific world in its essential elements and details, having never been heard of at the time we first put it into practice, notwithstanding the malicious statements of one Scott, of Minnesota, and one Kellogg, of Mich., that the treatment was old and well known. A greater falsehood never was uttered.

The truth is these unprincipled vilifiers are so blinded by their desire to disparage in others anything they did not themselves do, and to reap where they had not sown, that they really do not read far enough or candidly enough to grasp the real nature and extent of our discovery.

True, a mere inkling of our remedy or a crude and most ridiculous as well as dangerous approach toward it had been made as it now seems and was employed by a few obscure physicians, but of which we had never heard and which was entirely unknown to the medical profession at that time as any honest and well informed physician will testify. Yet this unprincipled Scott, in return for the personal favors received from us for years, and because he could not run our New York office, now audaciously charges that we stole the remedy from some doctor whom he pretends to have discovered and that nobody at that time had ever heard of. Let the galled and jealous jades wince. They gnaw the hardest file that ever struck their mendacious teeth.

Besides these would-be disparagers of our revolutionary discovery by trying to rob us of its due credit, we are now beset by a horde of pirates who, seeing the manifest destiny which is rapidly supplanting drug-medication by means of the new treatment all over the world, have stolen the substance of our Health-Pamphlet as far as possible without violating our copyright, and are sending out bogus pamphlets to clergymen and others in hopes to reap a part of our glorious harvest. But such approached clergymen, knowing of our original claims to the remedy, reject the nefarious offers and are sending us bushels of these piratical works to let us know what dastardly attempts are being made to rob us of our rights.

But all such piracies are naturally short-lived. Half a dozen or more, who started in at great expense, are already starved out, as we learn, while the rest are at the verge of closing out their pilfered stock, leaving the original Health-Pamphlet in peaceable possession of the field where of right it shall forever stand.

The knowledge we possess of the untold benefits which our discovery has conferred upon hundreds of thousands of afflicted families whose substance both financial and vital had been wasted upon drugs, is a reward for our labors infinitely greater, and longer to be remembered, than all the money we have received from these grateful recipients of the Health-Pamphlet. The richest legacy we possess and the one which we are the proudest to bequeath to posterity, is a summary of a few scores of these volunteer testimonials which we have condensed in our March *Extra* just published and which all our readers can have for the asking.

CREMATION versus BURIAL.

This question is rapidly coming to the front, and we have been urged by many of our readers to give our views on the matter in the MICROCOSM. We have hitherto declined to do so, believing that the public mind was not yet ripe for its discussion. Next month, however, this will be the burden of our leading article. Till then we solicit the reflection of our thoughtful readers.

SEVEN PAGES OF TESTIMONIALS.

In our March *Extra*, just issued, we have printed seven full pages of the most startling testimonials ever read, not one of which has been solicited by us, but which represent all parts of the United States and cover nearly all classes of diseases that afflict humanity, which have been cured by our new remedy without drugs. Every reader whose eye chances to fall on this notice, should not lay the paper aside till he has sent for that March *Extra*. It costs nothing but the asking. A postal card request is all that is needed. Address the Editor.

☞ Our new MARCH EXTRA is a most important document, and is offered FREE to every reader of "The Microcosm." Send for it.

The Microcosm

A MONTHLY JOURNAL OF SUBSTANTIALISM AND COLLATERAL DISCUSSIONS.
THE ORGAN OF THE SUBSTANTIAL PHILOSOPHY.
A. WILFORD HALL, Ph. D., LL. D., Editor and Proprietor.
(Author of the "Problem of Human Life," "Universalism Against Itself," Editor of the *Scientific Arena*, &c., &c.)
ROBERT ROGERS, S. L. A., Associate Editor.
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CREMATION versus BURIAL.

BY THE EDITOR.

During recent years cremation, as a method of disposing of the dead, has been growing in favor with advanced and independent thinkers, particularly those not confined to any religious creed.

While the educated and more cultured of the world fall readily into this view, the church, and especially the clergy, have been inclined to look with disfavor if not with something akin to horror upon the idea of consigning the body of one's departed friend to the devouring flames.

Yet with a moment's reflection, and in the absence of all prejudice, how much more horrible and repugnant, the cremationist replies, must be the emotion inspired by the thought of consigning the departed loved one to the loathsome association and possession of disgusting and devouring worms!

Aside from this contrast which the average imagination will readily paint, the sanitary phase of the questions involved, as relates to those living in close proximity to large cemeteries and public burying grounds, has long been a growing and sweeping argument in favor of some less perilous method of disposing of the dead than the one which admittedly contaminates the air and thus tends to engender disease.

Of late years, however, the traditional prejudice against cremation as opposed to burial has gradually been giving way, and those who formerly were most horrified at the thought of the former as a heathenish and materialistic rite which bordered on a sacrilegious desecration of the human form divine, have recently become able to discuss the matter with a logical calmness commensurate with the requirements of the age of civilized progress in which we live.

Even where sanitary considerations would have little weight, those of pure economy, as it would seem, ought to impress themselves upon the minds of all classes in a civilized community, especially when we take into account the extent of valuable domain encumbered by cemeteries and graveyards for those of high and low degree.

Then look at the extravagant and absolutely wasteful funeral-shows which are required by the demands of modern society, and which even the poorest families strain every nerve to ape at the fashionable behests of so-called respectability, to say nothing of the millions of money squandered annually in marble tombs, monuments and slabs, which decorate and cover every city of the dead.

All this would be saved to the necessities and charities of humanity could the world accept in lieu of burial the simple rite and trifling cost of incineration at the crematory on some neighboring hill, with only a handful of sacred ashes remaining for those who might wish to treasure such token as a memento of the departed.

The moral aspect of the case, so far as the possibility of covering up crime is concerned, is also vastly in favor of cremation. Secret burials have always been a favorite means of hiding murders, whereas with public cremation, under any sort of appropriate safeguards, no crime could thus be concealed. With the whole country accessible for hidden graves, no wonder that secret burials should be available to criminals; but with a single crematory established by law for a given community, at which many officials will be employed, and to which the public are always admitted, a secret disposition of the dead would be an absolute impossibility.

To those friends who might desire to memorialize a cherished loved one in a more ostentatious and demonstrative way than would result from the retention of a handful of formless and meaningless ashes, and thus perpetuate what is now accomplished in a granite monument or a marble slab, a most worthy and significant substitute can easily be suggested that will far surpass in beauty, pro-

priety and loving devotedness all the graveyard ornamentations ever invented by man.

How much more harmonious, for example, than the most richly carved, gilded and lettered monument, and how much more expressive as a reminder of bygone associations, would be the actual *skull* of the loved one—white, polished and pure as ivory itself, prepared to rest on one's table or mantel as an ever-present reminder that in this beautiful castle of the brain and soul once resided the real friend whose name, age, date of death, etc., could be indelibly engraven upon this monument of such real signification.

If the photograph of the living presence of the loved and lost one can appropriately be retained and gazed upon as a memento of bygone affection, how much more so may we cherish the actual seat of the soul, the citadel of the mind, and the home of the affections from which in actual life emanated the intelligent and affectionate words which make past relationships dear to the memory?

Such a relic and reminder of bygone associations and memories, while as pure and free from sanitary objections as a photograph itself, requires only the dissipation of the most unfounded, superstitious and frivolous of prejudices to become to every member of a sorrowing household one of the most treasured love-tokens of the dear departed that affection could suggest, inventive skill devise, or that could be furnished by nature and art combined.

Could we this day have placed in our study, on a table by the side of our library, the two polished *skulls* where forty-five years ago resided the intellects of the dear father and mother from whom our own being was derived, and could we know of a surety that these souvenirs of our childhood's love were once the genuine abodes of those venerated souls now gone to rest, no thousands of dollars could equal the estimate we should place upon such treasures while holding them in our hands and pressing them to our heart.

The official work of properly preparing mementoes so sacred to every loving friend of the departed could well be entrusted to the same responsible department that would have official charge of the cremation itself. Thus only a single day need elapse after the solemn ceremony of incineration had been performed, until the osseous seat of the soul and intellect of the loved one would return to its late abode to receive a sorrowful but gladsome welcome from those who but yesterday were so dearly cherished.

May we not look forward to this revolution in memorial souvenirs in the near future as but one of the real strides of modern civilization now so surely and unmistakably in progress? For one, we have no hesitation in actually hoping to witness before these eyes shall cease to gaze from out the osseous citadel of the soul, the inauguration of this very revolution on the part of some advanced and appreciative households who are above bigotry, and who are not afraid from superstitious morbidity to adopt appropriate advances in civilized life and social reform when they are presented.

Then, though the writer may not live to see it, the reader of this article will, after these mementoes shall have become as common in families as are marble slabs now in cemeteries, the properly engraved skulls of those men and women who shall have made their intellectual marks by impressing their own personalities upon the age and the community in which they have lived, and who by individual achievement shall have accomplished something toward lifting humanity to a higher plane, will, as an act of justice to the departed, be gathered together by public associations or city authorities, and by consent of relatives be placed in what may be termed the "Academy of Skulls," there to be kept with brief biographical sketches as an educational institution for the improvement of the young by keeping alive the memory of the good deeds thus represented and recorded.

The cases and shelves of such sacred museum might thus not only contain the skulls of local celebrities and prominent persons, but the authenticated casts of distinguished men and women from different parts of the world, such as presidents, kings, queens, statesmen, generals, scientific and literary lights, etc., produced *fac simile* in alabaster or some imperishable cement, exactly to represent the cranial forms where the real skulls could not be secured. May we not, from the nature of the case and the importance of the subject, fairly anticipate the establishment of such collections of skulls to constitute an educational feature in every town or city of any considerable size?

No phase of anatomy is more important to young students than the study of craniology, not perhaps in its sharp phrenological aspect so much as in the general differences in the forms of skulls (no two of which being alike) compared and illustrated by the known mental characteristics and achievements of their respective owners.

That something of the kind here foreshadowed would be appropriate to the natural yearnings of the human heart, as soon as it shall be purged of its irrational prejudices, is as certain as that humanity is destined in the coming future to advance instead of retrograde.

That the light of this millennial morn is beginning to break, may be judged from the al-

ready popular movement for the organization of crematory societies in different sections of the country, in order to popularize this vast improvement in disposing of the dead over the present abhorrent method of cherishing in our very midst innumerable receptacles filled with "all manner of corruption and dead men's bones," to engender disease and breed contagion.

One of these associations, called the New England Cremation Society, has just been organized in Boston with a list of members containing many prominent names of men and women in the religious, scientific and literary world, and with the expressed approval by letter of many prominent clergymen throughout the country, including such names as the Right Rev. Henry C. Potter, Bishop of the Episcopal Church of New York; Rose Elizabeth Cleveland, the ex-president's sister; the Rev. C. C. Tiffany, D. D., Rector of Zion Church, New York; the Rev. Dr. Heber Newton, of New York; Hon. Charles A. Dana, Editor of the *New York Sun*; the Rev. Phillips Brooks, Rev. E. E. Hale, Charles E. Morton, of Harvard College, and a host of others equally prominent.

The officers of this New England Crematory Society at Boston are: John Storer Cobb, President; with W. B. Westcott, Secretary; Vice-Presidents: Nathan Appleton, Mrs. Mary A. Maffett, Dr. John T. Codman; Treasurer, Albert S. Parsons; Executive Committee: C. J. Roth, E. M. Shepherd, Miss Quincy, Dr. Wm. C. Cutler, Dr. Edward B. Kellogg, etc.

Surely when prominent citizens like these shall join hands in carrying out such a necessary reform in the disposition of the dead, with the pronounced approval of such prominent divines as here named, the prejudices of the illiterate may well be brushed aside as counting for nothing. Civilization, in its progressive strides, has demands upon the intelligence of our race and of coming generations, but seeks neither the advice nor the consent of the ignorant and superstitious.

THE HUMAN MIND.

BY ISAAC HOFFER.

Wherever conscious sensation exists, there must be some degree of a mental state; for to be sensative to pain, or anything else, is evidence of a noticing or perceptive capacity—a sense of feeling, and this sense of feeling is a knowing sense, and is the essential and distinguishing sign of intelligence. A fully developed intellectual condition is, however, a very different thing from a condition of mere conscious sensation; and it is only in the human mind that mental energy is developed into a reasoning, projecting, and executive power.

In all animal creation below man the capacity of knowing is limited to external impressions; and knowledge remains a subordinate and servile power incapable of asserting itself, except in obedience to inciting circumstances and surrounding conditions. In the human mind the capabilities of knowing are constantly developed with the increase of knowledge, by internal, self-inciting, and self-acting energy. They are not limited to external impressions, but are limitless spheres for the storing of such impressions, for utilizing and converting the same into substantial knowledge, and into a designing, directing, and controlling power. While intelligence in animal life is but a servile agency to external conditions; in man it is an internal, self-exerting, self-developing and self-efficient energy.

The human mind is the only force in nature that can examine itself, watch its own action, study its own power, look at its source, its purpose and its destiny, and ascribe for itself a course of action for its own improvement, and for the attainment of definite effects and results. It is the only force that has originating, designing, exerting, directing and controlling power. All other forces are mere agencies without any power or control over their own actions. They move and act, and motion and action proceed from their movements and actions, according to fixed laws, and existing conditions, wholly without their power to bring about, to change or control. They are like a machine with its powers and movements fixed so that its actions must produce and reproduce the same results.

In all the operations and works of man there are but three things employed, mind, force and matter. Of these mind is the elementary and operating power, force the active agency, and matter the passive thing acted on. Every work of man has its inception, and its development in all its details to the final completion, perfected in the mind before it can be brought into a manifesting condition and materially represented; and therefore all the manifest works of man are only material representations of mental operations. Without mind man would be more helpless than the least species in animal creation, for there is no animal life without some degree of mental power.

While mind can examine itself, watch its action, and learn much of its powers and capabilities, it can not explain itself, or define what it is. Its existence in a material body has been assumed, by some distinguished scientists, as a sure evidence that it is the result of the organic action of that body,—that mental energy is simply the molecular action of the human organism.

This assumption is based, or rests, upon another assumption, which is not sustained by any known established facts in nature. Matter distinguished from force,—and there must be, and is, a distinction between a moving power and the thing moved, whether the moving power operates within the thing moved or from the outside,—is not known, and has never been shown to have any action whatever.

Matter in its normal condition on the earth is known to be passive and inactive, and that there must be some moving cause to bring it into action. Without the rays of the sun there would be very little action on the surface of the earth; and without some active agency operating in matter inertia is its inherent condition.

It is an admitted fact that the forces of nature applied to matter do move it, and that it can be brought into various kinds of actions, and variously transformed by different forces,

or by the same force differently applied. Heat, the result of activity that proceeds from some exerted energy, is an example of a moving power operating with varying effects, according to different degrees, upon the same and upon different material substances.

On the one side we have the known fact that matter can be moved, brought into action, and changed in its states and combinations by force, and on the other side we have an utter want of evidence to show that matter either in its atomic, molecular, or any other state has in itself moving or acting power of any kind; for matter disassociated from force is not known to man.

When we have positive and undisputed evidence that force is an active agency in matter, and can find no evidence, after ages of theorizing and searching, that matter has any action in itself, or any known existence without force, the question of atomic, molecular or organic action by matter itself should be no longer a subject for scientific discussion.

That life and mind should be evolved out of matter, or out of the interaction of matter and any force that does not possess vital and mental energy, is another theory resting upon the assumption that matter is the source of activity. This theory is even more unfortunate than the assumption upon which it rests; for it has standing against it the admitted fact that no authentic instance has ever been furnished to man where matter and insensate forces have evolved or produced a living plant or animal. It is an unfortunate theory too in being contrary to all known laws in nature, for life and mind have never been known to come from a source that had no vitality and no intelligence; and it is as unnatural and unreasonable that mind should be evolved out of matter, as it is that matter should be evolved out of mind.

Not only does all this negative evidence stand against this theory, but it has standing against it the positive evidence that life and mind, in all their varying grades and degrees —from highest to lowest—are now and, as far as man has been able to learn, always have been transmitted propagations. They never have been inherent forces in matter like other forces of nature, but have been perpetuated by a continuous reproduction of new specimens of each grade of life and degree of mind. It is an immutable law of nature that each species of life with its inherent degree of mental capacity must be propagated by its like. The human life and human mind can only be continued by the human species. All the foregoing facts, positive and negative, stand against the theory that matter in action is the action of matter; and against the theory that life and mind are but the effect of the molecular action in the organism.

This is, however, one more well known fact, which proves, perhaps more clearly and more conclusively than any other, that life and mind are active operating energies—real entities and not mere effects. That the vital germ in the seed is the organic agent through which all vital organisms are developed, is this familiar fact; and that the vital germ contains within itself the form and characteristics of the organism, and the power to develop it, is equally evident.

The mental capacity of an organism is a pre-existing condition in the vital germ, and is an elementary part in the development of the organism, compelling its formation to be suited for the operation of the particular mental energy that is to possess it. Instead of life and mind being an organic effect, the material organism is the product and material representative of the mental-life germ; for if the vital energy in a seed is destroyed, with all the material substances remaining undisturbed, it will not evolve an organism under the most favorable conditions; thus showing that the vital energy in the seed is the organizing power, and that the material substances are the ready tangible constituents for the construction of the organism.

The vital germ in the seed of the human organism is the germ of an intellectual vital energy, and this germ controls the development of the organism and completes it in the human form, with all the functions and faculties needed for the development and operation of an intellectual energy, and for the exercise and tangible manifestation of its internal actions and powers.

Ever since man's appearance upon the earth the human mind has been perpetuated by a continuous and increasing reproduction through intellectual-life germs; and it is but a rational conclusion that it had its source, from whence it came to the earth, in an intellectual vital energy.

Previous to man's appearance a progressive system of development in plant and animal life had been in existence upon the earth, apparently, for many millions of years. The crust of the earth is full, and many parts of it are composed almost entirely of the remains of plants and animals. These remains show that there had been, in the aggregate though not universally, a gradual progress from lower to higher grades of organisms until the advent of man, when all progress in organic development ceased; and no more complex organisms, no higher order of beings, and, as far as can be ascertained, no new species of plants or animals have made their appearance since then; and the great system of progressive development in life became limited and confined to the reproduction of the same species. The great power that for millions of years had kept this system of progress in life moving forward and upward ceased its impelling action; and with man's appearance a new power, a new reign and a new era was introduced upon the earth.

Man was the last species in the animal creation, and his mental energy the first production of a self-exerting, self-developing and self-controlling intellectual power—the last link in the system of progress in vital organisms, and the first link in the chain of progress in intellectual development.

The human mind is now the moving power in the march of progress, and in the development of new orders of things upon the earth. The present sphere of progress is no longer confined to advancing production in the material world and the world of life; but includes human operations in the material, the intellectual and the spiritual world. It changes the surface appearance of the earth, converts the forces of nature into subservient agencies, and takes charge of matter and life and utilizes and controls the same for man's physical comfort and satisfaction; it establishes human institutions for man's social and mental comfort and enjoyment, and it cultivates and develops itself as a means of necessary prepara-

tion for continuing the march of progress and for a more perfect understanding of all things past, present and future.

There is not a mineral, a plant or an animal, not a feature in the whole earth or its physical conditions, or in the universe, and not a line of action within the reach of mental apprehension, into which the human mind has not extended its researches and its operations. Not only to know the thing itself, but the cause and manner of its production, its nature and characteristics, and the purposes it serves, or for which it might be used. It has established societies, governments, industries, commerce, languages, literature, schools, art, science, philosophy, religion, etc., and is constantly employed in advancing and improving these, and in searching for and adding new discoveries. The march of progress under the force and direction of the human mind is of a vastly wider range, more varied character, and of a more intellectual nature than the progressive development of the great system of life under the progressive power that ceased its advancing steps at the appearance of man.

The mind being an elementary energy and a complete whole, and not composed of constituent parts, can not be analyzed any more than an elementary material substance; and all attempts to find the source and determine the essence of mind in this world, and by its own efforts, must end in failure, just the same as all human efforts have failed to find in this world the source of elementary material substances, and to determine what they are in their essence.

But mind is able to ascertain and know that it has certain faculties and powers which are not found in anything else in nature, and that all reasoning, theorizing and speculation about itself, or anything else, is its own exclusive work. The theory that mind is only the effect of molecular or organic action, and every argument to sustain it, are purely mental operations; and the question as to the truth or fallacy of this theory is raised in and by the mind, and there is nothing that enters into the discussion of this question, or of any other question or subject, that is not wholly the creation and the work of mind. The only apprehending, examining, comparing and determining power—the only testing power—of all questions and subjects, and the only power capable of controlling matter and the forces of nature for its own use and purpose, is mental energy; and a testing and controlling power can not be less a reality, less a substantial entity than the things tested and controlled.

This monad of energy has its center of action in the brain of man, and has the nerves, the organs and the forces of the body, by and through which it receives information, exerts its power and executes its purposes; and is not any more the effect or result of the molecular action in the human organism than the electric current in telegraphing or telephoning is the effect or result of the molecular action of the iron in the wire.

Lebanon, Pa.

WHISPERING GALLERIES.

BY REV. GEO. W. DU BOIS, D. D.

In "Ree's Cyclopædia," under the head of "Whispering Domes," I find this statement, viz., "that a low voice (faint whisper), uttered near the smooth wall of a circular chamber, will produce, at a point diametrically opposite, a *much stronger* sound than the *initial sound* at the point whence it proceeded." The writer then attempts an explanation of this phenomenon, on the theory of reflection, illustrating his meaning with a diagram.

In the same article the writer refers to the prison of Dionysius at Syracuse. This prison was so constructed (arched elliptically) that "a soft whisper was increased to a loud noise;" "the clap of the hand (augmented) to the sound of a cannon." The writer also refers to "the aqueducts of Claudius, which carried a voice sixteen miles," etc.

Webster defines the verb "to whisper" thus: "To speak softly or under the breath; to talk with the breath expelled in such a manner as to produce a rustling which makes audible the different articulations, but without that vibration in the larynx which gives *sonorous* or vocal sounds."

How then can these feeble vibrations of the labial and lingual muscles be so wonderfully re-inforced in the "whispering gallery?"

The explanation is simple enough upon the theory of *sound-force* as a real immaterial substance having its own "laws of radiation."

The sound-pulses engendered by the whisper start from near one focus of the ellipse. Feeble at their commencement they are radiated in right lines in every direction, and at every conceivable angle. They impinge upon the wall of the elliptical chamber, and are reflected to the opposite focus of the ellipse, the angles of incidence being equal to the angles of reflection.

Thus the original sound-pulses are *re-inforced*, and arrive at the ear of the listener, standing near the focus opposite the one where the initial impulse was given in greatly multiplied numbers and consequent force.

If sound is propagated in "air-waves" like "water-waves" and subject to the same laws, what confusion would result from this accoustical experiment in the "whispering dome." What endless intermingling and interferences! What retardations and accelerations! What neutralizing of condensations by rarefactions!

Could a feeble whisper make its way, so as to be heard in distinct modulations, through such a wild storm of battling billows?

The mind can not conceive such a possibility. Sound philosophy and common sense reject it. Hitherto we have been, as it were, congenitally blind, having been taught from childhood that the wave-theory is in perfect harmony with established physical facts and sound natural philosophy. But now we are enlightened by the Substantial Philosophy first announced in the "Problem of Human Life." Now we can say with that brave man in olden times, whose sight was miraculously given him by our Lord, and in defiance of the powerful *Pharisees* in science, "this one thing I know, that whereas I was blind now I see."

REMARKS BY THE EDITOR.

Dr. Du Bois is, unquestionably, right. Waves of air like waves of water have no true reflection. They merely break back and pile up among succeeding waves. This is because there is no forward or bodily motion of substantial particles in any sort of waves in any conceivable substance.

The forward motion observed in waves is

only that of the successive changes of position in the rising and falling particles which create the swell, and which otherwise remain virtually stationary.

This is beautifully illustrated by a field of flax in blossom. As true waves as were ever seen on the surface of water will pass over such field by the blowing of a gentle wind. But think of such a system of waves *reflecting* in any possible sense of that term as they strike the board fence inclosing the field!

The only conceivable *reflection* of any substance is where its particles advance with considerable velocity and strike bodily some suitable opposing surface, in which case a rebound will take place at the exact angle of incidence of such advancing particles. This is what causes the concentration of sound to given points in galleries of certain shape.

Suppose the whole inner surface of such a whispering gallery to be lined with highly polished silver, it is manifest that a single light placed at the whispering point would indicate by its reflection and greatest concentration the exact place for the ear to be stationed to hear most distinctly the whispered words. In precisely the same manner would india rubber balls, if they could be fired simultanously in all directions from the whispering point, concentrate by reflection in the largest quantity at the same hearing station.

Thus clearly is it shown that, while waves do not and can not reflect in any true sense, but will merely fall back upon themselves in broken confusion, the very idea of *reflection* and the very signification of *incidence* can only be harmonized with the bodily forward movement of the rebounding particles of some substance either material or immaterial.

SALVATION IN HELL, No. 2.

BY J. I. SWANDER, D. D.

The advocates of the doctrine of a second probation divide the inhabitants of this present world into three distinct classes: 1. The *infants*—those who have not yet attained to an age of personal accountability or a self-determining condition of their individual wills in the way of either choosing or rejecting the good. 2. The *heathen*—those who, having attained to adult age so far as such maturity can be reached through a natural development of body and mind, but for whom, on account of their not having anything more than the light of nature, it is claimed that they are without present probation, and therefore without present accountability. 3. The fairly enlightened *sons and daughters of Christian civilization*—those who receive a knowledge of God and self and duty, not only in the light of natural revelation, but also in the light of the Bible, and who are, therefore, supposed to go from this world to a state of eternal fixedness.

Having noted the above classification, let us now have an understanding as to what "so great salvation" fully implies and involves before we proceed any further with our inquiry after the soteriological possibilities of the hadean realm.

In the first place, we lay down the proposition that salvation does not consist merely in keeping out of hell or in getting out when there; neither does it consist primarily in getting to heaven or in the ability to remain there after having passed the pearly portals of the skies. It involves something more and something different. There is in man an ordained aptitude for God. The real wants of his nature are in exact proportion to his proper possibilities. Man is never fully saved until all his normal possibilities are fully realized. Such full salvation can be reached only as his being completes itself in conscious ethical union and consequent communion with God. Even a sinless individual could not fulfill his proper destiny without such relation to God. He would still be nothing more than a piece of innocuousness. Man's nature demands more. That more must be found beyond the plane of the mere human. Christianity is that higher form of humanity, and its only proper complement. Jesus Christ is the organic head thereof. Only in Him can human beings be complete. Men need to be saved from incompleteness, as well as from the power of sin as an element foreign and antagonistic to the normal condition of their being. The life of the human individual, whether infant or adult, whether heathen or civilized, can never round itself out in complete blessedness, or rather in blessed completeness, until it is "hid with Christ in God." "Neither is there salvation in any other." The human soul has been created with an aptitude and yearning for the absolute good. Such good is only found fontally in Christ. Hence even heaven itself, if it were attainable without Christ, would be unworthy of the name, and union with Him would make it a paradise from which no soul under the altar will either need or wish to be saved except in the way of reaching its full consummation of redemption and bliss in the resurrection of the body. (Rev. vi., 10–11).

Assuming, then, the essential correctness of the above definition of full salvation, we proceed to lay down the following propositions, believing them to be supported by the general tenor of scriptural teachings upon the subject, in harmony with our highest and purest conceptions of God's character as revealed in nature and in the Bible, in agreement with our knowledge of ourselves as rational and ethical beings, and in full accord with the enlightened Christian consciousness of this advanced and advancing age:

1. As no human being can be correctly regarded as in *full* possession of full salvation until the will of such individual has freely determined itself with conscious rational affection by choosing Christ, in whom alone are found the absolutely good and true and beautiful, we know of no reason why deceased *infants*, *idiots* and *heathens* should be supposed incapable of forming a personal acquaintance with and making a positive choice of Christ in the invisible world. Such a possibility can not be logically denied until it is proven that either such choice is not necessary to full salvation or that the aforementioned classes of human beings have had an opportunity in this life of determining themselves in favor of the highest blessedness attainable by all human beings. We should at least be willing to seal our lips.

in a half-hour of silence before we affirm that He who tasted death for every one does not still, by some means, offer the wealth of His beatific fullness in the invisible world to those who in this life, whether "in the days of Noah" or at any other time, were not positively "disobedient" to the heavenly vision.

2. All human beings are in a salvable condition until they have either made positive choice of the evil, with such full decision of purpose as to form their characters for the bad, or allowed their reasonable day of probation on earth to pass away without making that positive choice which was rendered both possible and necessary by the place, the time and the abundant opportunity afforded them for such decisive action.

3. Those who are here surrounded with sufficient light, whether they be the comparatively enlightened among the heathen who are "a law unto themselves," or the more advanced and highly favored sons of Christian civilization who are thus afforded superior opportunities to determine themselves in a free and deliberate choice for or against the good—all such pass, either before or at the hour of death, into a state of fixedness as to their moral characters and consequent destiny. Those who under such circumstances thus determine for the good will be pillars in the temple of God to "go no more out." Those who determine themselves in the other direction place themselves, by the force of such false and fatal action, beyond the "great gulf fixed," where "they that are filthy will be filthy still." To such, a future probation is not within the nature of things. It is involved in the very idea of humanity that each individual should have and at some time exercise power to limit or enlarge the sphere of his own freedom. Neither is there any positive evidence that those who exercise this power in the way of limiting their sphere of freedom to act, and thus place themselves beyond the fixed gulf will wish to make any radical change for the better, except to relieve themselves from torment. And what would such a wish amount to as a self-reformatory movement? A desire on the part of a life-convict to get out of the penitentiary is something very different from that radical change in moral character so essentially necessary to constitute one a member of good society and a participant in the advantages and enjoyments peculiar thereto. It is because hell is in the damned, rather than that the damned are in hell, that makes a future probation for them a constitutional impossibility. The doctrine of universal salvation requires a radical reconstruction of man's essential constitution as a rational and ethical being, as well as a radical change in the character of Almighty God. This feature of the subject was most aptly treated by Dr. A. Wilford Hall in his great public discussion fifty years ago. Already, then, the rising founder of the Substantial Philosophy expressed the truth as follows: "God exerts his attributes with reference to man's salvation only in such a manner as will comport with man as a moral responsible agent. And if man, exercising his moral agency, can frustrate the plan of God with regard to his present salvation, even when that plan was brought into operation by infinite goodness, wisdom and power combined, can he not, I ask, on the same principle, and exercising the same moral agency, frustrate the same plan also [in the invisible world] with regard to his eternal salvation?" (See *Universalism Against Itself*, p. 227.)

Then as to probation in the future world, there can be none for us to whom the word of salvation is sent in this life by the preaching of the Gospel. In order to avail ourselves of the benefits of any such possibility we must either prove that we are heathen, establish our characters as idiots, or play the baby act. But even such a course would involve a fatal blunder, as it would be against the truth, and persistent opposition to the truth is the principle of eternal damnation.

Fremont, O.

THE COUNTRY PAPERS ARE WITH US.

[The following flattering notice of our December article on Koch's lymph appears in a late issue of the *Norristown* (Pa.) *Review*, one of the leading papers of the State. It shows the gradually changing feeling of the press of the country toward the work we are doing]:

DR. KOCH AND DR. HALL.

Since the first announcement of the discovery of a cure for consumption by Dr. Koch, the press of the whole country has daily presented to its readers the multiplied opinions of prominent men, regarding the probable and possible efficacy claimed for it, varying in tone from the utmost confidence to the opposite degree of skepticism; but none thus far uttered contain so much of practical and appealing logic as that presented by Dr. A. Wilford Hall, in an article published in the December number of the MICROCOSM, a monthly scientific journal of which he is editor and proprietor.

The writer declares himself entirely free from all doubt as to the "practicability of effecting a radical cure of consumption even in advanced stages," but denounces the Koch lymph, unaided by other treatment than the lymph, as a "self-evident absurdity," and sustains his position by arguments based upon physiological facts, and clear to the most casual reader.

Dr. Hall's views are highly instructive, and deeply interesting as well. Forty-two years ago, he was given up by his physician as beyond help; and believing himself in a most hopeless condition, he devoted the weary hours to carefully observing his disease which resulted in his great hygienic discovery, and its successful application to his own case.

Dr. Hall has hundreds of testimonials from cases which were considered hopeless, but which were entirely cured by his treatment.

Dr. Hall claims for himself the privilege of having suggested to Dr. Koch the bacilli theory. Certain it is that in an editorial published by him in 1882, the theory that "consumption might be the result of bacterial bacilli, which might be driven from the system by vaccination," was carefully explained in all its details, and the Koch treatment is but an attempt to cure consumption by vaccination, the lymph being injected between the shoulders.

Dr. Hall suggests other methods of application of the lymph, which if acted upon may secure more desirable results with less danger and suffering to the patient.

Dr. Koch's recent admission, to the effect, that he had withheld the vital principle of the secret, explaining the manufacture of the lymph, and his sudden need of a vacation

among the pyramids and sands of Egypt, has done but little towards establishing the world wide confidence in his discovery, which the first announcement indicated.

The Health-Pamphlet, published by the author, Dr. A. Wilford Hall, embodies a detailed and minute account of his great hygienic discovery, and explains thoroughly the treatment which has proven so successful in cases of advanced consumption. The book is scarcely less valuable to persons in perfect health, than to the consumptive. It is replete with physiological information, facts which should not only be known but studied carefully as a means of preserving the health. Too much can not be said, in commendation of a work, which places within the reach of every one such scientific knowledge as will enable them to understand how to cure or resist disease and promote longevity.

E. D. SCOTT, OF MINNESOTA.

Last month we had occasion to refer to one Scott, of Minnesota, who was now engaged in sending a circular to our agents through the mails, in which he villainously charges us with having stolen the treatment set forth in our Health-Pamphlet from some obscure writer whom some one pretends to have discovered as having described our method two or three years previous to the date of our discovery. This charge, however, is but a reiteration of that made by an equally unprincipled villifier named Kellogg, of Michigan.

We have waited patiently for our turn and for the facts by which to expose the false and malicious charges thus made and circulated, and we are glad that we are now in possession of the required information through sources which admit of no manner of doubt, by which to show both the animus and the method by which these miscreants are trying to rob us of our well-earned reputation as the original discoverer of this most wonderful of all known remedies for diseased conditions, and which through our efforts alone, as this same Scott admits, has become a treasured boon in more than 300,000 afflicted families.

Scott, as we have letters and figures to show, is capable of stooping to any dishonorable means to gratify the feelings of his treacherous heart for some trivial or fancied grievance, and he was only too glad to seize upon the opportunity, when through the equally malicious publication of Kellogg he obtained the pretended facts which his own brain was not capable of concocting.

The fact is well known that in our crusade against drug-medication we have made numerous enemies who could not only seek to rob us financially of a part of the profits of our business resulting from the sale of this Health-Pamphlet, but, the better to accomplish this end, have actually resorted to the worse than a check-raising crime of reproducing some recent pamphlet with altered date, in order to anticipate our discovery and then attribute the whole thing to some obscure doctor long since dead, and in this nefarious and cowardly way furnish an authentic (?) document for such unscrupulous miscreants as Scott to quote from.

Another favorite trick of these literary desperadoes is to look up some recent edition of an old book, such as that of Dr. Wood's, and in which a reference to our remedy has found a place, and then audaciously to make such "authentic" quotation, while dishonestly giving the date of the first edition of the book *in which not a word about our method of treatment occurs!* We have recently had the satisfaction of trapping and exposing one just such scoundrelly villifier who was engaged in writing to our agents and making the falsified quotations here set forth,

Possibly some of these perverters of the truth of history are so ignorant as not to be aware that numerous new and startling things appear in all later editions of revised books that were not even hinted at in the edition bearing the original date. In such event they might be partly excusable did they not use their ignorance as a cloak for their malicious intent.

The well-known fact that up to the time when we made known our discovery to Dr. Stevens twenty-three years ago (at which time he announced it as entirely new in a public lecture) the best educated and most widely read physicians of the land knew nothing about it, is *prima facie* evidence that the pretended documents ante-dating us, and from which such enemies as Scott quote, are nothing more nor less than bald forgeries or reprints with original dates changed to suit this mendacious purpose.

Now to nail this villainy and put a padlock on the pens of the scamps referred to, we will pay E. D. Scott one hundred dollars in cash if he will show us any publication, however obscure its author, which sets forth the essential details of our Health-Pamphlet bearing a date earlier than that of our discovery, said date being proved to be authentic and not cooked up by some miscreant to serve a rascally purpose.

Let Scott now bestir himself, and instead of circulating his laughable and disgusting leaflets exhibiting graveyard caricatures of President Lincoln and Bishop Simpson, from whom he claims to have received a personal indorsement, let him trot out his mythical doctor from some western neck of woods, and allow an expert in fraudulent documents with changed dates to put his sham proofs through a course of rigid cross-examination. This may not pay him as well as his hypocritical cant in display-

ing poor wood-cuts of eminent dead men, with their more than doubtful testimonials concerning his personal integrity as aids to raising money for his old women's home, but it will be a good deal more like legitimate and honorable commercial business.

One prominent official of the New York Post Office, in speaking to us of Scott's circular that had been insolently sent to him through the mails, said: "I can not understand how such a despicable and treacherous scamp can manage to make a living in any decent community." And the Rev. Dr. Buck, of Washington City, who knows the enormous amount of good our Health-Pamphlet has accomplished in tens of thousands of afflicted families, writes us that he can compare such a traitor to only one animal in the whole range of zoology, and that is the skunk.

Similar letters concerning this burlesque on humanity are reaching us from our agents all over the country, to whom the Minnesota fraud has been enabled to write by finding their names and addresses printed in the MICROCOSM. Such a nefarious sneak should not be admitted into the society of any respectable family.

Little, however, do the men to whom this Scott has been sending his circulars know the depths of his treacherous infamy in return for our repeated personal intercessions in his behalf during the past year while he has been acting as our agent for the sale of the Health-Pamphlet. More than a score of times we have departed from the fixed rules of the office, and stepped personally into the breach between him and our manager, who had lost all patience with his insolent correspondence and impertinent demands. On many different occasions the manager would summarily have cut him off from all business relations with our office, brought his agency abruptly to an end, and sent him adrift as unfit to be intrusted with any responsible work, but for our personal entreaties to bear a little longer with his infirmities, which our manager diagnosed as a cross ranging somewhere between lunacy and idiocy. And for these kind offices on our part, of which he was constantly made aware, this worse than human scorpion now turns and stings the friend that had warmed him into life. Let him sting; his poison is now harmless, at least with the 500,000 who who will read this MICROCOSM.

REPLY TO SEDLEY TAYLOR, No. 2.

BY THE EDITOR.

(Concluded from last month, page 60.)

If anything was needed to overturn the wave-theory of sound after last month's reply to Sedley Taylor, the reader will be apt to find it in the following:

Mr. Taylor, in his letter to the MICROCOSM, next attempts a reply to our argument based on the *sonorous property* of the sound-boards of musical instruments by which alone, as we claim, the sound of the strings is vastly augmented.

By reference to our December article, to which his letter is a reply, it will be seen that we gave what we then considered and still regard as the most conclusive proof of the fallacy of the wave-theory of sound ever presented upon any scientific proposition. We showed that by holding the stem of a vibrating tuning-fork against a flat piece of *iron* of a certain size and form, it would produce almost no augmentation of its sound, notwithstanding this iron plate reproduces the vibrations of the fork in every detail, and thus transfers its full mechanical power to the air in the shape of "condensations and rarefactions" as required by the theory.

We then showed that if the stem of the fork shall touch a plate of soft wood of the same size and form, the sound will be augmented a hundred fold over that of the iron, notwithstanding the soft surface of the wood yields to the stem of the fork, thus reproducing but a small fraction of the action on the air which is caused by the piece of iron. In this way we proved positively that the augmentation of sound caused by the sound-board of a musical instrument has nothing whatever to do with the greatly increased air-waves sent off from these large surfaces as claimed by the wave-theory.

Hence it follows that the augmentation of sound observed must result, in strict accordance with the Substantial Philosophy, from the sonorous property of the sound-board alone without the slightest reference to its mechanical action on the air, thereby breaking down the wave-theory by a single argument based on a logical analysis of one of its strongest positions and illustrations. However wave-theorists may affect not to see or feel the force of this argument, unprejudiced investigators must regard it as conclusive.

Sedley Taylor, dull as he seems to be in matters of physical science, evidently saw that unless this new and unexpected fact in acoustics could be met and satisfactorily answered, then good-bye to the wave-theory of sound.

Clearly he must have seen, since he admits the fact and no doubt tried the experiment, as we show a little further on, that the piece of wood produces a hundred times more sound than the piece of iron of the same size and form. And as the soft and unelastic wood necessarily yields to the stem of the fork, not repeating its surface vibrations, while the incompressible and elastic iron must re-produce every vibration of the fork's stem to their full extent, Sedley Taylor absolutely must have known that the greater sound produced from the wood sound-board could not be caused by the air-waves sent off from the bodily movements of its surface. Hence that this great augmentation of sound observed must result from some cause hitherto unrecognized by wave-theorists.

Do not let us hurry over this matter to avoid a little apparent repetition. We are writing for history, and will come to Sedley Taylor's letter in a moment with words that will stick to him and his theory forever. Bear in mind that until we had presented the difficulty no wave-theorist, so far as any text-book shows, had ever thought of this idea of comparing the

effects of an iron sound-board which repeats all the action of the vibrating fork on the air, and a wooden sound-board which but partially reproduces that action. Hence, when Helmholtz, Tyndall, Lord Rayleigh and the other great acousticians had their attention called to the matter they were naturally enough astounded, as they saw that their mechanical theory of sound had struck a veritable snag.

For the first time in his life Sedley Taylor, the learned author of a popular text-book on sound, on reading our argument concerning the iron sound-board in the *Musical Opinion*, realized that a new and dangerous obstacle had confronted the wave-theory which unless it could be removed must bring it to a dead halt. He well understood the teaching of that theory as set forth in every text-book published, that it was the bodily vibration of the "large surfaces" of the sound-boards that augmented the sound of the strings bearing against them by sending off more powerful air-waves. Hence he knew that the incompressible plate of iron ought to produce a louder sound according to his theory than the soft and yielding plate of wood! There is no mistaking this universal teaching of the text-books. Hear Prof. Tyndall:

"I now pluck the string. It vibrates vigorously, but even those on the nearest benches do not hear any sound. The agitation which it imparts to the air is too inconsiderable to affect the auditory nerve at any distance. . . . It is not the chords of a harp, or a lute, or a piano, or a violin, that throw the air into sonorous vibrations. It is the *large surface with which the strings are associated.*"—Lectures on Sound, p. 88.

But if Sedley Taylor wants better authority, here it is. He himself taught, eight years ago in his text-book on sound, precisely the same as did Prof. Tyndall, that the sound-board, against which the strings of a piano bear, augments the sound by its *segmental* vibrations and sends off air-waves the same as do the strings, only on a larger scale. Here are his exact words:

"The sound-board being purposely constructed of the most elastic wood, yields to the rhythmic impulses acting upon it, and is thrown into *segmental vibrations like those of the string.* These vibrations are communicated to the air *in contact with the sound-board* and then transmitted further in the ordinary way. The amount of *surface* which a wire presents to the air is so *small* that but for the aid of the sound-board its vibrations would hardly excite an audible sound." ("*Sound and Music*," by Sedley Taylor, M. A., page 116.)

Prof. Helmholtz teaches the same, that the only office of the sound-board is to repeat the vibrations of the string or the tuning-fork bearing against it, but on a larger scale, and thus send off larger air-waves, thereby causing the greater augmentation of sound observed. Prof. Helmholtz never thought to ask himself the question—suppose the sound-boards were made of *iron*, thereby reproducing the vibrations of the strings many times better than will wood (as the touch of the finger demonstrates), why is it that we do not hear even a hundredth part as much sound as by the less vibrations of the wood? The truth is, neither he, nor Tyndall, nor Sedley Taylor, nor any other acoustician ever thought of this crushing objection to the wave-theory till the question was propounded by the writer.

When we made this point against Sedley Taylor's position in our December article he was literally stunned by it, as he saw if our facts were as stated in regard to the sonorous difference between wood and iron sound-boards, the wave-theory was doomed. But being an authority at Trinity College, and the author of a popular text-book used by both teachers and students, his pride would not permit him to give up the theory on which his book was founded. Hence he must say something, however fallacious and absurd, to try to blunt the point of this startling state of facts. And what, reader, does he say? Here it is verbatim from his letter to the MICROCOSM:

"If the stem of a vibrating tuning-fork be applied alternately to two equal plates, one of wood and the other of iron, the sound heard is notoriously much louder in the former than in the latter case. *According to the wave theory* the reason of this is that wood, being *much more compressible than iron*, is thrown, by the same amount of mechanical force, into *molecular vibrations of greater amplitude, to which corresponds a louder sound.* The vibrating stem of the tuning-fork thus sets the *particles of the wooden sound board* into ampler vibrations than it induces in those of the iron one, and therefore a louder sound is heard when it touches the former than when it touches the latter."

Now, we very much dislike to be forced to say anything disparaging to the honesty of a gentleman with whom we are discussing a question of science, but we do declare here, without mental reservation, that Sedley Taylor *knew* when he wrote these words *that they were not true as regards the teaching of the wave-theory.*

He *positively knew* that he himself, as well as Tyndall, Helmholtz and all writers on sound had taught, that it was the "*segmental* vibrations" of the string with "small surface" that were transferred to the sound-board with "large surface," there to be repeated in similar segmental or surface vibrations and sent forth in larger air-waves than the "small-surface" of the string would produce.

He *positively knew* that the "*molecular* vibrations" of the sound-board, "according to the wave-theory," had nothing whatever to do with the sending off of these larger air-waves constituting the great augmentation of the sound observed, any more than the "molecular vibrations" of the string or tuning-fork itself were the cause of the air waves produced. Yet he deliberately and premeditatedly tries to misrepresent the wave-theory in order to escape from the difficulty in which our argument had placed him, and thus he unwittingly abandons his theory of air-waves entirely by bunglingly confining the vibrations of the sound-board to the molecules within its substance which can not act on the outside air at all to produce waves of any kind!

He thus not only contradicts his own book and all other authorities, that the vibrations of the sound-board are superficial, segmental and bodily, like those of the string, but he comes squarely over to Substantialism by teaching that the greater volume of sound heard from the sound board when the stem of the tuning-fork touches it, is owing to the peculiar molecular structure of the board under the regnant force of cohesion, thus desperately abandoning all claim to the superficial or segmental air-waves heretofore claimed by the theory! A more signal and triumphant overturn of the wave-theory it is impossible to ask or imagine than that here furnished by Sedley Taylor himself.

Further, the very admission in his letter, as quoted above, that the wooden sound-board is "much more *compressible* than iron," is another reckless effort to destroy his own theory, since

being more easily compressed, it must, as we have shown, yield to the stem of the fork and not vibrate or tremble segmentally in response thereto as will the more *incompressible* iron, and therefore will not produce or send off the air-waves of greater amplitude as absolutely required by the theory! We have always insisted that the wave-theory is so inherently incongruous and self-destructive that, give its advocates rope enough, and they will hang themselves in any critical argument they may undertake.

Now remember, in recapitulating the point established, as Sedley Taylor is forced to admit that the *softer* or more *compressible* wooden sound-board sends off a many-times greater volume of sound than the iron one, and with only "*molecular* vibrations" which can not act upon the outside air as will the "*segmental* vibrations" of the iron, we submit that the greater volume of sound produced by the sound-board of a musical instrument *is not caused by air-waves at all, and consequently that Sedley Taylor, by his attempt to answer our argument, has tacitly and unwittingly broken down his theory.* Should not this be sufficient to settle the matter, at least at Trinity College?

But the foregoing is not by any means the worst dilemma into which Mr. Taylor has precipitated his theory in his frantic attempts to escape from our locust argument. We shall soon see the most lamentable and humiliating predicament of all.

It will be remembered, by reference to our December article, that we took occasion to contrast the powerful vibrations of the tuning-fork, producing almost no audible sound, with the almost imperceptible vibrations of the locust producing 80,000,000 times as much sound, thereby proving by the most conclusive argument ever known to science that the mechanical disturbance of the air by the sounding instrument had nothing to do with the sound it emits. In that connection we referred to the pitch-pipe through which a current of air is blown and which produces a loud sound with a very slight vibration of its reed.

We asked Mr. Taylor where was the "large surface" in this little insect by which its "segmental vibrations" produced this mighty cyclone of "condensations and rarefactions" to fill four cubic miles of air; and why the air-particles did not "slip off laterally" from its little body, refusing to be condensed, as he claimed was the case with the tuning-fork as the cause of its trifling sound? What does he say, after due deliberation, in reply to this crushing inquiry? Here it is:

"You are considerate enough to 'give me' what you regard as an 'easier case' of the same problem, in the notes of a very small locust common in America which can be heard a mile or a mile and a half off. Assuming that its vocal apparatus is in principle a *reed* kept in motion by an air-column, the solution of this case is included in that of the pitch-pipe!"

Well, advocates of Substantialism ought now to give it up! But if the locust has a "reed" in its little body, which the closest examination under a microscope after dissection fails to discover, will Sedley Taylor kindly suggest whence comes the current of air that must be blown through this insect to keep its "reed" in vibration for a full minute at a time, producing a vastly louder sound than that of any reed ever blown by a bellows? Surely wave-theorists must be at the end of their tether when driven into a corner like this. Positively Sedley Taylor must have known that this reed explanation was simply ridiculous.

Since the foregoing was written we have received a letter of correction from Mr. Taylor taking back what he said about the *reed* and the *air-current* by which our locust keeps up its sound so destructive to the wave-theory. As it is but fair, we give this letter verbatim as follows:

To the Editor of the "MICROCOSM":

Sir,—I find that in my letter to you of January 14th I was wrong in supposing that the vocal apparatus of a locust may be regarded as, in principle, a reed kept in motion by an air-column. Darwin's account of the matter ("Descent of Man," Vol. I., p. 352) is that the insect's left wing, which carries a finely serrated nervure, acts, like the bow of a fiddle, on the nervures of the right wing, which acts as the fiddle itself. In Hermann's "*Handbuch der Physiologie der Bewegungsapparate*," Leipzig, 1879, pp. 150, 151, it is further stated that the back of the locust's body ("hinterleib"), being entirely empty and consisting of an elastic skinlike covering ("Chitin"), *is an excellent resonator.* This flatly contradicts your statement that the locust's body *does not serve as a sound-board* ("MICROCOSM," December, 1890, p. 2), and assigns a good reason why its note, like that of a string bowed *on a hollow violin*, should be relatively strong, rather than, like that of an isolated tuning-fork, relatively weak. I am, sir, your obedient servant,

Sedley Taylor.

Trinity College, Cambridge, England, Feb. 10, 1891.

Possibly after a little more reflection on the subject of our locust Mr. Taylor will conclude to write us another letter of correction giving it up altogether and acknowledging that this terrible insect has succeeded in killing the wave-theory. We trust for the sake of his own present and posthumous reputation as an investigator of physical science he will do this rather than resort to such unmitigated nonsense as that set forth in this letter. Let us analyze it for a few moments.

At the time we wrote the "Problem of Human Life," thirteen years ago, we had never seen one of these locusts, and taking Mr. Darwin as good authority, we gave his view of the method by which this locust produces its sound as an entomological fact. Since then we have examined thousands of these insects, and have heard them sing while standing within a foot or so of where they were sitting. And to our surprise we found that Darwin's statement was pure fiction from beginning to end, and have so stated in previous volumes of the MICROCOSM.

The sound, as a matter of fact, is produced without the slightest movement of a wing or leg,—a mere tremor of the body alone being all that is observed. In fact, we have removed both wings and legs and the locust will still keep up its sound nearly as loud as before!

Another desperate effort of Mr. Taylor to save the wave-theory from the destructive effects of our locust is to make the body of this insect a "sound board" or resonant case acting as an "excellent resonator!" Unfortunately for the wave-theory, we have forestalled this shallow quibble, as appears in a previous volume of the MICROCOSM, by holding the stem of a delicate tuning-fork when sounding against all parts of the body of this locust both while it was alive and after it was dead, and not the slightest augmentation of the sound of the fork was thereby produced!

Yet according to this dying spasm of the wave-theory one wing is used as the "bow" and the other as the "fiddle itself," yet both wings are *exactly alike!* Was ever such a bow and fiddle before heard of?

The truth is, Sedley Taylor finds himself in a hole, and is trying to pull the hole in after

him. We are in all sincerity sorry for him, but can only help him by advising, without the loss of another month's time, that he announce publicly through the columns of the *Musical Opinion, Musical Standard* or some other musical journal of London, that the wave-theory is dead and is now only awaiting a decent burial; or perhaps cremation would be the appropriate ceremony. Let him do this and he will augment the respect of both his contemporaries and coming generations.

P. S.—This is the first case since the wave-theory was originally attacked in the "Problem of Human Life" where any author of a text-book on acoustics could be induced to step into the scientific arena and squarely measure lances with the arguments of Substantialism. This is the desideratum we have long desired, and have used all our diplomacy to bring about. Here we have it at last, and the reader sees the result.

THE ANNULAR THEORY.

No. 14.

BY PROF. I. N. VAIL.

In my last paper I dwelt chiefly on the primitive idea of a great "world tree" to be found in the mythology of all races, and showed how this overshadowing tree arose from the horizon of the world as the branchiform "world-stem" known to mythologists. I might continue the evidence of the primitive thought to great length, but it is not my design to present an exhaustive discourse thereon at this time. I have referred to the Babylonish name of the Euphrates and its intimate association with ophiolatry. In some ancient traditions, as is well known to the Eastern scholar, the Prath or Euphrates is made identical with the mythic *Nilus* which had its "head and source in the lofty heaven," and in both the Homeric and Hesiodic poems is called the "okeanos" that "encircled the earth," and which ancient man was taught to believe was the grand "source of all waters and rivers and streams." Again and again it is called, in the oldest legends, the "fountain of the okeanos," or great deep, the *birth place of Pegasus*, the "*flying steed of heaven.*"

All of these allusions, and multitudes of others I might relate, show most emphatically that ancient Prath was a great celestial river that encompassed the earth as one of the great branches of the river that went out of Eden to water the whole earth, and of which the Mesopotamian Euphrates is but a *memorial.*

But, as I have said, it was originally called the "Serpent God of the Tree of Life," as shown by Assyrian tablets. Now, this very designation locates it inevitably in the upper deep, as I will now proceed to show.

It would seem scarcely necessary for me to make the assertion to my readers that angels were, and have been in all time, looked upon as *celestial* beings, and yet when we read in the Apocalypæ of the "four angels bound in the *Great River* Euphrates," it does seem needful for me to point out that we have here a survival of annular ideas—a quotation from annular times under the ministration of these celestial *river spirits*, one-third of the whole earth and one-third of the race of men were affected, which no river but a celestial one could do.

Again, it was the river through which, according to Accadian and Egyptian myths, the dead had to pass on their way to Heaven.

In short, all mankind believed the dead had to cross *the River* from Time to Eternity, and the sun, or the moon, or some other *celestial being* was believed to receive them upon their arrival in the unseen world. I say, then, the idea of celestial rivers was a natural, perhaps a universal one, and could scarcely have obtained if celestial rivers were not at one time the gazing stock of the whole earth.

Now it is well known among Oriental scholars that the serpent was universally the symbol or emblem of flowing waters. In oldest graphics, as in Egypt and Assyria, the wavy form of the serpent was the hieroglyphic for water. And almost all the ancient writers, from Homer down, make it a universal practice to speak of the river-spirit, or fountain-spirit, as a *serpent* or *dragon.* Now, the physical tree of life was that world-tree that *gave life to the earth!* But no physical tree could possibly give life, except that *environment tree* that spread its sky-filling branches over the earth, and made it an Eden world and filled it with exuberant life, prolonged the life of the plant, and insured man a longevity of 800 or 900 years. Now, where was the "serpent-god" of this life-giving environment-tree? The tree being on high, its custodian spirit, the serpent, was there too! This tree was the same tree, renowned in mythology, as "bearing the golden apples" (the stars), and "guarded by the huge serpent which Hercules slew in order to bring those apples into view.

The moment we attempt to explain this serpent deity as guarding any other kind of a tree, we come squarely in opposition to nature.

The annular bands were known to be watery, and their designating hieroglyphic was the serpent. Again, an annular band or streamer had the *form* of a serpent, even if it were not known to be water. The two ends of a band, if I may be allowed the expression, in the horizon, east and west, were vastly farther from the eye of the observer than that part immediately overhead, consequently it was large in the zenith and tapering, serpent-like, toward the horizon, and being in constant motion around the earth, I can no longer marvel at the expression met with in the world legends, such as the "world-enfolding serpent," the "serpent that coils nine times around Parnassus," "the serpent-god of the tree of life," etc., etc. Let us for a moment turn our attention to Icelandic or Norsic annals, which above all others have maintained their original purity. Here we find the great "world-serpent," and the "great world-tree," and that, too, so inseparably interwoven with annular testimony that it is impossible to find one ray of light in the solution of the problem without annular aid. The most conspicuous feature in all Scandinavian literature is the world-tree.

Ygdrassil, that "sends its roots down into the underworld and its branches all over the heavens." There, too, the "world enclosing snake," the "Mid-gard serpent" arches the home of the gods, and the "Nidhug serpent" nestles at the base of the tree.

In whatever field of ancient thought my researches have taken me, I find this one all pervading memorial: The life prolonging tree, with its serpent custodian. Connected too, with this thought, is that other annular survival, the serpent that was originally a

beneficent guardian-deity, and *protecting spirit,* finally became the genius of evil and the source of all earth's ills. The investigator will inevitably find this to be the case. All through the writings of Virgil, Obid and their compeers, the serpent or dragon is the genius of the *altus,* or high sea, and the question is in order, how did the term high sea originate among those ancient people, if there was not an actual sea on high? Among these ancient Latins too, the beneficent serpent became the source and agent of evil, so also among the Greeks and the old Iranian races. India too, had her primeval earth and its inhabitants under the protection of the great many-headed serpent that floated on the celestial deep, and which finally crushed the earth in its giant folds.

Euripides tells us plainly the "brazen backed serpent" guarded the "sacred tree" by "winding his folds around the *inaccessible circle.*" What inaccessible circle, except the unapproachable arches of heaven? He also tells us that Hercules killed this serpent by "penetrating the recesses of the Okeanos, under the central seat of Heaven." The same writer tells us that "the caves of the serpent were the celestial *heights* and *observatories* of the Gods." I need not push this thought further, though I could fill a volume to prove, from many sources, that in remote antiguity the serpent was the one great central object of the world's adoration, and this, simply because it was regarded *as the spirit or genius of the world enshrouding vapors.* And that genius, so long as it was a protecting canopy, was *worshiped* as the guardian deity of the known universe, the spirit of the life-imparting tree. It is not needful for me to point out how this protecting canopy, in the deified personation of the serpent became the agent of evil; the ravager and destroyer of mankind; for, I say the unimpeachable testimony of a world of immortal witnesses proclaim that such was the case. First, a beneficent god, worshiped all over the earth, as the serpent images found in every continent in almost every land abundantly prove, demands this great *universal cause,* and the serpent vapors seen by every tongue and tribe under heaven could alone supply this cause. Second, the transformation from the beneficent to the evil agency, demands a removal of this cause. Now the cause was removed, and that too, as I have abundantly shown, at the very time the conquering *sun* began his march to victory, in the Eden world.

Now as dovetailing testimony, sun-worship should be found to have planted itself on the ruins of serpent-worship; for, the advent of the *sun* simply and inevitably *banished the serpent.* Well, what are the facts? Witnesses rescued from the dust, crowd to answer, and the response comes from the whole circuit of the earth:

Heliolatry was planted on the ashes of Ophiolatry!

A transition, I say, that can receive no satisfactory explanation outside of the final disappearance of the serpent canopy, and the universal conquest of the solar orb.

As a simple example of the testimony given by the cold but eloquent monuments of the earth, I will close this article with a voice from Egypt.

Typhan was the name of the good and protecting genius of ancient Egyptian thought. He was worshiped as a god, and for many apparent centuries the praises of priests and sacrifices and eulogies of Kings were centered upon that deity. For a long time previous to the time of the 18th dynasty, the monuments were profusely dedicated to that god, and his hieroglyphic made a conspicuous feature thereon. Immediately subsequent to that time he began to lose prestige, and it was not long till he was no longer emblazoned on monument or temple, and in many places, says Rawlinson, his very name was mutilated or erased, and Osiris and Horus and Ra, all solar deities, submitted in his place. In connection with this and dovetailing, felicitously with this account, Egyptian history declares that the sun existed before the heavens were formed, which can only mean that the sun becomes visible as the *annular heavens passed away.* Again, it has long been to Egyptologists a most puzzling difficulty to account for the well-known fact that the sun was long worshiped as a "*concealed* god." Amon Ra means the "concealed sun." And now if it can be shown that Typhan was a serpent, this dovetailing of facts would seem to be sufficiently complete to excuse this digression from the Eden narrative in order to throw more light upon it. I will attend to this feature in my next.

Elsinore, San Diego Co., Cal.

ONE OF PROF. TYNDALL'S EXPERIMENTS EXAMINED.

BY PROF. ALONZO HALL.

Professor Tyndall in his third lecture on sound has recourse to a beautiful experiment, intended to render visible to his audience the nodes and ventral segments into which a string divides itself when made to respond to a musical tone.

He used a fine platinum wire heated to redness by means of an electric current. The wire was stretched from the prong of a tuning-fork and over a bridge of copper to a peg by which to change its tension. The copper bridge and the fork were the poles of a voltaic battery, which placed the wire within the circuit and would be heated to a redness when the current was sufficiently strong.

The experiment began when the wire showed a bright red heat. I can do no better than to quote the professor's words describing the experiment: "I draw my bow across the fork; the wire vibrates as a whole; its two ends are brilliant, while the middle is dark, being chilled by its rapid passage through the air." [It might be well to remind Mr. Sedley Taylor *et. al.* in England that the word "rapid" just quoted does not mean "*slow,*" neither does it mean "frequent."] "Thus you have a shading off of incandescence from the ends to the center of the wire. I relax the tension, the wire divides itself into two ventral segments, I relax still further and now you have the wire divided into four ventral segments separated by these three brilliant nodes."—"Lectures on Sound," p. 110.

Here we have involved in one experiment four different so-called modes of motion, namely, electricity, heat, light and sound.

The professor finds it very necessary to explain *why* the temperature of the ventral segments is lowered and that of the nodes raised "almost to fusion."

I accept his statement that the wire will

separate itself into ventral segments and nodes, but I am not satisfied with his explanation of the incidental phenomenon of the nodes nearly melting, and the vibrating segments cooling off from the red heat to a lower temperature.

He says on the same page: "You notice also when the wire settles into a steady vibration, that the *nodes* shine out with greater brilliancy than did the wire before the vibrations commenced. The reason is this, electricity passes more freely along a cold wire than along a hot one. When, therefore, the vibrating segments are chilled by their *swift* passage through the air, their conductivity is improved, more electricity passing through the vibrating than through the motionless wire and hence the augmented glow of the nodes. If, previous to the agitation of the fork, the wire be at a bright red heat, when it vibrates its nodes are raised to the temperature of fusion."

Professor Tyndall may actually have done what he describes so graphically, but I am sure he would not jeopardize his reputation as an investigator of physical phenomena by repeating the experiment described, to be followed by such an explanation as, "Electricity passes more freely along a *cold* substance than along a hot one."

It is admitted by electricians generally that the most pronounced non-conductors of electricity, such as glass, the gases, magnesia, etc., are converted into good conductors by means of heat. Glass for instance, when heated to a cherry red, allows the electric current to pass very freely.

The question thus arises, if the phenomenon really occurred in the course of the professor's experiment, can physicists of the mode-of-motion school explain it satisfactorily? Even granting that the rapid motion of the ventral segments through the air cooled those parts of the wire, there can still be no scientific reason —from their point of view—why the nodes or motionless parts of the wire should show an augmented glow above the normal red heat of the wire when it is not in motion.

I will offer an explanation from a Substantialist's point of view, though I should much prefer to have the experiment repeated, and be assured that the "nodes" do show augmented heat "almost to fusion."

Heat *is* a substance, though not material, and when another immaterial substance, electricity, is forced through the fine platinum wire, the friction evolves heat sufficient to raise the temperature of the wire to a red heat.

If the current from the battery is constant, then the *red heat only* is the effect of the current's passage, and the changes of temperature in the nodes and the vibrating segments have nothing to do with the constant current from the battery, but depend wholly on the mechanical effect of the vibration.

When the prong vibrates in such a way as to cause the wire to arrange itself into nodes and ventral segments, there is no greater degree of heat evolved in the wire than before the fork was agitated. That is to say, the algebraic sum of the degrees of heat in the whole length of the still wire, when only showing a red heat, is equal to the algebraic sum of the degrees of heat in both nodes and ventral segments of the same wire when vibrating. The heat that was apparent in the part of the wire that becomes the vibrating segment has simply not moved with the segment, but is *crowded* back into the neighboring nodes, which heat, in addition to the red heat already present, augments the glow of the nodes probably "almost to fusion."

If Professor Tyndall's explanation of the phenomenon, namely, that "the ventral segments are cooled by their swift passage through the air," should still be regarded as correct, it increases the difficulties for the wave-theorists. For instance, the ventral segments must now, when cooled, be considered as poorer conductors than when hot; the nodes should retain their normal conductivity unimpaired, and the result should be that the electric current should—by the changed condition of the ventral segment—heat it to a greater degree than is observed. In fact, no explanation based on improved or impaired conductivity of the wire can account for the fusion of the nodes and cooling of the ventral segments.

In assuming that heat can be driven from one part of a substance to another part of it, I am reminded of the manner in which the tinsmith re-heats the point of the soldering copper without returning it to the fire-pot. When the solder ceases to flow along the seam, he knows the copper has *cooled*. He raises it to a vertical position, point up, for a few seconds, and resumes his work, when the solder flows as freely as before. The point of the copper seems really hotter than at first. The heat from the body of the copper passed to the point, and I imagine that, if it could be dropped from a great height, the heat would lag behind and be all crowded into the upper end, and instead of the normal temperature at the beginning of the fall the point would be as many degrees hotter as the lower end is colder.

If a red-hot conical shell be fired from a cannon, no doubt the whole surface of the ball when it leaves the gun is of equal temperature; but after the shot has traveled a thousand yards, will the forward part of the shot still have a red heat? I am sure it will have cooled perceptibly, but not, as Tyndall would say, by reason of its rapid passage through the air. Again, after the shot has traveled the thousand yards, will the temperature of the rear part of the shot be the same as when it left the gun? I am as sure that it will be very much hotter, because the heat from the forward part falls back to the rear part, and, if the speed is great enough, the temperature might become incandescent, though the algebraic sum of the degrees of heat in the whole of the shot will not appreciably have changed save a slight increase by atmospheric friction. A meteor in its wild dash through our atmosphere is heated to fusion. The heat is probably generated in the forward part, where it comes in contact with the air, and as fast as it is generated it falls to the rear and accumulates in such intensity that the meteor begins to melt *from the rear*, leaving a trail of incandescent sparks, and finally is consumed by this accumulation of heat.

THE LIVE FROG PROBLEM ONCE MORE.

A Toad in Solid Rock—And Frog in Solid Wood.

BY REV. JOHN MCCONNELL.

On page 76, Vol. VI., of the MICROCOSM, Wm. Cairne states, under the sweeping caption, "The live frog question settled. The whole mystery knocked out," that he knows that all the live toads and frogs ever found in rocks, etc., were exhumed from material so

soft that a "toad could dig him a nest into it over Sunday—that none have ever been found in original ledges of solid rock," etc.

Near West Lebanon, Armstrong Co., Pa., a stone was taken from a sandstone rock, about eight or ten feet from all parts of the outside of the rock. I did not see the rock myself, but the men quarrying the stone said that there was no split or crevice from the top or the side of the rock to the place where the stone was blasted off. The stone I, myself, saw. It was about five feet long and eighteen inches square. This stone the masons split lengthwise in two halves, after it had been brought to the place of building. When the two halves fell apart there was found about eighteen inches from the one end and not quite in the center of the breadth of the stone a live toad. The sun was very hot. The toad hopped about for some time, and in about one hour died. I examined the stone and could find no difference in solidity at any point. The masons did the same with hammer and chisel, with like result.

Did that toad work its way for nine inches through solid rock, dig a hole seven inches long and over two in diameter, and fill up its passageway as solidly as any other part of the rock whilst the workmen were resting over Sunday?

In York County, Pa., I saw a chestnut log 11½ feet long, two feet in diameter. The tree had been felled several days. The log was sawed off at both ends before dinner, and split open an hour later. The log was without crack, split or crevice. In the heart, four feet from one end, we found a live frog. Did that frog work its way from the end of the log and then turn round and fill its passageway with chestnut wood so solidly that no difference could be detected, during the time we were away for dinner? Or, did it work its way for twelve inches from the side of the log, then fix up the hole—wood, bark and all—so cunningly as to leave no trace of its skill behind? Is the question settled—the whole mystery knocked out?!

Salina, Pa.

EDITORIAL REMARKS.

If the facts here given be authentic, which we have no right to doubt, then the solution of the problem by Mr. Cairne, as referred to by Mr. McConnell, must be abandoned as inadequate. The facts here given surely again opens this question so full of profound mystery and so fruitful of scientific research. If an animal can live thus confined in solid rock, shut out from all air or moisture for ages, as must have been the case since that sandstone settled and solidified from its plastic condition, then vital force must be something vastly more enduring than hitherto conceived of by scientific men. The question is still open to our readers for new facts and new light bearing thereon.

A GOOD SUGGESTION.

At a hint by Rev. Father P. F. Karel, a Catholic priest of Peekskill, N. Y., and, by the way, a good friend of the cause of Substantialism, we commence with this number giving a monthly table of contents at the bottom of the last page. Thanks for the suggestion.

THOMAS CHATER ON THE WAVE-THEORY.

By reference to our second reply to Sedley Taylor in this number it will be seen that our December argument based on a comparison of the effects of a *wood* and of an *iron* sound board for augmenting the tone of strings, tuning forks, etc., has struck the wave-theory of sound in its very vitals. Not only does Sedley Taylor recognize this fact by his desperate effort to escape it, but Mr. Thomas Chater, a most critical acoustical expert of London, also feels that our novel argument has made the case absolutely desperate against the wave-theory, as he shows by an original explanation in the *Musical Opinion* of the action of the sound-board in augmenting tone. Mr. Chater evidently saw that the game was up with wave-theorists unless the effects of our comparison could be wiped out. Hence his novel "explanation." Next month we shall wipe out Mr. Chater, even worse than in the case of Mr. Taylor, as seen, page 73, which we commend to every reader who still thinks the wave-theory tenable.

A FIRST-CLASS SUBSCRIPTION AGENCY.

Persons wishing to subscribe for any publication in this country or elsewhere, or purchase any book in print, can save money, as well as receive prompt attention, by sending to the Knickerbocker Subscription Agency, 132 Nassau Street, New York, for one of their universal catalogues, which will be sent free.

EDITOR.

DR. AUDSLEY'S NEW LECTURE.

Last month we announced that we would begin publishing a new lecture by Dr. Audsley, read by him before a Musical Society of London. The first installment of this lecture is in type, but at the last moment was crowded over to the May number by the length of our second reply to Sedley Taylor, which could not be delayed. Dr. Audsley's lectures are staple articles, and will be permanent reading matter however long delayed. The first part will positively appear next month.

EXPLANATION OF MUSICAL "BEATS."

Next month, in our leading article, we will give an explanation of musical "beats," one of the most difficult and mysterious problems met with in acoustical science. No explanation whatever, as we will show, can be furnished by the wave-theory, while all difficulty disappears in the light of Substantialism.

A SUGGESTIVE FACT.

(From the Norristown, Pa., Review.)

"During the past year the drug business of the United States has fallen off $980,000, or about 25 per cent., largely due, as believed, to the quite general adoption of the method of treating diseased conditions without medicine, first discovered and published by the distinguished scientist, Dr. Wilford Hall, editor of the MICROCOSM, who, on request by postal card to 23 Park Row, New York, will send free information concerning this remedy."

GREAT DEMAND FOR THE HEALTH-PAMPHLET STILL CONTINUES.

We give herewith another drop from the thousands of volunteer testimonials received at this office. Those desiring to see scores of similar indorsements should send at once for our "March Extra," and receive a copy free. It is full of interesting matters bearing on this subject.

Dr. James Robertson, of Birmingham, England, repeats his former endorsement as follows, Feb. 14th:

"Dear Dr. Hall,—It will be but justice to you and may save me answering many private letters of inquiry if I now give you my rather extensive twelve months' experience of your new treatment. As I at first recognised, the general idea is a brilliant one, physiologically sound, and I now add—all criticism notwithstanding—so far as I can see it is thoroughly original. In practice, when intelligently carried out, it meets directly the immediate wants of a large majority of the ailing and suffering public; it sharpens the appetite, stimulates the liver, lightens the labor of the kidneys, moves the bowels, or rather moves them to move; by so doing it strengthens the back, clears the brain, gives spring to body and mind, chases away bilious melancholy with its legion of neuralgias, spasms and pains, and comes altogether as 'a boon and a blessing to men'—which, unfortunately for themselves, most of them are not able to appreciate. Personally I have benefited much by it, and when I find a patient with sense to use it thoroughly, I can dispense with medicine and attend to hygiene, the true province of the doctor. I can not withhold my testimony in favor of what I know to be simple, natural and good, a powerful defense to the healthy, and the best remedial process I know of, even in cases of serious organic disease. You may challenge the world, medical or general, to name a process of such widely applicable remedial power. Faithfully yours, James Robertson."

The Washington Life Insurance Co., of New York, 21 Cortlandt Street, New York, March 9, 1891:

"Dear Dr. Hall,—All my life I have been troubled with catarrh, which finally developed into chronic bronchitis. This caused me a vast amount of pain and annoyance and was complicated with dyspepsia, constipation, severe pains in the bowels and sleeplessness. Frequently I passed the night hawking and bringing up a thick, hard, stringy and tenacious substance which caused constant pain in the region of my heart and chest. This invariably occurred after a cold and medicines gave little or no relief. All of my connections on the maternal side died of consumption or bronchial affections, and I was convinced that my complaint would eventually develop into consumption. Indeed, I was on the point of submitting myself to the Koch treatment when, by accident, I heard of the Health Process, without medicine, through a friend, a physician. I was very skeptical but finally, after much hesitation and with great reluctance, I began the very simple treatment. To my astonishment and gratification I experienced instant relief, and I now know that I am on the direct road to recovered health. The distressing symptoms have disappeared and I am rapidly gaining in strength and weight. I now feel sure of a good night's rest and can go anywhere and be free from insomnia; and this without the use of drugs or medicines. I am now forty-seven years of age and I confidently expect, barring accidents, to reach old age. I write this as an expression of gratitude to you and from a desire to assist in your efforts to rescue others who, as in my case, see no end to their sufferings but death in the near future.

"Yours to command, J. Henry Small,
"General Agent, Washington Life Ins. Co."

National Accident Society, 280 Broadway, New York, March 11, 1891:

"Dear Dr. Hall,—I desire to bear testimony to the curative powers of your hygienic treatment and to aid you in spreading the tidings of your discovery to the uttermost ends of the earth. I am fifty-two years of age and always enjoyed good health until six years ago when I had serious trouble with my bowels. Diarrhœa set in and I suffered the greatest torment, having four to seven movements daily with watery and bilious discharges. No kind of food agreed with me and I really did not know what to eat. I consulted many physicians and tried about every known remedy without avail. My weight declined from 190 to 150 pounds. I could not sleep and was in such a state of discomfort and weariness that I began to give way to despair. In September, 1890, I had almost concluded to abandon my business and go to Bermuda in the hope that rest and a genial climate might recuperate me, when Mr. John W. Harman, president of this company, advised me to try your treatment. After the first application I had a good night's rest and within a week I felt like a new man. In two weeks my diarrhœa had entirely ceased and my bowels were comfortable. I am now perfectly well and, indeed, have never felt better and I weigh 170 pounds. I recognize the fact that you have made a great and original discovery. I want the community to know of it, and, in view of the fact that the idea is not patentable and that your charge is almost nominal, I think that you are justly entitled to every dollar you can make out of it. Yours very truly, Jos. I. Barnum, Sec'y."

Office of Ross & Keany, Wholesale Liquor Dealers, 64 and 66 Water Street, New York, March 14, 1891:

"Dear Dr. Hall,—For over a year I was the most miserable of men. In addition to malaria I was troubled with nervous dyspepsia. Everything disagreed with me. I passed many sleepless nights and became cranky and ugly. I believed that I had but a short time to live. I consulted several of our best physicians and spent large sums in medicines and in sojourning at mineral springs, but finally returned home utterly discouraged. Our mutual friend, A. J. Wolf, induced me to spend $4 for your Health-Pamphlet, which is the best investment I ever made. Since I began the treatment I have not had a chill or a fever. I eat anything, sleep well, and weigh some twelve pounds more than I did five months ago. I know you have many friends who, like myself, have been rescued from an early grave, and who, I am sure, will unite with me in testifying that you have discovered the true secret of health and longevity. Indeed, I regard your treatment as particularly valuable for the maintenance of health, and it should be used in every family in the land.

"Yours very respectfully, Wm. F. Hull."

W. D. Pollard, of Saratoga, Cal., writes:

"Dear Dr. Hall,—I was among the first to purchase your Health-Pamphlet two years ago. Prior to that time I had been an invalid for four years, and had been given up to die many times. My sainted wife carried me from one climate to another for the purpose of finding relief, but none appeared; and I had arrived at that stage where I was anxious to die. In this condition I purchased your pamphlet, and have used it regularly since with the surprising result that I have just been examined for life insurance in the Mutual Life of N. Y., and have passed as a 'gilt-edged' risk; not one objection was filed against me. This is to me marvellous.

"Sincerely yours, W. D. Pollard."

The Rochester Lamp Company, 37 Barclay Street, New York, March 6, 1891:

"Dear Dr. Hall,—Ever since I heard of your hygienic treatment I have relied upon it entirely for reducing weight while training for the many glove contests in which I have been victorious. Formerly I pursued the old-fashioned method of sweating and purgative medicines, but I found that they always left a feeling of weakness behind them. Since I have used the Health Process I find that when I face an opponent I retain all of my natural vigor and am in the best possible condition of wind and endurance. Moreover, after the termination of a severe bout I rarely have any feeling of exhaustion, and my recuperative powers have undoubtedly improved. When I resumed my ordinary diet after my latest contest in February, 1891, I gained seven pounds' weight in two days. I confidently recommend your treatment to all well persons, and especially to those who engage in athletic exercises for health, sport or money, as absolutely the safest and best method in the world to prepare for the most arduous performances or contests.

"Yours very truly, John J. Skelly,
"Ex-Champion Amateur Featherweight of America."

☞ In writing to any of the foregoing don't forget to inclose a stamped and addressed envelope, in order to insure an answer.

CONTENTS OF APRIL NUMBER.

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The Microcosm

A MONTHLY JOURNAL OF SUBSTANTIALISM AND COLLATERAL DISCUSSIONS.
THE ORGAN OF THE SUBSTANTIAL PHILOSOPHY.
A. WILFORD HALL, Ph. D., LL. D., Editor and Proprietor.
(Author of the "Problem of Human Life," "Universalism Against Itself," Editor of the *Scientific Arena*, &c., &c.)
ROBERT ROGERS, S. L. A., Associate Editor.
Address all communications to A. WILFORD HALL, 23 Park Row, New York.

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EXPLANATION OF MUSICAL "BEATS."—A NUMBER OF IMPORTANT SCIENTIFIC PREDICTIONS.

BY THE EDITOR.

Among the acoustical phenomena which wave-theorists claim as supporting their views, and which, up to the present time, have not been satisfactorily explained in accordance with the teachings of Substantialism, are the "beats" or partial cessations of tone which occur when two very nearly unison strings, reeds, or tuning-forks are sounded together.

This phenomenon is quite familiar to the piano tuner, and is his principal guide to accuracy in his art, though it by no means follows that he knows the real or approximate nature of the phenomenon he so constantly observes. Let us first explain what a musical "beat" consists of before entering into a detailed explanation of the real cause underlying it.

Take two tuning-forks each, say, of 100 vibrations in a second and consequently in perfect unison, mounted on their resonant cases. If both forks are bowed and set into vibration a deep, smooth and rich tone will fill the room. But if the prong of one of the forks shall be weighted with a small bit of wax so as to reduce its vibrations to 99 in a second, it will be observed that a sensible alternate swelling and weakening of the tone like a throb will occur once in each second.

This change from the unison effect takes place at the instant the two forks break past or cross their opposite phases of swing. It is plain, since one fork makes one complete swing in a second more than the other, that a point must be reached once each second when these vibrations will change phases or cross each other's directions, and at that instant, for some reason soon to be explained, the sounds of the two forks obscure each other producing a momentary weakness of tone bordering on silence. Is this *sound-interference* as taught by the wave-theory? Let us see.

The current theory of sound teaches that this partial silence which occurs in "beats" results from the momentary interference of the air-waves sent off from the two forks, and that at the instant of the phase of opposition between them the atmospheric "condensations" from one fork fall into the "rarefactions" from the other fork, and thus the two systems of air-waves like unto similar systems of water-waves must neutralize each other, thereby producing quiescence of the air which, of course, according to the wave-theory, constitutes silence.

Now we undertake to say that there is not a word of truth or scientific reason in the explanation as here given by the wave-theory, but on the contrary, as we will immediately demonstrate, air-waves have nothing whatever to do with this problem.

We undertake further to show that this phenomenon of "beats" is alone explicable on the principle that sound is a substantial form of force somewhat analogous to that of electricity, and that by the theory of substantial sound-pulses alone can any sort of rational explanation of the problem be made. We therefore beg of the reader to suppress his prejudices on this question if he have any, and for a calm half-hour listen judicially to the scientific evidence bearing on the subject.

In previous volumes of this journal, we have attempted to give a solution of "beats," but for want of time for due reflection we have not been as clear or explicit as desirable. We shall now try to elaborate the matter more fully, and thereby give abundant proofs of our position.

In the first place, as we have repeatedly shown, mere air-waves, supposed to be sent off from a bowed tuning-fork, can produce no effect whatever upon the prongs of another fork, even in the most perfect unison, in order to throw them into sympathetic vibration and thus to cause a responsive tone. This is proven most clearly by the fact that a fork so large and vibrating so infrequently as not to produce sensible tone, will produce no motion whatever in

the prongs of a unison fork however near to them, and however vigorously the bowed fork may be caused to vibrate. Dr. Audsley, of London, has challenged all the acousticians of Great Britain to make this simple test as a final settlement of the truth or falsity of the wave-theory of sound, agreeing forever to abide by the result obtained.

Plainly, if it is air-waves and not pulses of sound-force which cause a unison fork to respond, then the air-waves from a fork of eight or ten vibrations a second, and yielding no sensible tone should also start its unison mate into sympathetic vibration, since its theoretic air-waves must be much more powerful. This has to be conceded by candid and competent physicists. As no such effect, however, is produced by a body vibrating too infrequently to produce tone, it follows beyond all controversy that the motion caused in a silent fork by bowing its unison neighbor, is produced by the sympathy naturally existing between the substantial sound-pulses from the bowed fork, as they impinge upon the potential sound-pulses in the silent fork of the same sonorous and vibrational number.

To satisfy the most exacting advocate of the wave-theory that his view of sympathetic vibration is erroneous, let us here give a new and conclusive mechanical reason why air-waves sent off from the bowed fork can not possibly be the cause of starting its silent unison mate into action. And this mechanical reason, as we maintain, no amount of mathematical formula can gainsay or weaken.

Place the broad face of the prongs of the bowed and sounding fork directly toward the *edges* of the prongs of the unbowed fork. It is plain that any air-waves which may be sent off from the actuating fork *will strike both sides of such unbowed prongs simultaneously and with equal force, and thus will tend to move them equally in both directions at the same time.* Of course under such action the prongs of the unbowed fork *must stand still,* since no body can move under the application of equal external force's acting upon it in exactly opposite directions, according to the established laws of motion.

Yet it is a fact that such unbowed unison fork will instantly be awakened into sympathetic vibration, and will sound out the same precisely when the *edges* of its prongs are thus directly toward the actuating fork as when the broad side of one of its prongs is exposed! Let wave-theorists now meet and explain this state of facts by the action of mechanical air-waves, or forever close their mouths and silence their pens.

The same result precisely will occur in the case of a stretched string *with the unison tone directed towards its end and thus acting equally and simultaneously on all sides of it.* To suppose that the sympathetic response of that string is caused by the action of mechanical air-waves, thus impinging upon all sides of it equally and simultaneously, is to fly into the face of every principle known to mechanical law.

This being in accordance with reason and true mechanical science, it must follow as the only explanation of musical beats that the substantial sound-pulses from one fork so act on the potential or latent sound-force in a unison fork as to start it into vibration; then as the phase of opposition which occurs once a second between two bowed forks, is the very reverse of sympathy, such forks must tend at that instant to check or neutralize each other's sound until such phase of opposition is past or until full sympathetic unison is again established.

Plainly, if sympathetic sound-pulses from one fork, without any assistance from air-waves as we have seen, will arouse tone in another fork and start it into motion because of their unison relation, then the absolute opposition to sympathy between two sounding forks, which occurs once a second or at the before-mentioned phase of opposition, must not only tend to neutralize both sounds, *but must tend to bring both forks to quiescence,* though this result is but partially accomplished in consequence of the mechanical momentum of the prongs.

And here we venture a prediction in strict conformity with this reasoning, though we have never tried the experiment, namely, that two forks, one vibration out of unison per second, and producing an audible beat as described, *will not continue to vibrate or sound as long as the same forks when vibrating in perfect unison and equally bowed.* This must follow as a matter of course, according to Substantialism, from the unsympathetic tendency of the phase of opposition to stop the prongs of both forks while neutralizing both of their sounds.

Hence we make another prediction as a corollary of this, and without waiting to try the experiment, namely, that no two unison forks placed on their resonant cases near together, can be so bowed by any number of trials as to cause them to vibrate out of synchronism even to the slightest degree, *because their sonorous sympathy will instantly pull them into a phase of perfect synchronism or the completion of their swings simultaneously, however, the two forks may chance to start in a phase of opposition.*

So potent, as we further predict, will be this sympathetic attraction between the two vibrating unison forks to complete their full,

swings exactly together, and not one of them to lag a little behind the other (which is exactly what constitutes the before-mentioned "phase of opposition") that even if the two forks should be slightly out of unison—say one vibration in ten seconds—this sympathetic attraction would counteract this difference and force them into synchronism, since the more rapidly vibrating fork would be pulled back and slowed up by the other, and *vice versa*.

But remember, that in such case, though the attraction of the two forks would compel them to vibrate synchronously, yet both forks would come to rest much sooner than if in perfect unison and equally bowed, owing solely to their loss of energy by these efforts in modifying each other's motion. This paragraph should be carefully studied.

Now all these predictions can easily be verified or overturned by using two forks of a very low pitch and attaching a small mirror to one prong of each, then directing a separate beam of light against each mirror, to be cast at such an angle upon a screen side by side in a darkened room as to represent the prongs' motions on a large scale. If no effort at bowing the two forks after repeated trials, however they may start, can induce the two beams of light to dance in a phase of opposition, or in the slightest variation from completing their swings synchronously, then sympathetic attraction alone between the two sounding forks will have been demonstrated as the cause of beats by the partial neutralization of each other's energy while in such forced phase of opposition.

Take notice, we do not predict that the two beams of light will travel synchronously in the *same direction*, which is not necessary, but that whichever direction the vibrating beams shall take, they must avoid a phase of opposition and complete their swings simultaneously, the two sounding-forks thus coercing each other into synchronism by the law of sympathy however they may start into vibration.

If any wave-theorist wishes to convict us of error, instead of employing two *sounding* forks, let him take two perfectly unison forks so large as to yield no tone, say ten or twelve vibrations to the second, armed with mirrors as just suggested, and placed on separate supports with nothing connecting them but the air. Now, if the air-pulses sent off from the sounding forks are really what keep up the sympathy and cause the two beams of light to dance in synchronism, as the wave-theory must teach, surely the air-pulses from the large *soundless* forks in equally close proximity should exercise the same sympathy, and coerce the same synchronous dancing of the beams of light in whatever relation these two large forks shall happen to start. Will this be the case?

We here predict that so far from any such result taking place, the two beams of light from the soundless forks will dance either synchronously or in any phase of opposition just as they may happen to start off after bowing, and will so continue without sympathetic change till the forks come to rest, the air-waves having no effect upon their motions.

If this shall really take place with the large soundless forks and with their necessarily more powerful air-waves according to the wave-theory, thus showing no sympathetic action between them; and if our other prediction shall prove true that two unison sounding forks can vibrate only in synchronism because of this sympathy, will it not of necessity break down the wave-theory which teaches that sympathetic vibration produced in an unbowed fork is caused by air-waves alone?

Then suppose, as another test in the same direction, that we prepare two large and *soundless* forks, one of nine and the other of ten vibrations per second, with mirrors as before, and allow a single beam of light to reflect from one fork to the other and thence to the screen, as described by Prof. Tyndall in his illustration of beats, there will of course be represented upon this screen one silent beat per second by an alternate elongation and contraction of the light, and this will continue till the forks come to rest. But will the two beating and soundless forks come to rest through this influence of the claimed air-waves any quicker than if they should vibrate in perfect unison? Our prediction of course is, that no difference whatever will occur in the length of time these silent forks with all their supposed air-waves will vibrate whether in unison or not, while two *sounding* forks similarly tested, as just predicted, will come to rest much quicker, if they are one vibration apart, than if in perfect unison. This, if it shall turn out as we predict, will demonstrate that the sympathy which impedes action in *sounding* forks out of unison, but produces no effect on *soundless* forks in a similar phase of opposition, has nothing whatever to do with air-waves, but depends entirely upon the influence of sound-force as a substantial cause.

One other prediction before we close this paper, based on the philosophical considerations here presented, namely:

Take two unison forks of loud tone in close sympathetic proximity, each so connected with an electric battery as to force their prongs to vibrate, not in synchronism but in a phase of opposition—that is the vibrations of the prongs of one fork slightly to follow those of the other,—and we predict that in such op-

posed relation no sound will be heard, it being the same as the silent part of the "beat." But let the electric current be so changed as to force the prongs into synchronism, and instantly a loud sound will be heard, or in other words, the loud part of the ordinary "beat" will be produced.

If this should prove to be the case, and if our other predictions should prove true that two sounding forks while beating will come to rest much sooner than if sounding in unison in consequence of a sympathetic drag upon each other, while soundless forks with all their air-waves will show no such sympathy, would it not totally destroy the wave-theory claim that musical beats are caused by air-waves in interference; and would it not thereby demonstrate the truth of the substantial theory of sound?

We thus again give what we conceive to be the only possible explanation of the cause of musical "beats," namely, the sympathy exerted by one sounding fork over another slightly out of unison through the action of substantial pulses of sound-force as observed and illustrated in what is called sympathetic vibration.

That sound-force can exert such sympathetic effect upon a unison body or check such sympathy as soon as such body reaches a phase of opposition or ceases to be in a unison condition, is no more incredible or unthinkable than that magnetic force can go out from a steel magnet and exert a sympathetic influence over a metalic body that is potentially in magnetic sympathy with it, but will refuse all sympathy for bodies not in this magnetic relation.

Let wave-theorists explain magnetic sympathy on the theory that magnetism "is but the rotation of the particles of the steel magnet," as taught by Sir William Thomson, ignoring force as a substantial entity, and then tell us how such motion of the steel molecules can lift a distant piece of iron before they pooh-pooh the substantial view of sound-force as here set forth. If motion in the steel particles of the magnet can not explain the lifting of a distant piece of iron in opposition to gravity and exerted through impervious sheets of glass, neither can mere mechanical motion explain the wonders of sympathetic vibration as herein set forth.

Our aim in writing on these subjects as much as we are doing, is to place on record, before we shall depart hence, certain arguments, criticism and predictions, for the benefit of rising substantialists, that might be overlooked should we neglect so to record them while the questions involved are in the freshness of their original discussion.

We feel as if these arguments, placed conspicuously in the columns of the MICROCOSM from month to month for perpetual safe keeping while our mental powers are still active, will be a most important part of the small legacy we hope to bequeath to coming generations. If these discussions shall form the texts for future lectures upon scientific and educational subjects by coming young investigators, possibly long years after the writer of this shall have not even a stone to mark the resting place of his ashes, the only memorial he shall ever covet will be complete.

Next month we shall attempt an explanation of the phenomenon of the rotating tuning-fork in front of the ear with no sound issuing from the corners of the fork. This problem, more than any other, is resorted to by wave-theorists as a proof of the interference of air-waves. In that explanation we shall elaborate the most conclusive argument against this supposed law of sound-wave interference and consequently against the wave-theory itself yet produced.

SUBSTANCE.

BY J. I. SWANDER, PH. D.

What is substance? A proper definition of the term is called for. Etymologically, substance is from "*substantice* or *substare*, to be under or present, from the prefix *sub*, under, and *stare*, to stand, to stand firm. That which underlies all outward manifestations; the permanent subject or cause of phenomena; that which is real indistinction from that which is merely apparent; that which constitutes anything what it is; real or existing essence.

Assuming the correctness of the above definition, taken largely from Webster, let us now proceed to classify and make proper distinctions between the different classes of substances of which the Universe according to sound philosophy consists. In doing so we will see that a proper classification of all substances includes all and only those things which are real and of existing essence. Such natural classification must also so arrange all existing essence as to show that each co-ordinate class is constitutionally divisible into its natural subordinates.

One of the peculiar elements of strength in the system of thought now beginning to be examined by all unprejudiced and earnest minds is its classification of all real existences into substances *immaterial* and *material*. To classify all things into *self-existent* and *created* may do in a treatise on ontology or the science of being in general, but such a distinction has no necessary place at the foundation of a system and method of thought, which has already shown its superiority over all others by stimulating the public mind to seek after a more rational analysis of being, and to find a more satisfactory explanation of its phenomena, than any order of inquiry yet awakened in the bosom of man or pushed forward by the energy of mere human intellect.

It is quite common to classify all existing essences as *infinite* or absolute, and *finite*—that order of entities limited by time and space. This very correct distinction grounds itself in

the nature of things, and as such should be kept clearly and constantly in view in all efforts at correct reasoning concerning the origin, nature and mission of things, but its primary importance is in the sphere of theology, where the most correct of attainable knowledge of the invisible world is received through a supernatual revelation of truth to Christian faith, which is its own evidence of things not seen. In the sphere of philosophy it is different. Here nature is the text-book, and reason the pupil's guide to a knowledge of what is therein revealed. Not that faith may be ignored, for without faith we can have no proper understanding that the worlds were framed by the King invisible, infinite and full of glory. "Theology," according to Plato, "comes within the sphere of philosophy only so far as its facts or doctrines are objects which reason can examine or explain." Finite reason can not explain the facts that lie in the realm of the infinite. Hence, sound philosophy demands and adopts a classification of entities quite different from that which is admitted at the head of this paragraph.

Another distinction sometimes made in thoughtless and unphilosophical attempts to arrange the entities of the universe is that which classifies them as *mind* and *matter*. This is manifestly a use of terms not sufficiently comprehensive to embrace all the real things in the wide realm of being. It certainly requires but little effort on the part of an intelligent and unprejudiced man to see that there are some things which come under the category of neither mind nor matter. The Substantial Philosophy has already shown that while cohesion, gravity, magnetism, electricity, light, heat and sound, are neither mental nor material, they are nevertheless entities and substances in the essential constitution of nature.

We repeat, therefore, that there is one classification which underlies all sound philosophical reasoning. It distinguishes between the things that are *immaterial* and those that are *material*. This distinction grounds itself in the dual constitution of nature, and is in exact accord with the fitness of things. It is therefore essentially necessary that the readers of Nature's book and the diligent searchers after the truths set forth in its pages, be sure that they make this distinction and keep it in prominent view in their constant endeavor to secure for themselves the commanding position from which they may reasonably hope to see the realities and admire the beauties that would otherwise never come within the angle of their vision. The idea of immaterial substance is one not so easily grasped by the mind, and yet the firm grasping and holding of this truth is one of the keys indispensible for the opening of the door to the invisible world of true science, true religion and true blessedness.

Let it also be born constantly in mind that the immaterial and the material forms of substance are radically different in their basic principles, though co-ordinate and mutual in their relation to each other in constituting and perpetuating the economy of the universe. Immaterial entities are just as real as matter, and matter is just as real as substance under any one of its immaterial forms. Neither one is a derivative from nor a mere phenomenon of the other. Substance, whether immaterial or material, may render indispensible service in the grand and multiform display of Nature's numerous phenomena, but it can never be correctly classified as merely phenomenal. Idealists claim that matter has no existence of its own or in itself; materialists claim that all except matter is only phenomenal; Substantialism claims and proves that both idealists and materialists are radically wrong.

This fallacy of materialism is exposed by the Substantial Philosophy, which teaches that there is an invisible world no less real than that differently constituted order of things, of whose existence we have knowledge through the testimony of the senses. Keeping this fact in view we should, however, not forget that the opposite heresy, whether in the form of idealism, spiritualism, nominalism or phenomenalism, is just as far from the wholeness and symmetry of everlasting truth. It is now claimed by some that matter has nothing more than a phenomenal existence; and strange as it may appear, Newton is quoted as good authority for holding that view. Even admitting it to be true as stated by Sir Isaac that all the matter in the universe is compressible into one cubic inch of space, nothing more is thereby conceded than the compressibility of matter. Upon this point there is no dispute. Under the action of immaterial substance or force matter may undergo any one of a dozen changes in its form, but it is always nothing less nor more than matter in its essence. Even as the immaterial or force elements of nature, availing themselves of the opportunities at hand in the presence of matter may, by virtue of the law of correllation, assume different forms and become differently visible in different manifestations while it remains the same as its essence—conserved force—immaterial substance.

One reason why men reject the doctrine of an invisible world in general, is the fact that they have no proper conception of their own souls as microcosms or little worlds as real and substantial as the planet on which they dream. To such the gospel of creation is hid, because the god of materialism has blinded their eyes to the extent that they can see nothing real except that which is ponderable, tangible and divisible into molecules of matter. They claim that these molecules of which their material bodies are composed are in perpetual motion, and that their souls are the resultants of such molecular motion. What superlative sophistry! They deny the principle of propulsion, and yet claim that something is propelled. They profess to think, and yet deny the real existence of the thinker.

Fremont, O.

THE WAVE THEORY OF ACOUSTICS.*

BY GEORGE ASHDOWN AUDSLEY, F.R.I.B.A.

When first I received your kind invitation, through your courteous secretary, to address you on the subject of the New and Old Theories of Sound, I am free to admit my conviction was that it was simply impossible for me to do so on so short a notice. It was, believe me, no disrespect for your very gratifying invitation, no desire to avoid a task requiring considerable time and study, that dictated this conviction; it was simply its apparent impossibility, overworked and pressed on every side as I was by exacting and absorbing literary

* A Paper read before the Members of the South Eastern Section, London, England, November, 1890.

undertakings, and by two papers which I had previously promised to write—one on "The Swell in the Organ," for the College of Organists, on December 2d, and the other my second essay on "What is Sound?" for the Musical Association, in January.

A little consideration, however, decided me to see what midnight oil would do; and I resolved to try my utmost to meet you here this evening, and once more to experience the delight of addressing a distinguished body of practical musicians, which I felt sure would exercise kind patience in all my obvious shortcomings; and whose members would use their own judgments and well-known common sense in the consideration of the relative merits of the two theories of acoustics which it is my present task briefly to analyze and compare. I hardly think any one will, in hot haste, press forward with stereotyped mathematical formulæ and algebraic sums of impossible wave-motions, and posturize, with eyes turned up, in allbut religious horror at the enormity of the sin of one who dares to use common observation and common sense in a scientific matter, and who ventures to call in question the pet doctrines of the wave-theorist, and to smile at the beautiful formulæ on which alone he supports them.

I have been howled at from the mathematical cohorts for thus daring to denounce the undulatory or motion theories of science, and of sound in particular, which have so long been the happy hunting-grounds of mathematical sportsmen; but I have rested my soul in peace. I happily hold the slavish mathematical mind in about the same high esteem as a far abler man than I can ever hope to be felt himself constrained to hold it. Speaking of the "modern manufacturers of mathematical hypotheses," Mattieu Williams remarks—"It matters not to them how 'wild and visionary,' how utterly gratuitous, any assumption may be, it is not unscientific provided it can be vested in formulæ and worked out mathematically. These transcendental mathematicians are struggling to carry philosophy back to the era of Duns Scotus, when the greatest triumph of learning was to sophisticate so profoundly an obvious absurdity that no ordinary intellect could refute it. . . . The close study of pure mathematics, by directing the mind to processes of calculation rather than phenomena, induces that sublime indifference of facts which has characterized the purely mathematical intellect of all ages." Enough about mathematical matters for the present.

I have to ask your kind indulgence for this paper, for it is not what I should have prepared for you had the ordinary time been given me. I only received your kind invitation on October 14th. Many of you are aware that I had the privilege of reading the *first* paper on the Substantial Theory of Sound, ever read in Europe, before the Musical Association last Session; and doubtless some of you heard that paper, and perhaps more of you have read it, as printed in the Proceedings of the Association. It is my wish, therefore, to touch but slightly on the chief points of that paper, no more, indeed, than is absolutely necessary; and on the present occasion to lead you over as much new ground as time will permit. When I take you on to my old ground, I shall do my best to make you see matters more clearly. You will perhaps be content with some of my old experiments, for I have not been able to get my new pieces of apparatus ready for the present occasion.

As I said in my first lecture, it seems, perhaps, a rather startling question to put to the learned and accomplished members of such a Society as this—What is Sound? For have you not, during all your professional lives, been working "over head and ears" in it—bending it, blending it, and compelling it to interpret your souls' finest thoughts and highest inspirations? Yet I have to-night to ask you, What is Sound? and at the same time to try and lead you to a right answer to that question—a question and an answer worthy of your most earnest attention—to whom more so than to you practical musicians? It is highly probable had you, a few months ago, asked yourselves the question, that you would have accepted the ordinary text-book definition; and, on referring to those text-books which are the acknowledged authorities on the subject, you would have found Sound stated to be a wave-motion, or simply a mechanical motion of the air, set up by a mechanical action of some description of sonorous or vibrating body, such as a tuning-fork, a bell, a string, or a metallic tongue, and addressing itself to your sensorium by merely setting up in your ears a corresponding mechanical action. Did it ever strike you that Sound—one of the blessed gifts of the great architect of the universe—one of the things in nature which is present, active or passive, everywhere and in every object we know of—had a singularly common birth place, according to the popular theory; a miserable, struggling existence, full of vicissitudes, notwithstanding the dignity of the algebraic sums of its motions, which, when very much buffeted and interfered with, it could lay claim to; and that at last it had some hard and undignified work to do before it found rest in your brain? Most certainly, whilst musicians have been toiling to heap glory and dignity upon Sound, giving mankind reason to thank God for the gift of so much sweetness, scientists and mathematicians have been doing their best to degrade it to the level of a mechanical accident. We are called upon to believe that the mechanical hammering or impinging of air-waves on the tympanums of our ears is the only means nature has devised for the entry of music into our souls, and for the stirring up within us of the highest and the most refined sentiments of our being. We have, according to our great teachers of acoustical science, to believe that a certain kind of hammering melts us into tears; that another kind thrills our souls with a mysterious feeling of joy and gladness; whilst a slightly different kind of hammering on our tympanums sets our musical teeth on edge and irritates us almost to the point of fury. As musicians, you can not accept such a teaching—your every day experience is dead against such a miserable mechanical hypothesis.

With these hasty remarks, by way of an introduction, I may now direct your kind attention to the more important subject of my paper.

As all present must be more or less conversant with the teachings of the wave-theory of acoustics, I would willingly spare you any description of them on the present occasion; but it is absolutely necessary to allude to those teachings, for the purpose of showing the great difficulties which surround them, and in some cases to point out their positive absurdity and impossibility when tested by our daily experi-

ence, and examined under the cool light of reason and common sense.

I have here before me a large tuning-fork, which is a most convenient sonorous body, and one from which very valuable lessons may be learnt, as we shall shortly see: and my opening remarks shall lead up to the consideration of the fork as a sonorous or sound-producing instrument.

The Wave Theory of Sound, according to all the accepted text-books and the teaching of all its high priests, assures us that Sound outside our sensations is simply the wave-motion of the air or air-particles; and that this motion of the air-particles is produced by the mechanical or vibratory motion of the sonorous body or the sounding instrument. As no wave-theorist either in or outside this room will dispute this, I need not waste valuable time in giving more than a single passage in proof thereof, from Professor Tyndall's work, entitled "Sound." He says, sound "is propagated as a *wave* or *pulse* through the air. This wave impinging upon the tympanic membrane causes it to shiver, its tremors are transmitted through the drum to the auditory nerve, and along the auditory nerve to the brain, where it announces itself as sound." Observe, we are here assured, in unmistakable English, that outside the tympanic membrane of the ear sound is simply a *wave* or *pulse* of the air set up by an explosion or the mechanical action of some body.

He now defines what this wave or pulse is. "A sonorous wave," says the professor, "consists of *two parts*, in one of which the air is *condensed*, and in the other *rarefied*. The motion of the sonorous wave must not be confounded with the motion of the particles which at any moment form the *wave*. During the passage of the *wave*, every particle concerned in its transmission makes only a small excursion to and fro. The length of this excursion is called the *amplitude of the vibration*."

According to the wave theory, we are assured that, outside of us, *loudness* in a sound is simply wave-amplitudes of the air-particles created by the mechanical action of the sound-producing body, such as the tuning-fork before you. Accordingly, if one sound is louder than another, it is, as all acousticians tell us, only because the air-particles oscillate further to and fro in the one case than in the other, and consequently because the sounding instrument creates a greater atmosphere disturbance in the one instance than in the other.

Now let us look into this plausible idea closely, and see how it will stand the test of a little calm reasoning. It surely follows, as my friend, Dr. Hall, says, that if what has just been stated be true science, "the sounding instrument of a given pitch or vibrational number, which vibrates the farthest, having the largest surface and consequently producing the greatest amount of atmospheric disturbance, *should in every case produce the loudest sound and be heard at the greatest distance.* There is no disputing this statement by an advocate of the present theory of sound. To prevaricate, or even to deny these premises, would be to stultify the very foundation on which the wave theory rests."

Hence we come to the general facts in this matter on which we base our argument against the truth and reasonableness of the wave theory. Follow me carefully please. "There are many vibrating and sound-producing instruments, of large surface, wide amplitude of swing, and causing a powerful agitation of the air,—in other words, which produce intense '*condensations* and *rarefactions* of the air,' which alone constitute sound according to the theory,—*but which can not be heard more than six or eight feet away in a still room;* while there are other sounding instruments with but a small fraction of the surface to act on the air, having not one-tenth the amplitude or distance of swing, with not one-hundredth part the weight, and consequently producing but a slight fraction of atmospheric disturbance, or 'condensation and rarefaction' as compared with the others, *yet which can be heard nearly one thousand times farther away, and will fill millions of times greater cubical masses of air with their audible sound.* Such being the case is it not self-evident that sound is not produced by air-waves at all, since the last named sounding-bodies which produce but a slight fraction as much wave-motion of the air as the others, *actually produce many thousands of times the loudness of sound and consequently thousands of times the quantity of sound produced by the others.*"

Now, as we see plainly and conclusively that *loudness* of sound does not depend upon air-waves or atmospheric disturbance, *then sound itself does not depend upon air-waves at all.*

"In other words, this argument demonstrates as clearly as the fixed laws of mechanics and mathematics can demonstrate anything, that although sound-force is liberated from various sounding bodies by their vibratory tremor, the force itself or its loudness in no wise depends upon the air-waves or atmospheric disturbances thereby produced,—they being merely incidental to the tremor required for liberating the force—but, on the contrary, *the quantity of sound-force liberated depends entirely upon the sonorous property and cohesive structure of the sounding body.*"

As I desire that there should neither be a doubt on nor a begging of this fundamental question, and its bearing on the wave theory, let me remind you that according to that theory, and, indeed, according to its central proposition, "Sound, external to our sensations, consists of *air-waves:* that is, of '*condensations* and *rarefactions* of the air,' and that, on account of the elasticity of the air, those condensed pulses travel, when formed and started, at the known or observed velocity of sound. The theory further teaches that the greater the condensations and rarefactions constituting a given sound, the *louder* must be that sound, and the farther it will travel before the pulses die out or become inaudible."

There will, I feel sure, be no dispute about the accuracy of this brief statement of the basic principle of the wave theory; but in case any one of my hearers should, at the moment, question the manner in which it has been put before him, let me give the teaching in Professor Tyndall's own words:—

He says:—"We have already learned that what is *loudness* in our sensations is outside of us nothing more than width of swing, or *amplitude* of the vibrating air-particles. Every other real sonorous impression of which we are conscious has its correlative without, as a mere *form or state of the atmosphere.*"

Again he remarks:—"The greater volume of sound heard everywhere throughout the room, can only be due to the *greater amount of motion communicated to the air of the room.*"

This question of loudness in connection with sonorous bodies, is of vast importance in any discussion on the new and old theories of sound, so, at the risk of a little repetition, I shall give you a few of the remarks made upon it by the founder of the Substantial Philosophy. Speaking of the very passages I have just quoted from Professor Tyndall's work, he says:—"This is the teaching of all physicists on this subject, and a hundred similar passages could be quoted to prove it. Hence, if the wave theory of sound be true, it follows inevitably that the sounding body which vibrates farthest or causes the greatest disturbance of air,—that is, which gives the greatest amplitude of swing to the vibrating air-particles,—*should produce the loudest sound, and should be heard at the greatest distance.* On the contrary, if the wave theory be false, and if sound, instead of air-waves, consists of pulses of *substantial force*, radiating from the sounding body in synchronism with its vibrations, then it follows that the volume or loudness of sound should depend entirely upon the sonorous nature, quality, or property of the sounding body, *and without any necessary relation to the incidental disturbance it produces in the air.*"

(To be continued.)

REPLY TO MR. THOMAS CHATER.

To the Editor of "Musical Opinion and Trade Review":

Sir,—As the acknowledged originator of the Substantial Theory of Sound and as the first publicly to oppose the wave-theory with arguments based on the principles of physical science, I am naturally looked to as the proper one to meet and answer any arguments new or old that may be presented either favoring the wave-theory or opposing Substantialism. In this recognized capacity of semi-leadership it has been my custom to keep constantly upon the alert for the strongest and most plausible arguments in favor of the current theory of acoustics, and to let no such apparent proofs of the correctness of that theory escape unnoticed. Up to the present time I solemly aver that not one single argument or acoustical fact has yet been brought to my notice in favor of the current teaching on that subject that can not easily be met and logically brushed aside.

As the criticisms of Mr. Chater in your March issue have the merit of plausibility, at least until analyzed in the light of scientific truth, I am sure the interests of your readers will be greatly conserved by the publication of the following remarks:

Mr. Chater starts off by saying that the reason why "the more energetic vibrations of the iron sound-board under the stem of the tuning-fork, with their much greater action on the air, do not produce a fiftieth part of the sonorous effect caused by the soft pine wood sound-board *is perfectly easy of explanation.*"

I assert on the contrary that Mr. Chater's attempted explanation is without a shadow of scientific truth in its favor, as I will immediately show. Now let Mr. Chater watch me closely and see if I do not redeem my pledge. First, take his so-called "*truism* that without air *no sound can be produced by a vibrating body.*" A flatter contradiction of fact could not be placed in fewer words. A bell has been rung under water in the lake of Geneva and the sound thus produced heard by an ear similarly immersed nine miles from the bell.

When a boy, I have held my head under water with my ears filled with it, while another boy several feet below the surface, and hundreds of feet away, would rub two pebbles together, the sound being vastly louder to me than if produced and listened to in the open air. What reliance, therefore, can be placed in Mr. Chater's "explanation," based on such a scientific blunder as here pointed out at the very commencement of his criticism?

Having thus shown his "truism" not to be true we are the better prepared to appreciate his explanation of the enormous difference in sound augmentation caused by the iron and wood sound-boards as based upon this "truism." Here it is verbatim:

"Now 'soft pine wood' is composed or made up—like the lungs of man or other tone producing animals—of innumerable small cells or cavities, the woody fibers forming their outlines or walls; and upon contact of the stem of the tuning-fork the imprisoned air in these cells is compressed by its forward vibration and expands on its recoil, and so the entire substance of the wood is thrown into a state of isochronous vibration with the fork, causing corresponding waves of the air, and hence augmentation of the tone. Whereas the cavities in the iron and the contained air are so small as to be practically non-existent, and it is therefore incapable of adding to the volume or power of the sound produced by the vibrations of the fork. For the same reason, hard or close grained wood does not form so good a sound-board as soft."

The plain truth is, a more baseless lot of statements than the foregoing never were put together. Take, for example, a piece of pumice stone, fuller of air-cells than any piece of wood ever grown, and hold the stem of a vibrating tuning-fork against it, and its resonance is even less than from a similar piece of iron. Take a flat piece of hard dry-pressed sponge that is composed entirely of air-cells and hold the stem of the fork against it, and you will not get half as much augmentation of the sound as from the piece of iron! Why? Simply because the sponge does not possess the sonorous property or the quality needed to liberate this form of substantial force from the fountain of natural energy.

Take a sheet of rolled glass, which contains less porosity or air-cells than iron or any other known substance, and its resonance far exceeds that of iron. Where are your air-cells to cause this difference? Take a thick card of blotting-paper which will give out almost no resonance from the stem of the vibrating fork, and yet it is so porous or full of air cells that it will fill with water at a touch to three or four times its weight.

But finally, in order to annihilate this foolish criticism of Mr. Chater, take a goblet filled with champagne and tap it with a pencil while the wine is effervescing and full of air-cells or gas-cells, which are the same, and a dull sound is the result; but as soon as the effervescing ceases and the cells disappear, the same tap will cause it to ring out brilliantly! This fact is well known to all well-informed wave-theorists, but it can only be explained on the principles of Substantialism. Surely, if the cells in the wine deaden the sound, then the cells in the wooden sound-board do not cause the augmentation observed?

What a pity Mr. Chater did not know something about the wave-theory of sound! Had this been the case he would have known that every author who has written on the subject of sound-boards, including Tyndall, Helmholtz, Sedley Taylor, etc., have always attrib-

uted their augmentation of the sound of strings, tuning-forks, etc., to their large *surfaces* and their bodily vibrations, and consequently to the more powerful segmental air-waves thus sent off, and that not one writer has ever before thought of attributing this marked augmentation to the air cells within the substance of the wood.

Mr. Chater should recognize the fact that no man now has the right to step forward as a self-constituted champion of the wave-theory and then invent novel explanations of a difficulty which ignore and contradict the standard books on the subject. The wave-theory, let him remember, is already established and must stand or fall by the explanations already given of sound-phenomena as set forth in the text-books. If Mr. Chater so desires he is, of course, at liberty to get up a new theory, such as his ingenious air-cell hypothesis, even if it contains no truth, and then defend it if he can; but he has no right to put forward such novel "truisms" as any part of the wave-theory of sound.

Of a similar character is his explanation of the source of the loud sound caused by a pitch-pipe, which results, as he assumes, from the fact of the reed vibrating in a large air-cell. This, too, is a false "truism" if I may be allowed the solicism. Thrust the stem of the vibrating fork into this pipe and no augmentation whatever of its sound will occur. Then thrust the vibrating prongs of the fork into a similar air-cell, and still no augmentation takes place unless the chamber contains a column of air that is about of the same vibrational number as that of the fork and thus responds by sympathetic vibration. The truth is, the air-cell of the pitch-pipe has nothing to do with the loudness of the sound emitted, this loudness being due solely to the vibrating reed and the corresponding rapid breaking up of the air-current blown through it.

Mr. Chater thinks if I would send him prepared specimens of our loud-sounding American locust he could easily explain its method of producing its wonderful tone. If his "explanation" should come no nearer the truth than that given of the great augmentation of sound produced by the wooden sound-board in comparison to that of an iron one, it would hardly pay me for the trouble of sending him prepared specimens.

A. WILFORD HALL,
Editor of the MICROCOSM,
23 Park Row, New York.

PROF. WOOD'S REPLY.

The reader will remember Prof. A. B. Wood's letter, on the "swiftly advancing" prongs of the tuning-fork, as printed in the March MICROCOSM, with our answer to the same. Since then we have received a reply from Prof. Wood, admitting nearly everything we insisted upon as indisputable scientific truth with the exception of a single remaining claim in favor of the wave-theory of sound. He admits virtually if not directly that the truth or falsity of that theory now hinges upon the single argument he there presents. It is gratifying in no small degree to feel that so able a scientific thinker is willing, after conceding so many points in our arguments against the current theory of acoustics, to limit the entire controversy to a single remaining question. We will take pleasure in presenting the professor's letter with our remarks in the next number of this journal.

A MIRROR HELD UP TO A. I. ROOT, DR. KELLOGG, AND E. D. SCOTT.

BY THE ASSOCIATE EDITOR.

It is to be regretted that any man claiming to be an honorable citizen, should be capable deliberately of making the statement published by Mr. Root in his *Bee* journal for March, just brought to my notice, concerning Dr. Hall's great discovery for the promotion of health and longevity.

Our readers will remember the terrific castigation administered to Root by the editor of this journal less than a year ago (Vol. VII., pp. 142, 154), when the *Bee* man deliberately confessed that after buying the Health-Pamphlet, under a solemn pledge of honor not to reveal it outside of his own family, he had coolly published the whole thing to the world in his paper and confessed his crime, trying to justify it on the plea that it was wrong to keep such a valuable discovery from the public, and that it was therefore equally wrong for Dr. Hall to charge $4 for the knowledge. The consistency of all this will appear before we close these animadversions.

Root knows and confesses that but for Dr. Hall's efforts in bringing this treatment to the knowledge of the world by selling it at $4 under a pledge of honor, neither he nor any of his afflicted neighbors would now be enjoying its benefits, though he dishonestly insists that the remedy was not new at the time of Dr. Hall's discovery.

To prove this statement, he refers to a little book which he confesses was not printed till "1850," a year after the date of Dr. Hall's discovery as shown in his Health-Pamphlet! Yet right in the midst of this absurd and self-contradictory effort to still his own conscience by such a ridiculous attempt to prove that the treatment was old and well known to the medical profession, he laughably slips up by calling the very treatment he had obtained from Dr. Hall a "*new* remedy"! (page 185). The demoralization of the *Bee* man's reasoning power seems only equaled by that of his conscience.

The book referred to by Root is not only anticipated by Dr. Hall's discovery, but as the author of that book lived in the same vicinity as Dr. Hall, and no doubt knew of his wonderful recovery from consumption under his new treatment which became generally known, it is almost certain he got his first ideas of the new remedy from Dr. Hall's extensive circle of friends, as at that time there was no effort made by them to keep the facts a secret.

But as the full details of the remedy were not known to any save the discoverer himself, this accounts for the important fact that in the book referred to by Root *the real gist and essential features of Dr. Hall's treatment are entirely overlooked.*

Thus the vaulting ambition to disparage Dr. Hall and rob him of the honor of that great discovery has literally o'erleaped itself by letting the cat out of the bag, that the little book which had been lyingly reported as anticipating Dr. Hall's discovery was not in print till a year after Dr. Hall had cured himself of consumption by that remedy! Give the devil rope enough and he is always sure to hang himself in the end.

If the medical profession as Root claims knew all about this treatment, and if the book he refers to really made it known, which it did not, why have not some of these doctors

made it known to Root during all the years he has been consulting them about his health? Why did not some of his numerous acquaintances, also in constant consultations with various physicians, get even a hint from them concerning this marvelous remedy, so as to communicate it to Root and not leave him in total ignorance of it during all the years of his life, until he chanced to learn of Dr. Hall's Health-Pamphlet, and was induced to buy it for $4?

Yet this was the actual condition of the afflicted all over the world at the time Dr. Hall's pamphlet made its appearance, with physicians of all schools and professions dealing out drugs for all classes of disease, and even not intimating this wonderful drugless remedy which they knew all about! This is rather a cool testimonial for Mr. Root unwittingly to publish in favor of the honor of the medical fraternity!

Is it not vastly more probable that medical practitioners were in the same ignorance as to the scope, details and therapeutical value of this treatment that Dr. Stevens, of Syracuse, N. Y., was, when Dr. Hall revealed his discovery to him twenty-three years ago and startled him with the revelation? But Dr. Stevens was an honest man, and lost no time in admitting Dr. Hall's discovery to be new to the medical world, whatever hints had been printed to the contrary notwithstanding. Accordingly he at once adopted it personally and in his practice as a genuine revolution in therapeutical science. And the same precisely has been the case with more than one thousand other practicing physicians whose names Dr. Hall has on file, and many of which have appeared in the MICROCOSM, who have received the new treatment as a beneficent revelation to a suffering world, and who unhesitatingly declare that nothing like it as a practical remedial system was previously known to the profession.

It is now too late for conceited upstarts and plagiarists like Kellogg, and mendacious bigots like Scott, after Dr. Hall has brought the medical profession to his feet and compelled them to adopt his remedy, to try to create the impression that this discovery was old and well known.

Both Kellogg and Scott knew that what little inkling of this treatment had appeared in print, previous to Dr. Hall's full disclosure of the remedy, was so imperfectly elaborated and so limited in its scope and application to cases of emergency, that it had made no impression on the doctors of the country by which to induce its adoption or arrest the dealing out of drugs. As soon, however, as Dr. Hall's Health-Pamphlet had set forth the full treatment—not to meet a desperate emergency and then be dropped until another similar emergency occurred, but to be employed as a permanent and persistent health-restoring and health-preserving process—then lo, and behold, the doctors had always known all about it! No: Root may thus try to ease off his half-paralyzed conscience for the violation of his solemn pledge of honor not to reveal the treatment outside of his own family unless it should be paid for like any other prescription, but it will end in his total self-stultification as a man.

Notwithstanding Root knew he had thus pledged his sacred honor, and notwithstanding he knew and acknowleges that the treatment is worth many times the $4 charged for it to any one who will carry it out according to Dr. Hall's instructions, yet as soon as he had read the pamphlet and had become satisfied by a test that it was more than was claimed for it, and that he had struck a bonanza for the cure of all forms of disease, he saw what a splendid chance he now had to create a sensation in his paper and reap a harvest of subscribers if it was not for that unfortunate pledge of honor! So the infamous thought struck him that as it must be a *crime* for Dr. Hall to sell a discovery for $4 that was so essential to suffering humanity, therefore it would be *no crime* for him to sacrifice his honor by making it known through his paper, especially as he could thereby make a pile of money out of the discovery under the sham plea of a philanthropic interest in the sick and suffering! Eureka! shouted the old hypocrite as he chuckled to himself—"I've struck it!" And the conscience-seared *Bee* humbug proceeds to write his editorial revealing the treatment and imploring his subscribers' forgiveness for his shameless act, which he hopes will be condoned in consequence of the priceless revelation he is about to make to a suffering world, thereby largely to increase his subscription list! And then with half-suppressed crocodile tears for the afflictions he was about to relieve, and with a merciless cut at the mercenary Dr. Hall, for ignobly trying to make money out of the discovery that had cost him forty years of investigation to prove, he shuts his eyes as he hands the seal of his condemnation to his printer, and then staggers back home to take another treatment!

If my moral sensibility and discrimination between right and wrong had sunk to such a low ebb as that of A. I. Root, I would sell out my whole conscience for much less than $4 and regard it as a speculation.

But Root never thought to ask himself the question, which came readily to the mind of every intelligent subscriber to his journal, if it is criminal for a man to sell the knowledge of his own discovery for a small fraction of its real value, what must it be for a man, after obtaining that knowledge under a solemn pledge of honor, to violate his oath in order to make money out of the discovery by revealing it in his paper, thereby to increase his patronage?

But this is not the worst phase of the wretched *Bee*-fancier's predicament. In casting about for reasons to satisfy his subscribers concerning such an act of infamy he seeks, as before hinted, to strengthen his cause by trying to show that Dr. Hall was anticipated in his discovery by a book which he quotes, and then unwittingly admits *was not in print till a year after the date of said discovery*, and even when the book is quoted it does not contain one of the complete and essential phases of Dr. Hall's system of treatment!

A more barefaced and pitiable indifference to truth and imposition upon the public has never appeared in print with the exceptions of that of Dr. Kellogg, of Mich., and E. D. Scott, of Minn., before referred to, who audaciously quote the same identical book *and deliberately date it three years back*, to prove that Dr. Hall stole his discovery from that publication! And even with its real date one year after the discovery made by Dr. Hall, *there is not the slightest proof that this early edition contained one word of what those miscreants quote*, as was

shown by Dr. Hall last month. They evidently had not brains enough to know that a book is often "copyrighted" years before it is in print, or as soon as an aspirant for authorship chances to hit upon a title page he may intend to adopt. But as soon as the literary ass, Kellogg, and his scurvy imitator, Scott, saw that the book was "copyrighted" in 1847 they deliberately charge Dr. Hall with theft, *though admitting that the book was not in print till a year after his discovery!!!* If ever men deserved to be branded with the mark of Cain it is these same two specimen western criminals. Such moral assassins are worse than highway robbers thus to publish false dates to filch from a man his own brain property as well as his justly earned reputation.

But Root manifestly had not the same kind of motive to damage Dr. Hall which actuated Kellogg and Scott. Theirs was a mingling of revenge, envy, malice, jealousy, avarice and hate, but from different standpoints and on different grounds; while Root's was pure avarice mingled with an insatiate desire for creating a sensation in his paper while glorying in the shame of violating his sacred pledge, under the hypocritical pretense of benevolently wishing to give the world the benefit of so valuable a discovery!!

Yet this same benevolent, Christian, conscienceless reprobate and sham philanthropist, declares in his March article that it was the fact of his having "paid $4 for the secret" that induced him to go ahead and try it thoroughly, and as he now confesses, he was "agreeably surprised" at the great improvement it made in his health.

If it were possible for Root to tell the unadulterated truth, he would say what thousands of others have said—that it was solely on account of having paid the $4 for the secret, that he now enjoys the marvelous benefits of the treatment, and that if he had casually seen it in some paper as a free gift to the public he would never have tried it at all. Yet for working out this system during forty years of patient experimentation, thereby to demonstrate in his own person its effects on longevity; and for effectually organizing a successful method of presenting the remedy to the public by requiring a pledge of honor and a small fee, thereby to insure its thorough trial, this unscrupulous maligner, without one word of just praise to Dr. Hall for thus promoting the health and saving the lives of thousands, wickedly condemns him as an extortioner.

So highly, however, does he now value the remedy that he declares had he known of it one night when he was near dying at Madison, Wis., and that thereby "I could have perfect relief in three minutes without using any sort of drug or medicine, I would willingly have given *ten dollars* for the privilege!" (page 185, second column). Yet this ingrate publishes Dr. Hall as about the chief of sinners for charging $4 for what would have been worth "ten dollars" to him for a single application!!!

Poor Root; as an act of philanthropy, we leave him in the congenial company of the two arrant frauds, Kellogg and Scott, as a trinity of the most detestible characters to be met with in all history.

☞Old subscribers should not forget that if they have not renewed for volume VIII this is the time, as the volume is half out. Three new subscribers entitles the sender to one copy free.

THE ANNULAR THEORY.

No. 15.

BY PROF. I. N. VAIL.

I have referred to the Egyptian Deity Typhon as a conspicuous annular fossil, and I want to direct the reader's attention to this fact while I proceed to show that he was a *serpent in the heavens.* Let us also keep this other fact constantly in view, viz.: The serpent or dragon was the ancient-symbol of celestial waters, which, serpent-like, "coiled around the earth." The "serpent in the sea" is, even in the sacred writings, made the emblem, or rather the genius of the world of waters, as every scripturean knows. With this knowledge we turn to the monumental inscriptions of the eastern world and read them in a marvelous flood of light.

Typhon was worshiped in Egypt as a God, and under different names. All the hieroglyphics representing him, were *aquatic* characters, as the crocodile and hippopotamus, thus directly connecting him with the watery element. One of his names, Apop or Epep, which means to "mount and mount," or "rise continually;" which at once affirms that he was a perpetually *rising* feature, and one therefore, that revolved about the earth and in the heavens. But his name, Apophis, from "Ap." to mount, and Aphis, a serpent or dragon makes him the mounting serpent, and in this attitude he is represented again and again. Another of his names is Sat or Set, which links him with *high* or *lifted* waters, and in later times his name is associated with the northern heavens, in connection with Tat, the "*world pillar*" (concerning which the annular theory has in store the only possible solution), but the guardian of the "world's pillar," in all eastern legends is a serpent. Typhon then is a serpent!

He was also a feature in the sky, for, as all Egyptologists know he was the perpetual *enemy* of *the sunlight* under the name of Osiris. He was accustomed to force the sun into his "coffin," or "Soros," and Plutarch and other ancient writers say that Typhon made war upon the other gods and drove them from the heavens. That he slew the sunlight and imprisoned Jupiter the *storm god and thunderer.* Now, it is as plain as the noon-day sun, that annular vapors only, in the shape of a canopy, could do any of these things. Only a canopy of vapors could force the sun into his coffin! Only a canopy could slay him. Only a canopy could drive Jupiter, the rain and storm god from his domain, the sky. In this very legend then we have a memorial of an annular feature whose name was Typhon, and whose domain was the sky.

This conclusion, however, can be proven again and again by other evidence. For instance, if Typhon was a canopy, hiding the sun and banishing the other celestial deities, that feature must have passed away, as a new-born and conquering sun came into power—as Jupiter again regained his freedom. Well, is it necessary for me to tell the classic student how that "Horus, son of Osiris," a new-born sun in the fullness of time, came into power, marshaled his solar cohorts, made war upon Typhon and put him to death? Is it needful for me to tell him how, that in this "war of the gods," Jupiter "crushed Typhon with his thunder"? I could fill a dozen pages with this kind of proof which can have but one mean-

ing. Turn to ancient Greece and we find this same tragedy of tragedies enacted, only under other names.

Typhœus is slain as the *serpent* Python which Euripides denominates, "*That huge wonder of the world!*" and slain, too, by a solar deity; and here, too, Pytho is a watery agent, for he produced the flood of Deucalion. I find the same scene in the *shanameh* of ancient Iranean thought. I find it in ancient India. It is a *world wide history* that the *serpent* or *dragon was the genius* of *celestial waters*,—an annular canopy, that away back in immemorial antiguity, overarched the earth for the last time, and because it banished the burning sun, and with it the storm-king, and winter and all the other agents of ill, it was looked upon as the world's protector and worshiped as a beneficent deity. As a philosophic result the serpent was then the universal monarch and deity of the earth. Accordingly, we find upon the Egyptian monuments temples and tombs, every sign of Typhonic adoration. Not in Egypt alone, but in Assyria, ancient Persia, Turan, India, Chin, or ancient China, we find this one universal monotheistic worship of the Agothodæman, or good demon. Even in both Americas and in Scandinavia, monuments and legends attest the universal practice of Ophiolatry, proving that primitive man gathered around the good dragon or serpent in demonstrative adoration.

Now let us for one moment look back upon the human race in that venerative attitude, and behold their astonishment and amazement upon seeing that canopy pass away,—upon seeing their protecting deity vanishing amid all the essentials of majestic disorder and ruin, which annular decline necessarily involved.

It is very plain that deluded mankind would characterize the dragon or serpent now as an agent of evil and no longer as a good demon. Do we find any evidence of this change on the old monuments and in the ancient legends? If we do, *what does it mean?* No sooner do we go in search of this evidence than we find it shining through enveloping clouds of centuries, and it tells us too plainly to be misunderstood, that Typhon ceased to be the god of Misriam and "received the earnest impricatations" of mankind. "His very name," says Rowlinson, "was effaced from the monuments." The change has been characterized "remarkable" and "inexplicable." In the light of this theory all the mystery vanishes. It is not a little remarkable that the Egyptians, as this canopy passed away to the north, made its serpent-genius the abode of Satan; in short, Typhon, as the eastern scholar well knows, become the Egyptian devil, and there is abundant testimony that all nations, after about the time of the eighteenth dynasty of Egypt, looked upon the *northern heavens* as the abode of Satan. Of this, more hereafter.

As the Typhonic canopy passed away the *sun* came into power, and the reader knows, without telling, what primitive mankind would turn to, as it turned from the serpent. What deity would then receive the adoration of man? It would be unphilosophic to suppose that man would not at once worship the genius of the sun. Now, if we find this to be the fact, we can do no other than to admit that the sun came into view as the serpent vapors passed away. And when the united testimony comes from around the circle of the whole earth, that *sun worship*, *sun temples* and *sun idols*, were erected upon the ruins of serpent-worship, the order of annular declusion is shown so conclusively, that to doubt the fact, would seem more than supercilious. The sudden change from the practice of Ophiolatry to that of Heliolatry, has a momentous meaning; and I say the world can explain it only by the calcium light of the annular theory.

In concluding this paper, I will give my readers a test by which they can satisfy themselves that my arguments are no "dreamy" effusions, but that under them is the fundamental rock of truth. If I slip occasionally from that rock-bed, the rock nevertheless will be there forever.

If the Typhonic vapors passed away they went polarwise from the equator. Those people who lived north of the Tropics, as in the latitude of Greece, would necessarily see those grand annular arches, like huge serpents, congregating in the north-polar heavens. Here was the last battle-ground of Typhon as he passed away in stormy terror. There he stood for centuries, overarching the polar world as he received the declining vapors and precepitated them upon the earth. There he was known as the *mid-guard serpent*, overspanning the polar stars. I want my readers to imagine this Typhonic arch, with the clear heavens in the north under it, and then turn to the twenty-sixth chapter of the book of Job, seventh verse, and read: "He stretcheth out the *north over the* empty place," etc. I ask the reader to trace the word "north" to its root and find its Hebrew meaning. If it is found to be a proper name, and derived from a word that would imply the ability to hide the sun, as Typhon did, I ask him to give the annular theory and its humble author due credit, and we will ere long be ready to proceed with the Eden narrative.

Elsinore, San Diego Co., Cal.

EFFECTS WITHOUT CAUSES.

BY THOMAS MUNNELL, A. M.

Wave-theorists do not hold that wavelets are *produced* by sound, light or heat, but that said forces *consist* in wavelets or small undulating motions through and in air and ether. Whatever differences there may be in the phenomena of these three different kinds of wavelets they are nevertheless but similar movements propelled through the same media. The effect of one of them is realized in the ear, that of another in the eye and that of the other upon the whole body. Sound-waves can not address the eye nor can light-waves address the ear. Each kind attends to its own business and never interferes with the business of another. Light undulations have no more effect upon the ear than sound has upon the eye; and the question comes up: If neither of these three kinds of motions is *anything*—a mere motion being absolutely nothing—how can they each produce a different effect and fill a different office? That is, in what do their different abilities consist if they are all nonentities? And even if waves are real substantive things that have like the soul an existence after the excitement ceases, they are not intelligences and could not of themselves make choice of the very different offices they fill. And as no wave-theorist contends that they are immaterial entities like gravitation or magnetism, the question remains, how can one nonentity do anything different from another non-

entity, or do anything at all? Do you reply that it is not the mere motions that cause the different effects, but the natural forces that produce them—a knock on the bell causes it to communicate its vibrations to the surrounding air; the excited and tremulous surface of the sun sends its tremors through space? But the question still returns, if the sun sends forth nothing but wavelets and the bell does the same, why does one kind of waves produce heat, and another sound, if neither of them is anything but a slight atmospheric or etheric disturbance? To admit that it is the great natural forces lying behind each of these three kinds of waves which cause their different phenomena, is to surrender the wave-theory, for then light is not mere motion, but motion *plus* the quality imparted to it by its driving force and together producing its special phenomenon. So if the solar heat rays after reaching the earth are nothing but motions, why should they be anything else in the sun itself? Then it follows that our "King of Day" is itself nothing but a conglomerate of motions so agitated by each other that the friction of their decellions of nothings illuminates and warms all the planets and all their innumerable tenantry and does it all with what?—with an orbecular collection of nonentities! If such a position is not sufficiently absurd, where would you find one?—one that makes the same thing (motion) both cause and effect of itself.

Now, a motion is *only* a motion in whatever number of ways it may be produced. Wavelets are only wavelets, whether started by a gong, a bell, a tuning-fork, an explosion, a thunder storm or solar rays, and here returns the original question: Why should one motion or nonentity address the eye, another the ear, and another the whole body?

Substantialism steps up and says it is because air-waves are not sound-waves, but that sound being an entitative existence belonging to the great and exhaustless reservoir of force in nature is, under certain circumstances, released as sound and starts with a kind of electric intuitiveness to the organ for which it was intended by its Creator in the beginning. How can an unintelligent light-wave fly with the directness of intelligence to the eye and not the ear if both are but motions of matter? In brief, why should not all kinds of mere waves of matter have the same effect, and how can we account for their elective ability if they are nothing but temporary disturbances in the atmosphere or ether?

Solar rays, consisting of both light and heat, when they leave home fall upon the moon and are there analyzed, the heat staying there and the light leaping across its 240,000 miles alone, and if the light from sun to moon consists of nothing but *waves*, in what does it consist from moon to earth? If the same why should there be any difference between solar and lunar waves? If not the same, what makes the difference, if not the absence of the real substantive entitative *thing* we call heat. Do you say that solar and lunar waves are of different forms and therefore of different effects? Well, prove it, and we will agree to believe it. Or do you say the intensity of solar light is reduced when the heat is left behind? But this resort surrenders your Malakoff, for how could heat or anything else be left behind that has no substantive existence? You can neither add nor subtract cyphers, motions, nor any other nonentities.

Now, is it not a comfortable thought that, although the wave-theory has so long ministered to sad and doleful materialism, and though many of the stoutest hearts were cast down by its apparently invincible arguments, *Substantialism* comes to the front bowing and smiling, but with power to smash said arguments to fragments and grind them to dust and deliver those who, through fear of materialism "were all their life-time kept subject to bondage."—Paul?

A TREMENDOUS INDORSEMENT.

We copy the following testimonial—engraving and all—from the *Farm, Field and Stockman*, of Chicago, Ill., the leading agricultural paper in this country. How noble and manly thus to hear testimony to the truth! And how contemptible in contrast are the jealous and envious ravings of such bigots as Kellogg, Scott, Root & Co!—ASSOCIATE EDITOR.

A FRIEND OF HUMANITY.

We publish on the next page a portrait of Dr. A. Wilford Hall, the author of Hall's Hygienic Treatment for the cure of disease, preservation of health and the promotion of longevity, without medicine. Dr. Hall is, also, the author of the "Problem of Human Life," and a number of other works on scientific and religious subjects; also, the editor of the MICROCOSM and the originator of what is known as the "Substantial Philosophy," or "Substantialism" of which the MICROCOSM is the organ.

The story of the discovery of what is known as Dr. Hall's Health System, often mentioned in these columns, and offered by us as a premium, the principles of which are fully set forth in the first named work, is the story of the doctor's life. Unlike the average physician, Dr. Hall believes in and takes his own medicine, if medicine it may be called. It may be as well here to invite attention to the proper title—Ph.D. and LL. D.—indicating advanced scientific attainments.

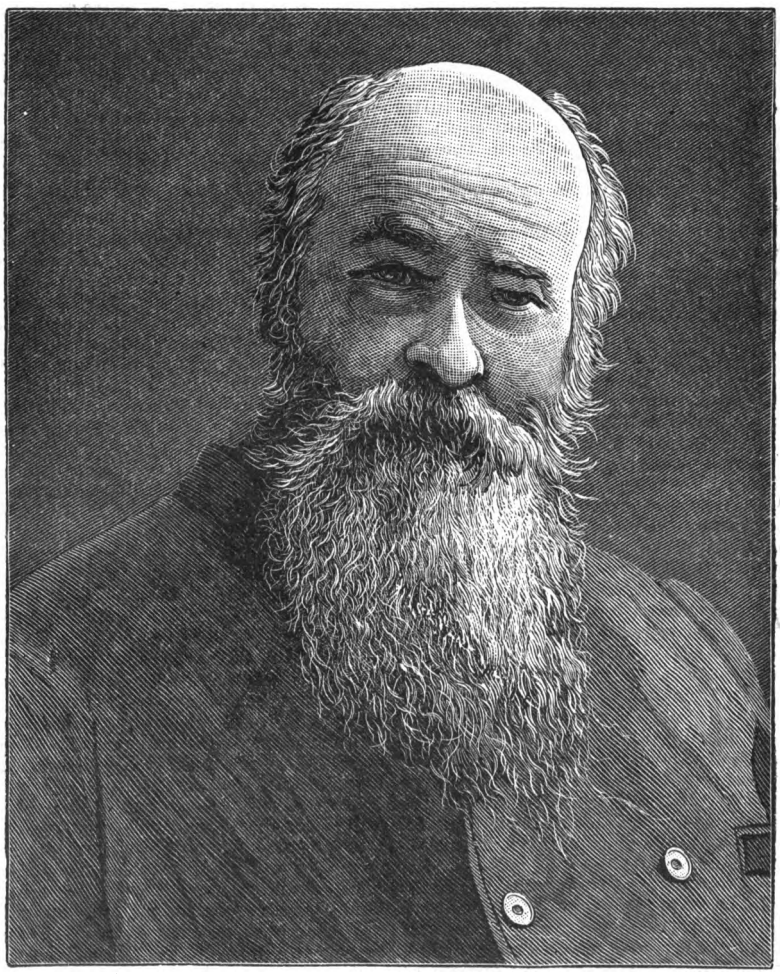
Before venturing to give his discovery to the public he practiced upon himself for about forty years, and in this way effectually demonstrated its value and practicability. In his case the trite saying, "Physician heal thyself" is accomplished fact.

His malady was that most terrible of all diseases, consumption, with its usual forerunners or accompaniments, indigestion, dyspepsia, torpid liver, and kidney failure. His case was about as desperate and helpless as could be. One lung was partially gone, and racked with a terrible cough and reduced almost to a skeleton, he was compelled to give up all work and retire to the house, with scarcely strength enough to walk a block without sitting down to rest. His younger brother, Samuel, had a short time previous died of consumption; and his family physician, who was also his warm friend, advised him to settle up his business affairs as there was but little prospect, if any, that he could survive over a year. His case was identical with that of his brother's who had just died. A consultation of experienced physicians did not afford a ray of hope. Every thing which drug, medicine or science could do had been done and failed.

In this desperate strait he decided to take the matter into his own hands and, to use his own words, "I resolved not to die by the triumphant power of consumption and its noncomit-

ant ills, but at once to enter upon such a conflict with the insidious destroyer as either to break his hold on my vitality or to take the victory out of his grasp by falling under the effects of my own desperate experimentation."

In these experiments drugs and established medical practice were entirely eschewed and a new system sought for, as he says: "I knew from my brother's recent experience that drugs could accomplish nothing in such an extremity, and consequently my whole scheme of organic reconstruction, aimed solely to aid and abet the physical laws of my being; thereby to counteract, if possible, the work of disease and



A. WILFORD HALL, PH. D., LL. D.

destruction going on in my system. * * * To supplant in the circulation the disease bearing germs which were doing this deadly work, by life-giving elements of pure nutrition in harmony with the laws of vital force," etc.

To go into the details of his experiments which happily for him were successful from the start, would be to give away the system, which before we could obtain a knowledge of it ourselves we signed a pledge of honor binding us not to do. These details are set forth in full in the above named work.

The results are what we are interested in. To use the doctor's own words after he began practicing this discovery on himself as an experiment, we quote: "I began perceptibly to improve both in weight and physical vigor. At the time described I weighed 120 pounds. In three or four weeks I had gained about five pounds, with a glow of healthy color beginning to come to my face. My cough also began to subside, my pains left my kidneys and my pleurisy ceased to trouble me, and all symptoms of dyspepsia had left me never to return; and so it went on every month adding to my weight and physical vigor, till finally some twelve or more years ago, I had reached the maximum weight of 225 pounds of the firmest muscular structure probably of any man living, young or old, and that too without any undue corpulency in the common adipose sense of the term."

About twenty-three years ago Dr. Hall made known the secret of his discovery to Dr. R. F. Stevens, of Syracuse, N. Y., who with keen insight saw at once that it was a discovery worthy of this progressive age, and began its practice both upon himself and his patients, with what success the following extract from a letter written by him to a friend in New York City over two years ago will answer.

(See this important testimonial in our March

"Extra" which will be sent free to any who may desire it.)

Since its publication over three hundred thousand people have purchased and are using this system successfully in their families, and the doctor has received over fifteen thousand testimonials of benefits received, all of them voluntary. Many of these testimonials recite marvellous cures. They are, of course, too numerous to mention here.

The following indorsement from James Robertson, M. D., the distinguished physician and surgeon of Birmingham, England, is of importance and will show how the system is viewed in that country.

(This testimonial also appears in our "Extra" among scores of like import.)

Our own experience in the use of the system covers eighteen months. We used it a year to be certain of its beneficial effects before recommending it to our friends. Since then we have induced several of our friends to use it and all unite with us in giving it an unqualified endorsement. We would not give up the right to use it for money. It is because it has proved of such inestimable benefit to us that we want all our readers, especially those who are ailing, to have it. Compared with the money expended by each family in doctor bills which the use of this discovery would save, its cost, $4.00, is but a trifle.

OUR OFFER TO THE POOR.

Still a large demand for our Health-Pamphlets, from persons too poor to pay for them, continues to come to this office. We have so far turned no one away from our door who sends a certificate from a post master that the applicant is too poor to purchase $4 worth of medicine if prescribed by a physician. This offer has cost us tens of thousands of our Health-Pamphlets; but we feel satisfied, as we know that thereby we are alleviating the sufferings of humanity.

THE NEW MANIFOLD CYCLOPEDIA.

Mr. John B. Alden, Publisher, 393 Pearl Street, this city, as the public are aware, is now nearing the close of his great "Manifold Cyclopedia" of forty volumes,—possibly the most complete and elaborate encyclopedia in the world. A friend calls our attention to the regular alphabetical article *Substantialism*,—written as we are informed at the suggestion of the late Rev. Dr. Howard Crosby by a professor of physics in some Iowa college whom we do not know. Whoever he may be the article states the principles of the Substantial Philosophy as correctly as we could ourself have stated them and in much better form. It is certainly gratifying to the friends of this philosophy that so soon—while the founder is still living and within a dozen or so years from its birth—a succinct recognition of this revolutionary scientific and philosophical doctrine should be placed permanently on record in one of the first encyclopedias in the English language. We here copy the article complete as follows:

SUBSTANTIALISM, *sub-stan' shal-izm*: in modern metaphysics, the antithesis of speculative idealism: in recent physico-philosophy, the doctrine (originated and developed by A. Wilford Hall, Ph. D., LL. D., of New York) that every force of nature—physical, vital, mental, and spiritual—is a real, substantial, though immaterial entity. The discussion has been mostly physical, as it starts with and rests on the phenomena of light, heat, and sound, particularly. Here, the doctrine antagonizes the vibratory or undulatory theory, which gives only matter with a propagated mechanical action. Dr. Hall at first adopted the old term "corpuscular" for his theory, but afterward rejected it because it implies an emission of particles, which is no part of his philosophy. He regards all the forms of force as manifestations of one pervading force-substance, drawn from one reservoir. The luminiferous ether, with its vibrations, is rejected. Sound was his first stumbling-block, but is now seemingly so much in his favor that he has made converts of acousticians, such as C. W. Pearce, Mus. Doc., Cant., and George Ashdown Audsley, both of England. At first thought, nothing would seem to be clearer than that sound, when propagated by the air, is a succession of waves in the form of rarefactions and condensations in every direction, the vibrations being repeated by the drum-membrane of the ear. At first, Dr. Hall granted incidental air-waves; but he now considers them of no account, if existing even for a single foot from the most powerful sounding body; he attributes all to an immaterial sound-force (needing, however, a material conducting medium in order to travel, as shown by a bell in an exhausted receiver), making a string, a diaphragm, or a flame to move at a distance from the sounding instrument, when the "vibrational number or tensional capacity" of the object and the instrument sufficiently agree. Mechanical vibration or tremor in that which occasions sound is simply the means by which the sound-force is liberated. While the quantity or loudness of sound-force thus liberated depends generally upon the amplitude of vibration of the sounding instrument, it depends much more upon the sonorous nature or quality of the sounding body itself. It never in any degree, however, depends upon the amount of atmospheric disturbance which the sounding instrument incidentally generates, nor upon the air-waves which it sends off in the form of supposed condensations and rarefactions. This is the great and fundamental error in present acoustical science. The vibrating fork, for example, can produce no possible effect upon the free air, in the shape of condensed pulses, even an inch from the vibrating prong. Its own swiftest motion is but a few inches a second. The vast disparity between the generally credited cause and the observed result is not explained on the old theory. A tuning fork, whose sound is scarcely audible unless in close proximity to the ear, if heavily struck against a pad, and held at the open mouth of a tube whose air-chamber is of the same vibrational number, will by synchronism of its sound-pulses sympathetically throw the air-column into vibration which, in turn, at once liberates more than one hundred thousand times as much sound-force as was produced by the fork alone, as can mathematically be demonstrated, estimating the cubical space which the two sounds will fill (the *Microcosm*, 1889, Dec.). This year (1890), Dr. Hall has used as a weapon the law of inverse squares of distance. The phenomena of sound (excluding the mental side of the subject, which has no more to do with one physical theory than another) are a crucial test, as well as good illustration, of the theory, for which in all its aspects, scientific and religious, see the *Microcosm* (monthly), and Dr. Hall's *Problem of Human Life, Text-book on Sound*; also the *Scientific, Arena*, 2 vols., suspended. The bearing of the theory on immortality is obvious. If all forces are immaterial substance, spirit and life can not be mere motions of matter to cease at death.

What a Prominent Minister of Texas Thinks.

Dear Dr. Hall,—I write to suggest that you visit London and deliver a course of lectures on the Substantial Philosophy, and especially its demonstration of the immortality of the soul and the impossibility of maintaining the latter doctrine on the ground of the mode-of-motion theories. This course would likewise furnish you an opportunity of introducing your Health-Pamphlet to the millions of England and Europe and thus confer an untold boon upon suffering humanity. For immediate benefit and permanent good, I regard it as one of the greatest discoveries ever made. You are entitled to all the credit of its discovery and general adoption, and I am glad to see you vindicating your claim. Suffer no man to despoil you of this honor. I rejoice at your success. God bless you till we meet in our Father's house on high.

Your friend, JAMES H. SCATES.

CONTRIBUTIONS LEFT OVER.

Contributors must not feel neglected if their articles do not appear promptly. We will do our best to print all acceptable contributions as soon as our space will permit.

A CANDID ATHEIST.

Editor MICROCOSM,—I have received an occasional copy of your journal during the past year. To assure you that I am pleased with it would be supererogatory. It has no duplicate in the universe of letters—it is shadowless. Necessarily, it draws its admirers and supporters from the "saving remnant." This fact, and its cause—the highest possible order of literary ability—saves your publication from the suspicion of trade-journalism that might result from your enthusiastic championship of Hall's Health-Pamphlet. I know that your remedy is worthy of all praise, for I have seen it tested. I should have known it anyhow, for your profundity as a philosopher is incompatible with trade trickery.

Whether true or not, your therapeutical philosophy is very fascinating to me. Its highest conclusions include a supraphysical cure, to which your remedy for bodily ills, with all its excellencies, is incomparable. For thirty years I have been a sincere and consistent atheist—*consistent*, because I have not been happy in my belief. I can not believe that an honest atheist can derive happiness from his convictions, unless happiness depends *wholly* upon something outside the emotive sphere. It would be brave, and self-abnegating beyond finite apprehension, if a philosopher could face certain annihilation with thrills of joy, but this would involve a *natural* self-contradiction; and this is not possible, as *one* such self-contradiction would wreck the universe.

The most devout Christian can not Christianize away his dread of death, even when certain that he will live forever in glory. If a philosopher can not philosophize away his dread of death—and he can't—how shall he serenely welcome annihilation? Notwithstanding his fear of simple dissolution, the Christian can be happy from a contemplation of his assured future bliss. With the philosopher—Spencerean philosopher—death and eternal oblivion are synonymous and, being merely human, and unable to climb out of himself, he can not anticipate this hopeless plunge with one little flicker of happiness. Unhappiness as a consequence of true philosophy, it seems to me, can not compatibly be, for it is not in consonance with the beneficent trend of things—that eternal trend upon which the integrity of harmonious succession depends. This appears to me to be an argument in favor of the Substantial Philosophy. If it is, it will be helpful to the skeptic, for only extra-scriptural arguments go with him.

I am publishing a small medical journal, *The Medical Gleaner*, and would be glad to exchange with you. I will put your name on my list and risk your approval.

With profound respect, W. C. COOPER.
Cleves, O.

REMARKS BY THE EDITOR.

We believe if Dr. Cooper will carefully study the principles of Substantialism, much of his doubts as to the existence of God and the possibilities of a future conscious existence for man will be dissipated.

We can readily understand how a critical thinker must become involved in doubts on all questions of religion, with no ground for his faith save the conflicting theological creeds about the teachings of which a dozen or more trials for heresy are now in progress in different sections of the country. A book purporting to be a revelation from God, which can *fairly* admit of so many conflicting and directly opposite interpretations, can have no other tendency than to foster atheistical doubts. Is such conflict fairly attributable to the Bible, or does it come from the supercilious attempts of ecclesiastical conventions to formulate religious creeds, and then impose them upon the people as an absolute substitute for the Bible itself? We leave it to the creed-bound denominations to answer.

No wonder that thoughtful men like Dr. Cooper are reaching out anxiously for some super-scriptural proofs—some new and confirmatory developments from the books of nature, science, and philosophy—that will throw light upon the present dark future which seems to envelop humanity. We earnestly commend to all such candid skeptics a careful study of the *Substantial Philosophy*, as affording the only real analogical proofs of a possible future for humanity to be found in the book of nature.

The fundamental principles of that philosophy, which teach and demonstrate that all the forces or phenomena-producing causes which appeal to human observation, must in the very nature of cause and effect be Substantial entities, will throw more light on the possible conscious existence of man after death than all the creeds and theological sermons in Christendom put together.

In that philosophy was the first attempt made to overturn the motion-theories of science, and thereby prove that every form of natural force, even including *sound*, must be an objective though immaterial entity, thereby to demonstrate that the higher forms of natural force which actuate and control our bodies must also be Substantial and consequently indestructible, as a reasonable and logical basis for personal immortality.

If, as all our colleges teach, the forces of sound, heat, light, etc., are but the mere *motions* of material molecules, and which forces necessarily cease to exist as soon as such matter comes to rest, then manifestly Haeckel and other materialistic scientists are not only excusable, but entirely justifiable in applying the same law to the human organism and insisting that life-force, mind-force, spirit-force, etc., are likewise but the motions of our material brain and nerve molecules, and as motion must cease to exist at death.

CONTENTS OF MAY NUMBER.

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The Microcosm

A MONTHLY JOURNAL OF SUBSTANTIALISM AND COLLATERAL DISCUSSIONS.
THE ORGAN OF THE SUBSTANTIAL PHILOSOPHY.

A. WILFORD HALL, Ph. D., LL. D., Editor and Proprietor.
(Author of the "Problem of Human Life," "Universalism Against Itself," Editor of the *Scientific Arena*, &c., &c.)
ROBERT ROGERS, S. L. A., Associate Editor.
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PROF. A. B. WOOD'S LETTER; WITH REMARKS BY THE EDITOR.

DR. A. WILFORD HALL:

Dear Sir,—Let some points in my letter published in the March MICROCOSM rest for the present, and let us first thoroughly discuss the vital question in this controversy. That question is this: Is the velocity of the tuning-fork prong *equal to* the velocity of the wave raised by it or is it much slower?

The object sought now is not victory over an opponent, but the clear exhibition of the naked truth. Every thing therefore in your position that is *true* I admit willingly. In my letter in the March number of the MICROCOSM I admitted that the motion of the fork-prong *in space* is a *slow* motion, as slow, let us say, as you represent it.

I wish now to make a second admission, viz., that the air-particles in the wave raised by the prong do not move faster than the prong itself. The motion of the air-particle is probably quite a good deal *slower* than that of the prong at its swiftest speed. The prong's motion raises both a *wave* and a *wind*. The wave-motion is a minute "*excursion to and fro.*" In the excursion the particle *comes back* to the point from which it started and there rests. The excursion is one not *long* enough to be visible or sensible even if air could be clearly seen.

This minute insensible excursion, *slow* in actual *rate* of motion, produces the wave. The *other* motion of the air produced by the prong is *wind*—air moving off farther and more *rapidly* than the particle in the wave-motion, and not returning again to its place. This wind is raised because the prong moves *faster* than the particles in the wave, and so some of them are torn from the wave and shoved on.

The particles in the wave then do not move *as fast* as the *prong* moves at its swiftest speed.

Again, a *third* admission I will make, viz., that the wave itself can not be swifter than the prong, provided, and this is the vital point, provided the *second particle ahead in the wave does not start on till the first one reaches and impinges against it.*

This, it seems to me now, must be your idea of the process of wave-motion. A particle is started on by the moving prong at its rate of motion. Now you suppose, do you not, that the second particle ahead does not start on till the first one reaches and impinges against it? Then it starts on reaching and impinging against the next particle and so on to the end of the wave's course. If that be the fact, you are right in holding that the wave can not have greater velocity than the prong, and waves would vary in velocity as the prong varied in velocity, just as you hold.

Is it not your view then that the second particle in a wave does not start on till the first particle impinges against it?

But is that the scientific motion of a wave?

Certainly not. Were this so, it would be easy to show there could be no wave at all. A particle, starting on as supposed, would travel quite a distance before finding a particle in its *exact line.* Air-particles are comparatively far apart. A cubic yard of air might be compressed into the space of a solid inch. Then a particle of air moving into this cubic yard would impinge against one in about 15,000 particles. No wave could originate in this way—and scientists never thought so.

What then is the idea held? Not that the second particle *waits* before starting on till the first one impinges against it, but that the second particle starts on long before it is reached by the first one.

This is *the decisive fact* in this discussion.

If the second particle does not wait for the first one to strike it, but starts on *before* the first one reaches it, then you see, the wave will be more rapid than the particle, and the less the second allows the first to approach it, the more rapid the wave will be.

Each particle is surrounded with a sphere of repulsive force of more than a thousand times its diameter, which, under the pressure of fifteen pounds to the square inch, still holds all particles off at a great comparative distance. When a sound pulse passes through the mass of air these mutually resisting spheres of repulsive influence press into each other but slightly.

If the oncoming pulse could press one sphere half-way to the center of the other, this pulse would be comparatively long in getting through, and yet it would go through very much faster than if particle impinged against particle.

If the second particle in the wave starts on when the first one is just pressed in a little the wave would pass very rapidly. And if the second particle does not allow the first one to enter its sphere *at all* then the wave would pass instantaneously.

The velocity of the wave then depends upon the *amount of approach between the particles*, and not at all upon the rate of the prong. This rate may be very *slow*, as slow as your

own figures represent it, and yet the wave be very rapid. The rapidity depends upon the smaller or greater *approach of particles.* With *no* approach the wave is instantaneous. With *much* approach the wave is slow. With approach *to* the particle and collision, the wave is of the *same* velocity as the fork-prong.

If a long row of rubber balls in contact with each other is struck at one end, the pulse goes through to the other end with a velocity depending not upon the blow, but upon the tension of the balls. If one ball penetrates a quarter of the radius into the sphere of the next one, the pulse will not go through the row as quickly as if one could not penetrate the other more than *one-thousandth* of its radius.

You see then the velocity of the pulse does not depend upon the velocity of the blow. If one ball could not press into the other *at all* the pulse would go through *instantaneously.*

Can we not all see that this same process takes place in case of a sound pulse? The *sun* is not more apparent, it seems to me, than this fact.

How much greater is the velocity of the wave than of the particle in it? If the oncoming particle penetrates into the sphere of the particle ahead *one hundredth of its diameter* before this second one moves on, then, it is plain, the sound wave would move one hundred times as fast as the particle moves. If it penetrates only the *one-millionth* of its diameter, which is nearer the truth, then the wave would have a velocity of a million times the velocity of the particle, or a million times the velocity of the fork-prong, supposing it to be no greater than that of the particle sent by it.

Have I not shown now to a demonstration that the wave must be more rapid than the prong? And how much more rapid the wave *is* than the prong depends upon the density and elasticity of the air.

The velocity of the fork-prong then is of no account in our discussion. It is a curious question merely for boys studying arithmetic.

At a great distance above the earth the air particles being under less pressure, are further apart.

In producing a wave one particle must move *further* into the sphere of another particle to *start it on,* hence the resulting wave will be *slower.*

Now is it not clear that the question asked in the beginning of this letter: Is the velocity of the tuning-fork prong equal to the velocity of the wave raised by it? must be answered in the *negative?* Respectfully,

A. B. WOOD.

REPLY BY THE EDITOR.

We are still more than ever pleased with the candid frankness of Prof. Wood in his admissions not only that there is no "swiftly advancing" about the prong of a vibrating tuning-fork, as he conceded in his March letter, but that the prong travels in space even as slow as we claim for it, that is even slower than the hour-hand of a clock after said fork has been sounding nearly four minutes. These are most valuable admissions and saves us a deal of argument in proving the proposition.

Now with such admissions as these, which no unbiased investigator could avoid making, we see not the least trouble in disposing of every thing in the foregoing letter that seems in any way to favor the current theory of sound.

In his first paragraph Prof. Wood states the "vital question" to be this: "Is the velocity of the tuning-fork prong *equal to* the velocity of the wave raised by it, or is it much slower?"

But, we take the liberty of correcting Prof. Wood by denying in toto that this is the vital question in our controversy, or, in fact, any question at all connected with it. So far from there being the slightest discussion between us on the question as to which moves the swiftest, the prong or the air wave it sends off, the whole controversy is upon the assumed possibility of any wave or pulse being started by a prong, moving as slowly as he admits through the unconfined air.

Prof. Wood absolutely knew, if he carefully read our March reply to his letter, that we deny that it is possible for the swiftest moving prong that ever vibrated (less than four feet per second at its swiftest) to produce a condensation of the free air or send off any sort of a pulse, and consequently he must have known that we positively deny that such a prong could start an air-wave. Hence it is thrusting a new issue into our controversy and making it the "vital question," as to which travels the fastest, the prong or the wave it sets up!

Would it not be much better and more to the point for Prof. Wood to meet the issue in our reply to his March letter, and first show that a tuning-fork's prong can or does start a wave at all, before he talks about the velocity of such wave as compared to that of the prong, being the "vital question."

And we here add further, to relieve his mind fully on the force of his argument, that we do not dispute his facts in regard to the velocity of a pulse as compared to that of the blow which produces it *in any medium where a pulse can be transmitted, such as confined air, rubber, glass, ivory, etc.*

In fact we concede right here and now that the pulse in such case may move vastly swifter than the moving cause or blow, so that the entire part of his argument involving this question is admitted. But that, we repeat, is not the "vital question" at all. Let him prove that a pulse can be sent through the free air by a tuning-fork's prong, even at its swiftest motion, and we will accept the wave-theory without further objection.

In every work on physics we have examined there is a lamentable want of discrimination displayed in this discussion of pulses and their speed through various substances. The true

theory of pulses and the cause of their speed seems to be entirely overlooked by these writers. Let us briefly state for the benefit of rising investigators, what constitutes a pulse in any material body, and thus try to get at the true cause of the difference of speed in pulses through different materials.

Our position is that the particles of material bodies which cohere must in the nature of matter *touch one another, or there could be no coherence.* Hence a blow struck against a particle of an elastic and compressible body, which is not in a fluid or mobile condition, such as air, must by its absolute contact with adjoining particles transmit a pulse through such body. To suppose the particles of a cohering body to be *not in contact*, and yet to be capable of conveying a pulse through that body, is to our mind a great absurdity, as will be abundantly shown further on in this reply.

If the particles of a body must be in contact in order to convey a pulse, then what is it that causes the different speeds of pulses in different material bodies? This is the "vital question," and one which every physicist who has written on the subject seems to have overlooked. We answer, that the cause of a pulse *is the compressibility* and *elasticity of the PARTICLES of a body in contact*, and that the cause of the difference in the speed of pulses in different bodies *is the difference of degree that exists in these same properties of compressibility and elasticity in the particles of matter.* Hence, a pulse through glass or ivory will travel vastly swifter than a pulse through rubber, cork or confined air, simply because the particles of glass and ivory are vastly less compressible than those of air, rubber and cork. Is not this plain?

If a solid body in the form of a bar could be found which is absolutely incompressible, then plainly no elasticity could exist in such body, and consequently no pulse whatever could be conveyed through it by a blow against one end. The whole bar might be moved bodily by such blow, but this is not a pulse. A pulse proper could not be conveyed without the aid of the property of elasticity in its particles, and that property can not exist where a body is incompressible.

If you ask how a particle or molecule of a body can be compressed, unless its atoms are separated from each other and are thus brought closer together by compression, we answer that these atoms, if any exist, are likewise as compressible as the whole body, and if you please, you can carry the same principle on down to infinity. This, though failing to explain the infinite, is the only possible solution of the compressibility of air or any other substance whatever. Yet what writer on physics, living or dead, has ever hinted at this simple and only rational solution of the cause of a pulse sent through a body?

We repeat that Prof. Wood overlooks the only vital question in our entire discussion, namely: can a pulse of any kind, swift or slow, be sent through a perfectly fluid or mobile body like free air or water, by a movement in it as slow as that of the vibrating prong of a tuning-fork? We kindly suggest that a little proof would be in order before assuming and taking for granted such a prodigious impossibility as that a tuning-fork prong, moving no faster than the hour-hand of a clock, can compress the free air or free water in defiance of its absolute mobility.

In our March reply to Prof. Wood we quoted from Prof. Stokes, now the President of the Royal Society of Great Britain and one of the highest living authorities on acoustics, to prove that a body moving through the air with the velocity of one's hand,—millions of times swifter than the prong while still sounding audibly,—will not produce a compression or condensation any more than if the air were an "incompressible fluid." Why did not Prof. Wood make a note of this fact and offer some reply to it? If such a movement of the hand can not produce a compression of the air, as this high authority admits, but merely allows it on account of its almost infinite mobility to flow around, and thereby equalize the disturbance the same as does the movement of the tail of a fish near the bottom of a lake, it is plain that no wave of "condensation and rarefaction" can be started by such a slow motion. Of what use then is it to discuss the supposititious question as to which moves the fastest, the hand or the pulse it may start, when by common consent it starts no pulse whatever?

Now, if the movement of the hand or that of a pendulum, a distance of a foot in a second, is too slow to condense the air, what about that of the hour-hand of a clock that requires ten minutes to move the *eighth of an inch*, and which Prof. Wood now concedes to be a vastly swifter motion than that of the prong while still sounding audibly? Is it not plain then that Prof. Wood has totally missed the only "vital question" in the premises, and that the whole of his argument, discussing the formation and velocity of the wave that has no existence in fact, and which can not possibly be started, is an absolute waste of ink, time and paper?

But we are not disposed to ignore the professor's reasoning on the hypothetic air-particle being driven by the prong into a "sphere of repulsive force more than a thousand times its diameter" before the next particle is reached, and about the next particle starting off on its wave-velocity long before the air-molecule projected by the prong can reach it, etc.

All this hypothetic reasoning is as imaginary as it is self-contradictory. Let us critically examine it for a moment. In the first place, according to Prof. Wood's view, the prong does two things to the air-molecules in contact with it exactly opposite in their effect. It produces a *wind* by sending off the particle "more rapidly than in the wave-motion and not returning again to its place." Then we are told that "this *wind* is raised *because the prong moves faster than the particles in the wave.*"

Next we are told that the particle in the motion constituting the *wave* moves slower than the particle in the motion he calls *wind*, and while the particle in the wind goes on "not returning" the one in the wave, which of course must be the same particle, ' comes back to the point from which it started and there rests." Now, if this is the real "exhibition of the naked truth" we confess we are not scientific enough to see it.

We do not comprehend, for example, how the same particle of air driven off by the prong can first play the rôle required by the "sound-wave" by going away *slower than the prong*, and then "come back to the point from which it started and there rest," to be hit again and again by this prong, and at the same time to be driven away by the prong at its full speed and at a considerable distance, to act its rôle in the motion called *wind* in which it does not return at all! This double motion and conflicting velocity of the air-particle in two opposite directions and velocities at the same time, one going away not to return, and the other motion taking it away much slower and bringing it back to rest at the place from which it started, is a slight reminder of the old story of the wave-theory motion of the tympanic membrane in which it takes a score of different directions, to a score of different distances, and at a score of different velocities at the same time, while one is listening to that number of musical instruments in an orchestra! These are among the beautiful and scientific requirements of the wave-theory, while Helmholtz assures us that:

"*Any particle of air can, of course, execute only one motion at one time.*"—"It is evident that at each point in the mass of air, at each instant of time, there can be *only one single degree of condensation*, and that the particles of air can be moving with *only one single determinate kind of motion*, having *only one single determinate amount of velocity*, and passing *only in one single determinate direction.*"—*Sensations of Tone*, pp. 40, 222.

But we want to treat the theory, as well as its able advocate, fairly and view it toward all its numerous angles. According to Prof. Wood's novel exposition as set forth in his argument, and contrary to all the teachings of acoustics, the prong of a tuning-fork, as we now assert, *can not possibly hit an air-particle at all* to drive it away either in the shape of wind or of a sound-pulse, and consequently the whole theory bursts into scientific smoke. Let us prove it.

If the air-particles are "more than a thousand times" their diameters apart, and are held in these positions by a "sphere of repulsive force" surrounding each particle, it follows of course that this "sphere" will keep the particle from touching the prong of the fork by its "repulsive force" just as easily as it will keep it from touching another particle. Do you see? Thus the prong in vibrating does not hit an air-particle at all, especially when its entire swing while still sounding, as proved by Capt. Carter, is but the 64,000,000,000th of an inch, or only a small fraction of the estimated diameter of an air-molecule!

As Prof. Wood believes in this "sphere of repulsive force" surrounding the air-particle to keep it from contact with a neighboring particle, he must necessarily consider this sphere as composed of substance of some kind, since nothing but a substantial entity could by any possibility keep two bodies from coming into contact. And as he does not accept the doctrine of *immaterial substance* as constituting the physical forces of heat, light, sound, electricity, magnetism, gravity, etc., he must as a matter of course regard his "sphere" of repulsion as constituted of matter of a still finer quality than air. Is not this unavoidable?

Now we insist that Prof. Wood should give us some light upon this spherical material body surrounding each air-particle, which he calls "repulsive force," as a kind of etherial cushion to act as a spring to produce motion in a distant air-particle nearly as soon as itself is touched by the prong. Let him tell us whether or not this cushion or repulsive sphere is composed of particles or if it is all one homogeneous particle. If composed of innumerable separate molecules, do these molecules touch each other, or are they also separated a "thousand times" their diameters apart like the air-particles themselves, and are they each also surrounded by a repulsive sphere of still finer material substance to act as cushions to keep them from coming into contact with each other? And if so, these finer material cushions should also be constituted of material molecules proportionately smaller, and with still finer surrounding "spheres" of repulsion to keep them from coming into contact with each other, and so on forever more, thus always reminding us of Dean Swift's stanza:

"There never was a flea so small
But has other fleas to bite 'im;
And these again have lesser fleas,—
So on *ad infinitum.*"

Now these varying and perpetually success-

ive gradations of finer and still finer material substances constituting this infinite succession of material "spheres of repulsive force" can not be the common *ether* so useful in the construction of the motion-theories of science, as that is supposed to be all of one grade of fineness; and, besides, it is proved to have no resistance whatever, much less fifteen pounds to the square inch, in preventing two material bodies from coming into contact, as witness the motions of the planets through enormous quantities of this supposed ether, filling inter-planetary space, without the slightest measurable resistance to such motions. Suppose this accepted theoretic ether had a resistance of fifteen pounds to the square inch, like this supposititious repulsive sphere of Prof. Wood, it is plain that the earth would come to a dead halt in fifteen minutes in trying to wade along her orbit around the sun through such thick stuff.

No, it is not ether at all, but must be some other material substance very much denser, and as it involves necessarily infinite grades of successive fineness of quality as well as an infinite grade of size in the molecules composing it, including an infinite variety in their respective distances apart, we respectfully suggest to Prof. Wood to save infinite complication by not constructing his "spheres of repulsive force" of particles or molecules at all, but call each "sphere" a single homogeneous particle—a spherical cushion with the air-molecule in the center, and with these spheres all touching each other.

Now, we think that while we have really helped the professor out of the difficulty of the infinite and complex succession of "spheres," we have unfortunately got him into a worse scrape; for, if the resisting "spheres" surrounding his air-molecules really touch each other, and as single and distinct homogeneous masses—without particles—can be compressed into smaller space, thereby allowing the air-particles to "crowd closer together" as Tyndall expresses it, what hinders the air-particles themselves from touching each other without any surrounding spheres to act as cushions, and at the same time what prevents any amount of compression into smaller space the same precisely as in the case of these hypothetic and useless "spheres?"

If this spherical material cushion of Prof. Wood, as a single homogeneous particle, can be compressed so as to bring a cubic yard of air into a cubic inch, we see no good reason why each elastic and compressible air-molecule should not be its own cushion, or why the air-particles themselves should not all touch each other with the quality of contracting and expanding to the greatest possible observed and required limit.

Who, in the name of science, authorized Prof. Wood or Sir Isaac Newton to take for granted that the air-particles are solid and incompressible bodies, and that they are many times their diameters apart, with the spaces between them filled with some elastic matter that will admit of compression and expansion, and still without a word concerning the molecules constituting these inter-molecular cushions? Why such circumlocution, when it is ridiculously more simple to assume the air-particles themselves to be as elastic and compressible as the whole air composed of them is known to be? On this supposition we can let these elastic air-particles actually touch each other as the only thinkable thing, when all Prof. Wood's trouble to explain the method of propagating an air-pulse will be at an end. For plainly, Prof. Wood is obliged to admit that the air-molecules, which are surrounded with these repelling spheres, are either *compressible* or *incompressible*. If compressible, then of what use is his hypothetic *spheres of repulsion*, since the molecules themselves could be in absolute contact and still be compressed to any observed degree?

But if the air-molecules are *incompressible*, then the professor must admit the existence of a material substance that sound can not pass through at all, since an incompressible body can not be thrown into "condensations and rarefactions" which constitute the essential feature of a sound-wave according to the theory!

But look at the self-annihilating character of the theory in the well-known fact that the nearer to absolute incompressibility a body comes, as in the case of water or mercury, the better it conveys sound! It is plain, therefore, that could a body be found, like Prof. Wood's supposed air-molecules, wholly incompressible and consequently wholly inelastic (and therefore wholly without "condensations and rarefactions") it would conduct sound still better!

It is a fact that Newton, supposing these air-molecules to be solid and incompressible, actually concluded that sound therefore must pass through them instantaneously, in order to explain the discrepancy in his formula of density and elasticity by which the wave-theory fell short 174 feet a second in the velocity of sound. How could he believe in "condensations and rarefactions" as constituting sound-waves? [See his Principia.]

If the "*velocity* of the wave *depends upon the amount of approach between the particles*," as Prof. Wood says, and if wave-particles "*do not move as fast as the prong*" (paragraph 5), Prof. Wood gives away the whole theory in these two sentences, since it must follow that the wave velocity will necessarily correspond

with the velocity of the prong and consequent velocity of the particle! How fast should a sound-wave travel, by one particle approaching another, when the prong is moving no faster than the hour-hand of a clock, which Prof. Wood admits? (See his 2d paragraph.) It is perfectly plain that a swift and powerful blow of the prong will drive a particle further into this soft and pliable "sphere of repulsive force" than a slow and weak blow. Hence a loud sound should vastly outstrip a soft one, since the velocity of the approach of particles must be vastly greater in the one case than in the other, just as a swift blow of a bat must cause a greater indentation of a base ball than a slow one. Is it possible that Prof. Wood or any other trained physicist can accept such an absurdity as that a prong moving only the millionth of an inch, and at the rate of half an inch in a day, would drive an air-particle as far into this supposed sphere of repulsive force, as a blow 100,000 times as swift and 100,000 times as great a distance? This is exactly what the professor's argument involves, admitting his position that the particles are thus kept from touching each other. Indeed, the professor actually admits the logic of our argument that if his theory be correct the velocity of the wave depends upon the velocity of the particle, which in like manner depends upon the velocity of the prong. (See 6th paragraph from bottom.)

From the difficulties involved in the pulse-theory of Prof. Wood, only a part of which we have space here to elaborate, it would seem much easier for him to end all complication by coming over to the substantial view, that sound is an immaterial objective entity—and thus at a single step abandon all his trouble of explaining pulse-formation by a motion so slow as to produce no possible compression on an infinitely mobile fluid like air.

For an intelligent scientific investigator to insist seriously, according to any principle known to mechanics, that a small body like the sounding organ of a locust, for example, moving through the free air at a velocity less than four feet a second, should so condense this mobile fluid as to send its pulses of condensation and rarefaction a mile in all directions, is so inexpressibly absurd that we marvel at the blinding effects of the wave-theory over minds that are able to reason clearly and lucidly on all other mechanical subjects. But it is a solemn fact that has to go on record in this controversy, that as bright an intellect as the one possessed by Prof. Wood is really compelled through the tyrannical influence of this theory and the scientific authority which maintains it, to insist that a tuning-fork's prong, which he admits to be moving at a velocity through space no greater than that of the hour hand of a clock, actually compresses the free air, with its almost infinite mobility, into condensations and rarefactions rather than merely displacing it.

That a trained intellect should not be able to see the force of this crushing consideration against the wave-theory, after Tyndall and Stokes have both admitted that the motions of the hand or the movements of a pendulum are too slow to condense the air or send off a pulse, is certainly a discouraging prospect to one who believes as does the writer in the final and inevitable triumph of truth over error.

Plainly the reason why Tyndall, Helmholtz and Stokes made these frank admissions—that no slowly moving body like the hand or pendulum could condense the free air—was owing to their inexcusable misapprehension that the vibrating prong and string moved through the air with the swiftness almost of a shot from a gun. But now, after this terrible and ridiculous error has been exposed, as admitted by Prof. Wood, and the fact demonstrated that the fork will sound even when its prongs are moving thousands of times slower than any other object known to mechanics, how incomprehensible must it appear to the future student of science that a man of Prof. Wood's ability should still claim to adhere to the wave-theory.

Our faith, however, in the progress of humanity and in the final triumph of scientific truth, compels us to believe that before this volume of the MICROCOSM shall be closed, we shall have the pleasure of announcing Prof. Wood as another out-and-out convert to the cause of Substantialism. Our reason for this belief is that we sincerely regard him as an able and an honest man, notwithstanding the scientific errors to which he now adheres. We shall see.

THE ANNULAR THEORY.

No. 16.

BY PROF. I. N. VAIL.

"He stretcheth out the North over the empty place, and hangeth the earth on nothing." At the close of my last paper I put this quotation from the Book of Job into my readers' hands, with the request that they would search for its annular meaning. Doubtless some have found to their surprise that the word "north" is used here as a proper name, and that the object or phenomenon so named was located in the northern skies; and that all philological evidence identifies that name with the Egyptian Typhon, the antagonist and concealer of the sun-god, he having repeatedly forced that luminary into its "soros" or "coffin," *and all nature mourned its absence*, until "found." But I have shown that Typhon was "the mounting serpent" Apophis, and it becomes plain that the "north" bent, or "stretched out over the empty place," was the serpent canopy, or genius of the watery arches in the northern sky. Moreover, in tracing the name Typhon, or its

Greek equivalent, back to its root meaning, we are interested to find it to signify vapor, mist or smoke; and what is more remarkable, its Hebrew equivalent, as used in Job, means to "*conceal.*" Putting these links together we have a marvelous chain of annular testimony. The "north" bent over emptiness, becomes the genius of the serpent canopy "that warred on Jove," *i. e.*, hid the sky and concealed the sun; and we are no longer surprised at the otherwise meaningless myth that the whole dynasty of solar deities fled from the attacks of Typhon and *concealed* themselves from sight —no longer surprised that the whole earth worshiped the serpent as a God. No longer surprised to learn from the legends of India, Iran, Greece, Egypt, etc., that the solar genius again marshaled his forces, under the leadership of Jupiter, the sky, and joined in that grandest and mightiest of conflicts on the plains of Heaven. Mustering to the bugle call of time, the legions of the sun, met the Agathodemon and hurled him and his cohorts to the earth. In this we have a record of the only battles that ever took place in Heaven, and in the fall of that spirit of annular vapors is personated the only dragon that ever dwelt in the skies, or fell from its battlements. Here the calcium light of the annular theory dispels the clouds and the mists from our frail conceptions of the spirit land.

I suppose my readers can understand how as a necessity, a canopy of banded vapors in the northern hemisphere, moved northward, toward Polaris, in order to fall. The poles were the points of least resistance, and thither all annular matter tended, and necessarily lost their revolving momentum and reached the earth. As a necessity, vapors could not hang unsupported in the polar heavens, any more than a stone after it had ceased to have centrifugal momentum. Hence, in all ages of the annular world, there was undoubtedly an open or "empty place" in the heavens, near the pole. This, I say emphatically, can be established with the strongest possible testimony. It was a circular space measurably free from annular clouds during all the *quiet* periods of the world's onward and upward progress, in the line of intelligent development. And yet during those periods of catastrophic changes, that have left there way-marks everywhere, it was the breeding place of those battling legions of celestial demons, which the traditions of the whole earth hand down to us with no uncertain import. It was a space visible to all mankind, in the northern hemisphere—literally a "floating island." I find it in almost every tongue, but most familiar to the ordinary reader as the floating island, the ancient name of which was *Asteria* from the stars beaming forth from it —and *which the sky-god fixed* as the birth-place of Latona's offspring. (Apollo and Diana. *Children of the sky*, and now known to be *solar phenomena*).

It was an island hemmed in by the Typhonic vapors, *shining and brilliant* as the sunlight, constantly luminated them. This bordering hem of shining vapors, made Asteria the "Serpent-begirted isle" of Greecian and Eastern legends, and *hung there as late as the time of the 18th dynasty of Egyptian kings!* Typhon banished from the medial skies took up his abode there as the "Tall Pillar," and was represented on the monuments as a great arching serpent, having precisely the shape of the Greek capital letter "Omega" (Ω). The right terminal curve representing a serpent's *head*, and the left its *tail*—the hieroglyph of Apophis, the world serpent. Is it not a little curious and significant that the *last* of the annular vapors, arching the northern skies, should thus have been symbolized by the Greek letter, the literal meaning of which is "the last?" But this very emblem proves an annular fact, for this island-hem, hung in the skies, presented that form, minus the terminal curves, in the latitudes of Lower Egypt, Greece and India, as any arithmetician or optician can prove; and we have here the starting point to the very important discovery that all primitive alphabets, from the Runic and Cuneiform, down through the Coptic and Egyptian graphics, *were copied with all their meaning from the annular heavens.*

This omega-shaped arch is so frequently referred to in ancient poetic thought, that it is, to me, impossible not to see it held constantly in view. In the exact shape of a huge world serpent, no one can mistake the meaning of the "great dragon coiled around the Olympian height," or the "dragon, huge prodigy of the earth, ruddy and brazen, *guarding the heights of Okeanos.*" No wonder the star-gazer in the Book of Job, as he saw this "huge prodigy," exclaimed, "Thy hand hath formed the bended serpent," and again "He bendeth Tsaphon over the empty place." And as the head and tail of this celestial dragon apparently *pierced* the earth in the N. E. and N. W. points, we can understand the otherwise inexplicable scriptural allusions to the "piercing serpent," the "fiery flying serpent," etc., etc.

I wish my readers to clearly understand the shape of this wonderful world arch for, so sure as law exists in the universe, that arch shone forth for uncounted time in the northern skies, a marvel to all mankind. Imagine a stupendous golden-colored and light-bearing horseshoe standing erect on the earth, with its broad bridge-shaped or table-like top spanning the polar heavens, and its tapering ends piercing the earth into the *underworld* and evanescing to a point. The sides of a circle, however large it be, will appear to come together in the great distance, like two rows of trees. So that a little reflection will enable the reader to erect this arch in his mind, as primitive man saw it, and concerning which I find innumerable references in the great mass of ancient world-thought.

It stood like a huge inverted mountain; and a great many references to it are made, as a "mountain," or "celestial rock," or "summit of the world."

The "Tall Pillar of Egypt" is also the "Roof Pillar of the World," and what is evidence of the strongest kind, is the fact that Egyptian legends affirm that it was *made out of the branches of the great "World Tree,"* or, as I have shown, the *branchiform canopy of vapors*, and they also identify *it* with their sacred "world mountain" in the northern skies. In ancient German thought it is the "*Irminsula*," and because it pierces the earth and heavens, in Hebrew it is called "Bariach" or piercing serpent, or as it might be rendered the "serpent of the baris or arch." Hesiod also throws much light upon it, when he tells us it was the *offspring of Typhon.* It is also interesting to note that Python, the serpent-author of Deucalion's flood, is but another name for Typhon; was slain by Apollo, a solar deity, and its meaning in Hebrew is "*deceiver.*"

We have here also a happy solution of the mysterious "world bridge," or "Bridge of Heaven," found as a remote survival in the ancient-thought of every people. In the Talmud, it is the pillared arch that connects earth and heaven; also the bridge over which the soul ascends into the celestial paradise. It is the Scandinavian "Bifrost Bridge," or Eye-brow of Ymer." In far off Japan and China we find the celestial "Roof-pillar uniting heaven and earth." The "Floating Bridge of Heaven," etc., etc. In ancient Persia we find the "*Chinvat Bridge*" over which the dead climbed to the hall of judgment, and in a remarkable allusion to this bridge, Er, the Pamphilion says: "*It was brighter than the rainbow and extended right through the heaven and through the earth.*"

India had its bridge of heaven and its sacred world mountain, called *Mandara* or *Meru*. But the very name identifies it with an *annular band;* for Meru is the same as the Greek Meros, or *thigh of the sky-god*, and Euripides tells us that it was a "*portion derived from the æther, or element that once surrounded the earth.*" To not see here an annular allusion, one must be blind indeed, but when we are further told that the Meros once enclosed and concealed *Bacchus*, a solar genius, we have a fossil of the most unmistakable import. But what do the sacred books of the ancient Hindus say respecting this world mountain, once a part of the lofty æther? The Puranas thus describe it: In the middle (of the region of the Jambu-Dwipa tree, or tree of life) is the golden mountain Meru. The height of Meru is 84,000 yojanas and the depth below (the earth) is 16,000. The diameter of the top is 32,000 yojanas and of its base 16,000, so that this mountain is *like the seed-cup of the lotus of the earth.*"

Here is one of the most positive memorials of annular times. A mountain with its broad *base* in the *heavens* and its *apex penetrating the earth into the underworld*, can have no other import, and when further compared with the pericarp of the lotus, *i. e.*, an *inverted cone*, there is left no room for a doubt. So that I may boldly say that, independently of the great mass of geological, astronomical and scriptural testimony, the Indian Meru establishes the annular fact forever, and the sooner investigators turn their efforts to the establishment of this great thought, the earlier will the earth be lifted to a higher plane.

Elsinore, Cal.

AN OVERWHELMING ARGUMENT.

BY THE EDITOR.

We have frequently been asked by believers in the teachings of modern acoustics, if the wave-theory of sound be incorrect why is it not possible to select some single assumed fact, essential to the current view, so self-evidently false as to crush the life out of the theory and defy all efforts on the part of its advocates to meet it?

We have pointed out many just such classes of assumed facts in past issues of our publications, and have challenged physicists over and over to answer them if they can. But to meet the exact case of the friend who now writes us, we will state a single assumed fact which by universal consent is essential to the existence of the wave-theory, and which, if it is as claimed, flatly contradicts observation. It is as follows:

Every text-book on acoustics teaches that sound, outside of our sensations, consists of condensations and rarefactions of the air, and consequently that a condensed pulse necessarily travels through the air, even if confined in a tube, at the exact velocity of sound. No one disputes this being the teaching of the wave-theory. Prof. Albert M. Mayer, in his article—"Sound"—in Appleton's American Encyclopedia, uses this very illustration of a long tube open at one end with a closely fitting and movable piston in the other end. After stating what the effect would be on moving the piston into the tube in case the air was incompressible, he adds:

"But air is *compressible* and *elastic*, and after the piston has been pushed into the cylinder, a *measurable interval of time* will have elapsed before the air would move out of the open end of the tube. *This interval is the time taken by sound to travel the length of the tube.*"

Now we assert that Prof. Mayer knows as surely as he knows the effect of any other mechanical action, that the instantaneous movement of this piston *six* inches into the tube would drive the pulse swifter than a similar movement *one* inch. Why? Simply because a greater and more powerful spring-force is introduced behind the pulse in the shape of the condensation in the one case than in the other. To deny this would be to teach the self-evident absurdity that a *powerful* condensation of air released behind a bullet, in an air-gun, would not send it any swifter than a *weak* one!

Hence, this mechanical principle being admitted, as it has to be by every intelligent wave-theorist, it follows if sound-pulses are condensations of the air, that a loud-sound, requiring as the theory teaches, a more powerful condensation, must travel faster than a soft or faint sound which is produced by a less condensation of the air. But as all sounds—the softest and loudest—travel with the same velocity, it simply demonstrates that sound does not consist of condensations of the air at all.

We thus annihilate the wave-theory on the single assumed and essential fact that a sound pulse is an atmospheric condensation. As certain as that a powerful condensation of air, as just stated, when released behind a bullet in an air-gun, will drive that bullet swifter than a weak condensation, just so certain must the air-pulse itself travel faster in the one case than the other, *because the bullet can not travel swifter than the pulse which propels it!*

Now, let wave-theorists answer this argument squarely, or else admit their theory broken down by the very mechanical law on which it is based. Let them carefully note that as a condensed pulse must travel through a tube with the exact velocity of sound according to Prof. Mayer, and since such pulse must travel swifter or slower according to the spring-force of the condensation propelling it, as proved by a bullet shot from an air-gun, it absolutely follows that a *loud* sound set off by a powerful condensation should travel much swifter than a *soft* one, if there is a truth in the wave-theory.

Will Prof. A. B. Wood, as the first critical and competent wave-theorist we know of, kindly and without unnecessary delay give his serious attention to this difficulty lying in the way of his theory? Let him not overlook the fact that just as certain as the bullet goes faster out of an air-gun when charged by a powerful atmospheric condensation behind it,

just so certain must the *pulse* itself thus created travel faster since the *pulse* is what drives the bullet! But as this *pulse* and a *sound-wave* are identical and travel at the same velocity according to the wave-theory, let Prof. Wood carefully explain why a loud sound having a powerful pulse does not travel faster than a faint one. We pause for an answer—clear, comprehensive, but as brief as possible.

"THE INVISIBLE WORLD."

This book, by Dr. J. I. Swander, is now in the hands of the printer and will be ready for the reader at an early date. It will contain 320 pages, and will sell for $1.50, by mail. Those who subscribe in advance will receive it for $1. The doctor will offer large inducements to those desiring to act as agents. Better send your name at once with $1 to Rev. J. I. Swander, Ph.D., Fremont, Ohio, and thus save half a dollar.—EDITOR.

RUTHERFORD COLLEGE, N. C.

We have recently had a very pleasant visit from the Rev. Dr. R. L. Abernethy, president and founder of the above named college. Unfortunately on the ninth of last August the College buildings caught fire and were burned to the ground with their two valuable libraries, amounting to a loss of more than $30,000.

This liberal and very progressive institution—the sole work of Dr. Abernethy and his family—has for forty years been doing immense good to the poor of that state and many other portions of the South, owing to the very generous terms held out by the doctor for the education of their sons and daughters.

No sooner had the college been reduced to ashes than the president, undaunted by the disaster, began the erection of new buildings, which he has now nearly completed externally. As this college is undenominational and unsectarian, it is the duty of every well to do man, south or north, to donate of his means to help refinish and refurnish this almost free college for the poor of both sexes, more than two thousand of whom have received education within its walls without pay.

Dr. Abernethy, with whom we have been in intimate correspondence for years, but whom we had not enjoyed the pleasure of meeting, is a whole-souled and noble specimen of the wide-awake southern gentlemen. Observing the robust physique and glow of health that characterized him, we were not long in learning from his own lips that he attributes it all to the conscientious use of our hygienic treatment, having purchased the Health-Pamphlet soon after its first announcement in the MICROCOSM, of which he has been a subscriber and reader since its start.

One feature of the Rutherford College which should insure the most friendly feeling on the part of Substantialists, is the fact that it has never been afraid to advocate the principles of the Substantial Philosophy in opposition to the materialistic motion-theories of science.

President Abernethy never stops to ask if a scientific doctrine is popular with the schools before teaching it to his pupils, but simply and solely "is it true and in accordance with the principles of natural law?" And we are glad to learn from the doctor himself that he has set apart one class-room in his new building to the special work of inculcating the principles of Substantialism. He is at liberty at any time to draw on the MICROCOSM for $100 and a full set of our "Scientific Library," toward furnishing that room.

OUR ARTICLE ON THE TUNING-FORK.

Last month we promised to print in this issue our explanation of the *silence* observed at the corners of a sounding-fork held in the fingers and rotated in front of the ear. Owing to the two or three related editorials on acoustics in this number, one long one in reply to Prof. Wood, the tuning-fork article is deferred till next month. Let no one neglect to read and even study these articles on sound, for on the principles therein unfolded hangs the truth or fallacy of the Substantial Philosophy, as also the motion-theories of science.

EXIT KOCH'S LYMPH.

BY THE EDITOR.

At last the medical profession of this city have been forced to the conclusion that the Koch lymph is a failure as a cure for consumption. Dr. Shrady, editor of the *Medical Record*, after experimenting with the treatment for nearly six months, has been compelled, out of a sense of duty to the fraternity of which he is very nearly the head, to announce as his conviction the total inadequacy of the claimed remedy for the purpose intended.

Seven months ago, in the December number of this journal, we pointed out the very result which Dr. Shrady and his co-laborers now are obliged to acknowledge. We did not do this as a mere guess which happened to turn correct, but from a careful weighing of the probabilities of any such procedure proving successful.

We do not approve of habitual croaking about any invention or discovery claiming to accomplish important results, without the most thorough investigation, however inadequate the means may seem to the end sought. Indeed, we despise the chronic croaker as about the most dismal and doleful of all human companions. But this fact does not conflict with an honest avowal of one's convictions concerning a claimed discovery, especially when it relates to a subject to which he has devoted a life long study and which has been intimately interwoven with his own personal experience, as was the question of a possible cure for consumption on the part of the writer.

Having practically settled this very question in the affirmative forty-two years ago in our own personal experience and by a process of the most common-sense character, as well as one the farthest possible removed from that proposed by the German expert, we felt that we had earned an indefeasible right not only to predict a failure of the Koch lymph, but to utter a warning cry to the whole country, and especially to the medical fraternity, against placing any confident dependence upon such an unnatural system of treatment unaided by a most thorough hygienic regimen.

We not only knew from our own experience just what physiological conditions and hygienic processes were needed, in the very nature of cause and effect, to arrest tuberculosis and then drive its germs out of the system; but for a year and a half before the Koch lymph was mentioned, the very process which had been effective and had proved a permanent cure in

our own case, and which we had unfolded in our "Health-Pamphlet," had been doing its beneficent work in hundreds of families all over this land in arresting and breaking up the same disease.

The moment the Koch furor was started in this city under the most enthusiastic expectation of the medical profession, including the very doctors who have now publicly abandoned the lymph, we saw by observing and comparing all the cases that appeared in print, that the favorable symptoms occasionally reported were mostly fictitious, or at best more the result of mental healing on the part of the sanguine and hopeful sufferer than from any beneficial effects of the injected lymph. Indeed, we have our serious doubts if a single case was actually and directly benefited by these subcutaneous injections, and that if any did improve even temporarily it was for the reason we have named and in spite of the unnatural poison thus thrown into the circulation.

We invite the doctors who have thus abandoned the lymph treatment, after honestly and faithfully testing its merits, to look into the record of cures from our own original health process, hundreds of cases of which we have on file and scores of which have appeared in these columns.

A remedy that is in general harmony with nature's plan for the cure of one disease ought to be entirely consonant with every diseased condition to which the human system is liable. To suppose a system of treatment, like that of injecting the Koch lymph, could be specially applicable to one organic derangement but would leave other diseased conditions of the same body untouched, was full of objectionable misgiving from every rational standpoint.

Not so with the health-process set forth in our own hygienic discovery. On the contrary, to our own surprise, when the treatment first began to spread over the country not only incipient consumption, dyspepsia, constipation, kidney and liver troubles, all of which had been arrested and broken up in our own case forty-two years ago, but diseased conditions by the dozen, many of which are rarely heard of, were arrested as by magic and eradicated from the system. More than sixteen thousand voluntary testimonials describing cases of this kind have been received at the MICROCOSM office, and are still coming in from all over the civilized world until it became useless to try to find room for filing them.

But for the prejudice of the profession against any discovery that has originated outside of a regular medical laboratory, and which clusters around great names who happen to enjoy the favor of some crowned head with very little brains, the thousands of doctors who know of our hygienic system and who are successfully using it with their patients instead of drug-medication, would at once call a convention and pass resolutions in favor of its universal adoption and in opposition to the use of drugs except in extreme cases.

We believe that this time will come, and that too in the not far distant future, when, as we trust, some system may be devised for compensating the learned family physician for his services without making the absorption of poisons by the patient an increment of the services thus to be rewarded.

In the meantime our Health-Pamphlet is still finding its way into the most unfrequented nooks and corners of the civilized earth, by relatives and friends sending to such secluded denizens the gladsome news of what this drugless remedy has done for them when all other means had failed. As a simple matter of fact orders of this kind are still reaching us daily, without the least effort at advertising on our part, and that too in defiance of the almost frantic efforts of a dozen piratical scamps from as many different sections of the country, who are sending out counterfeits of our pamphlet at reduced prices, thereby trying in vain to reap a part of the glorious harvest. But these miserable thieves forget that financial lightning "does not strike twice in the same place," and that with all their dishonest efforts against such a widespread start of the original pioneer in the work, they can never expect returns sufficient to reimburse their outlay in advertising. Seven different pirates known to us have learned this fact by sad experience and have abandoned the field. The rest will soon follow in the same wake of inglorious failure.

(Continued from page 88.)

THE WAVE THEORY OF ACOUSTICS.*

BY GEORGE ASHDOWN AUDSLEY, F.R.I.B.A.

"We repeat, if this substantial view of sound-force be true, and if the wave-theory be false, we would naturally expect to find some sounding bodies of a given size and of a given pitch, which would produce very little atmospheric disturbance, yet which would produce sounds of great volume and intensity, *the very thing which does actually occur in numerous instances.* Whereas, if the wave-theory be true, and the substantial view of sound-force be false, we would naturally and of necessity expect that every vibrating body of a given size and of a given pitch or vibrational number, having the same amplitude of swing, would produce the same uniform loudness or intensity of sound, since it must of necessity produce the same condensations and rarefactions of the air—*the very thing which does not take place in instances without number.*

"Hence, we reach the irresistible culmination of these premises in the following general conclusion, namely:—If we can, by careful observation, find certain sounding bodies which, at a given pitch, vibrate with large amplitude of swing, thereby causing (according to the common notion) great disturbance of the air, but producing almost no sound at all, and which sound is not audible a distance of ten feet in a still room; then, again, if we observe certain other sounding bodies of the same pitch which produce an almost deafening sound while in close proximity, and which can readily be heard a mile away, *but whose amplitude of motion or vibratory swing is so slight as scarcely to be seen by the naked eye, and consequently which produces almost no motion of the air,* then it follows by mechanical, mathematical, and philosophical demonstration that sound does not consist of air-waves at all, and has nothing to do with atmospheric disturbance, as universally taught, and consequently that the present theory of acoustics hopelessly breaks down. Is there a logical and fair-minded man on earth who would not accept this general conclusion, provided the premises as stated were shown to be correct?"

I have both logical and fair-minded men in

*A Paper read before the Members of the South Eastern Section, London, England, November, 1890.

my audience on the present occasion—What are your opinions, gentlemen?

"Now, for the overwhelming truth of the premises, the following facts may be given. A tuning-fork, for example, held in the fingers, or a wire stretched over rigid supports, when caused to vibrate at its best, and swing to and fro with an amplitude of a full sixteenth of an inch, *can not be heard more than six or eight feet away in a still room*, notwithstanding the powerful condensing effect such large vibrations must have on the air; while a tiny locust, familiar to almost everybody in the United States, weighing not one hundredth part that of the fork or string named, and with a vibrational tremor invisible even when in close proximity to the insect, will sit on a green leaf, and send forth sound almost deafening to the bystander, and *which can be distinctly heard at above a mile in all directions*, as Darwin himself admits in his work entitled, 'The Variations of Animals and Plants.' Thus a sounding body with not one hundredth part the mass and with but a small fraction of the mechanical action on the air caused by the tuning-fork or stretched string, actually produces a range of sound more than *eight hundred times greater*, and a volume of sound filling more than *eighty million times the cubical space*."

Gentlemen, after a statement of these simple facts which are open to your daily experience, I might pause for a reply. I shall not so waste time, but I call upon any wave-theorist in this room, or in the world, to logically and scientifically reconcile these incontestable facts with the teaching of the wave-theory, whose law, as given by one of its high priests, is that "*the distance through which the air-particle moves to and fro when the sound-wave passes it, is called the amplitude of the vibration. The* INTENSITY *of the sound is proportional to the square of the* AMPLITUDE." ("Sound," p. 11.)

Let the enthusiastic wave-theorist bear in mind Professor Huxley's great rule of logic in examining hypotheses. He says—"Every hypothesis is bound to explain, or at any rate not to be inconsistent with *the whole of the facts* it professes to account for, and if there is a single one of these facts which can be shown to be inconsistent with (I do not mean merely inexplicable by, but contrary to) the hypothesis, *such hypothesis falls to the ground*—it is worth nothing. One fact with which it is *positively inconsistent* is worth as much and is as powerful in negativing the hypothesis as *five hundred*."

Now this rule of logic puts the poor wave-theorist in an awkward fix; and until he can show that the facts I have just mentioned in connection with the loudness of sound is consistent with his hypothesis, he will remain in that fix; with Huxley's words ringing loudly in his mental ears—"One fact with which it is positively inconsistent is worth as much, and is as powerful in negativing the hypothesis as five hundred!"

Dr. Hall says—"We do not pretend to assert that no scientific investigator has observed the fact that insects are capable of issuing sounds of great volume and that can be heard to a very great distance. They have, on the contrary, often observed this fact, but believing in the wave-theory, as they did, it is not surprising that they have made no attempt to solve the problem, since manifestly a true solution, had it been struck, would have annihilated that theory, as has just been shown.

"One single exception to our statement, however, occurs. Daniells, in his great text-book—'Principles of Physics'—does actually state the problem and attempt a solution. At page 380 he declares that the reason why insects are heard so far away *is on account of the great number of vibrations they are capable of producing in a second!* But had this distinguished physicist thought for a single moment he could have known that the number of vibrations relates alone to *pitch*, and has nothing in the world to do with *loudness* or *intensity;* while it is a fact that the locust, which is heard further away than any other insect, *gives the loudest part of its strindulation at a key of less than 1,000 vibrations a second?* Being totally in the dark, however, on the true nature and cause of sound, Daniells became bewildered by a mystery which can only be explained on the principles of Substantialism (not yet heard of by that scientist when writing his book) and, as a consequence, he wildly mistook the true cause of pitch (rapidity of vibration) for that of intensity! He never realized, in his confusion, that the number of vibrations which a sounding body makes in a second, relates entirely to its pitch, having nothing whatever to do with the loudness, volume, or range of its tone.

"Had Daniells been aware of the true nature of sound, as a substantial but immaterial force, having no more to do with the amount of atmospheric disturbance incidentally produced by the sounding body than the substantial electric current has to do with the incidental disturbance of the air caused by the motion of the dynamo-machine, he would have realized that instead of an insect being heard a mile on account of its great number of vibrations, *some insects of the very highest sensible pitch produce tones so faint as not to be audible half a dozen feet away?* If the great number of vibrations in a second is the cause of the intense sounds of some insects, as this highest authority in physics declares, *why, then, are those insects with the sharpest possible key, requiring more than 10,000 vibrations a second, limited to a few feet of range and intensity?*

"The truth is, this very blunder of Daniells in attempting a solution by giving the well-known cause of pitch as the cause of intensity, is an absolute confession that our argument as presented against the wave-theory of sound is unanswerable, and that the volume and loudness of the sound of the locust has nothing to do with the disturbance which that insect is capable of producing in the air."

I may say, much as Dr. Hall has said, Gentlemen of the Colleges—you who are still teaching the wave-theory, just as if neither a difficulty nor a question had been raised against it,—it is expected of you, and I trust the members of this Society will call upon you, to meet the argument I have advanced, or to honorably admit your wave-theory to stand defeated on one of its basic principles. If you will still keep the silence which has hitherto marked your scientific cowardice, I earnesly hope that every examining musical body in England will follow the honorable lead of the College of Organists, and strike out all acoustical questions from their examination papers. Musicians, who alone have consecrated sound on the altar of art, can, at all events, protest against its degredation at the hands of scientific acousticians and transcendental mathematicians.

(To be continued.)

DEATH.

BY ISAAC HOFFER.

"Seeing that death, a necessary end, will come when it will come."—SHAKESPEARE.

Webster defines death to be "that state of being, animal or vegetable, but more particular of an animal, in which there is total or permanent cessation of all the vital functions, when the organs have not only ceased to act, but have lost the susceptibility of renewed action."

Why is there a total and permanent cessation of all the vital functions? And why have the organs lost the susceptibility of renewed action? Is the cause of this cessation of functional operation, in the organs, or the organic combination, or is it in the vital energy? Are the organs and the organism the source from which vital energy and functional operations proceed, or is vital energy the vivifying power that vivifies the organism and produces the functional operations?

To get at the foundation of death we must get at the source of life. There are different theories as to the source of life upon the earth, among which special creation, and biological evolution are the principle.

Neither of these theories is sustained by any known existing laws of nature. The former has this in its favor, that it is about the way man would do it, if he had the power, and that it avoids the difficulty of developing a child from the seed without vital sustenance.

The latter has against it first, the negative attested and admitted fact, that matter does not produce life of itself; second, that insensate forces, and their interaction with matter, have never yet in a single authenticated instance produced sensitive life; third, that life has never been developed, within the knowledge of man, without a vital germ of previous life nurtured and developed by the female life. And it has against it the positive evidence that every known plant and animal, including man, as far back as the records of man's knowledge go, has been the product of previous life. There is no organ in the human body that was not developed by vital energy. Human life is the essential and the only power that ever developed a human organ and produced a human organism. Life existed in the germ of every human being before the organs of the body were formed, and it would be a self-stultification to hold that the organic power that formed the organs was produced by the organs before they had any existence. There is no rationality, and no consistency with the known laws of nature, in the thought that the material in the seed is the acting organizing energy, or that this energy is the effect of material molecules in action, or that there is any action in molecules without some acting moving cause. When this moving cause ceases to act in the human body, then, there is a "total and permanent cessation of all the vital functions, and the organs have lost their susceptibility of renewed action." Immediately after death the organs and organism may be in a perfect state, but there are no more functional operations or organic actions. The vital energy—the vivifying power is gone. This energy—this power can not have been in the material that constituted the body, nor in the organic combination, the form, or the condition of the material, or else it would not have lost its power of action while the body remained in its complete organic form.

The theory that life has but one source, and that therefore man can not be a dual being, is true as to the theory, but erroneous in the conclusion. Life is an individualizing energy, and man is the product of that energy, and is composed of material substances vivified and characterized by the human life, and organized into the human form, and is a dual being in so far that his body is matter of this earth, and his life and mind are immaterial energies from a vital and mental source.

As far as man can trace life, or even his own life, towards its source, or towards his appearance upon the earth, he meets everywhere life back of the remotest point he can reach. And if he looks through the mists of ages into the darkness of the advent of life, even of human life, upon the earth, the logic of reason, and the logic of universal and unchanging law point still with unvarying directness towards a knowing living energy as the only possible source of life and mind. Vital and mental energy can not create matter out of themselves, nor out of nothing, and matter can not generate or evolve life and mind out of its own substances.

The material substances of the body at death return to the earth, the source from whence they came, but not until the active principle—the organic agent—and the knowing-life are no longer present. The body with all the material substances still remaining in a perfect human form, and in a fully organized condition, has lost its vital and its organic action. It has lost all that formed, developed, and sustained a human being; all that gave it life, energy, knowledge, and powers of exertion, direction and control, all that constituted it a human being; and has left nothing but inert material substances in the human form, and this wholly in the power of chemical agencies of dissolution and redistribution.

It is not possible to look at the dead body of a friend without seeing, and painfully feeling, that your friend is not there. All that endeared him to you, that made him worthy of your friendship, and all that constituted him your fellow-being, is gone. The dead body is not your departed friend. It is for the knowing, the appreciating, and reciprocating friend, and not for the dead body that you mourn. You feel and you know that the dead body before you is not your friend; your senses and your reason tell you that all the essential characteristics of your friend, all that made him a being of life, of intelligence, of energy, and of activity, is gone; and every rational consideration, every logical deduction, and every philosophical conclusion confirm the position *that your departed friend, and not his material body, was the real man, the Substantial entity, the elementary energy, and the indivisible and unchangeable part of his duality.*

What remains at death was dead matter before it became a part of the body. No living substance can be absorbed into another living body. Everything, therefore, that constitutes the material body, had to be dead substances utterly decomposed, before they could be assimilated, vitalized and organized. A living body, therefore, is composed of dead decomposed matter vitalized, and is dead matter as soon as vital energy ceases to act. It is evolved out of dead matter and ends in death and dissolution.

Life is not evolved, is not composed of different substances or of constituent parts, and,

therefore, is not divisible nor dissolvable. It is a transmitted energy, it comes from life and has nothing of death in itself. How it was introduced upon the earth, and became associated with matter, nature does not show; but how life is perpetuated and continued in association with matter is everywhere manifested under the unvarying law of transmission and reproduction.

Life is an invisible intangible energy of individualized and characterized forms that may be materially represented in plants and animals; and the death of a plant or animal is simply the withdrawal of the acting vivifying energy that gave it life. The material substances that constitute the body resume their normal inert condition, and, what of the vital energy and the knowing life of man? Can life die? The question itself suggests a contradiction in terms.

It is an admitted fact that matter is indestructible, that something can not come to nothing; and if the knowing life of man is a reality, an entity, then it comes under the law of indestructibility; and as it is an energy of individualized and characterized forms, not composed of constituent parts, not evolved in any sense, but is a complete whole transmitted by life, it can not be dissolved into parts, it can not be changed into something else, but must remain an individuality, and according to the laws which govern the material part of man at death, must return to the source from whence it came with all its elementary energy unchanged, as the material substances of the body are returned to their source without any change in their essential properties.

The law of indestructibility prevents annihilation, and makes it impossible for something to pass into nothing. The law of stability in elementary forces and substances forbids the death of life and of living intellectual energy, and assures the endless continuance of the knowing-life of man with all its elementary powers and characteristics unchanged. The law of individuality in life permits of no change in the distinctive characteristics of elemental forms of vital and intellectual energy, and thus secures to each soul the sure preservation of its individuality under all states and relations.

The question sometimes raised, whether the knowing-life is not only the effect of molecular and organic action, and not a reality, not an entity, is one which involves many irreconcilable contradictions, and is based upon a hypothesis and not upon known facts and laws. All questions of whatever kind and nature are raised in the mind, all discussions, including those of life and mind, are solely the operations of the knowing-life; and when this knowing-life by, and through, its own actions denies its own real and entitative existence, it perverts the order of its own actions, and of all the laws of activity. It makes the effect the cause, and the cause the effect; gives the power of the cause to the effect, and makes the effect the controlling power of the cause.

It makes the cart push the horse, instead of permitting the horse to pull the cart.

The fact that the knowing-life at death passes away unseen, unheard and unperceived, by even the closest watching, is no evidence whatever that it has come to an end, or passed out of existence, or lost its individuality, or its elementary powers and attributes; for life and mind are invisible, intangible energies that can not be apprehended by the senses. No one can see the vital energy in his own body, not even the vital action, for only the effect produced in the material body can be seen. Nor can any one see the mind, or the mental operations of another, unless they are manifested through the material organs. The senses can not take cognizance of gravity, attraction, repulsion, or any of the forces of nature; only the effects of their action in matter can be perceived. What a person can perceive of the knowing-life of another, is the effect of its action in the body. The vivified appearance of the body, and the manifested activities of the mental energy, are what we constantly see, hear and perceive in each other; and these constantly present *effects* are all that can be perceived, by the senses, of the knowing-life. And the fact that these familiar effects are all that can be thus noticed, misleads the mind and gives the actual appearance that death ends all; and so firmly becomes the impression of this appearance fixed in the mind, that it is difficult to comprehend clearly, and appreciate fully, the true relation of cause and effect in vital action, and the logical and inevitable result of death, as clearly indicated by the facts and laws of nature.

Apparently each child has its origin in the seed, and its beginning as a perfected, though not fully developed human being at birth; and so strongly is the impression made upon all persons, that the birth of a child is the origin of an entirely new life, that it is almost impossible to keep in view the well-known fact that this new life was evolved out of previous life which reaches back beyond the grasp of human comprehension; and that there never has been an intermission in the continuity of life. The birth of a child adds a new link to the chain of life; a chain that never had a break, for no new life was ever produced, that had not a continuous unbroken connection with the source of life. Each life is an individualized and characterized form of continuous life, and is linked to the great source of life, just as the material substances in the seed and body are connected with the matter of the earth—the source from whence they came; and it is but a rational conclusion, perfectly consistent with the laws of nature, that the knowing-life, and the passive matter, should at death each return to the source from whence they came, and with which they are connected. The former to return in the individualized form, in which only it is known, with the vital-intellectual energy unchanged, and the latter in its dissolving state with its elementary substances unaltered.

Death is a natural process, a necessary ending of the union of life and matter, for neither are in a normal state in this union; and there is no loss and no change in any of the elementary properties and characteristics of either at their separation.

The only change is the total cessation of vital and mental action, and the total disappearance of the effects of this action. This is all that the closest observation of the process of death reveals. There is no disappearance of any thing that the senses could apprehend in the living body, except the effect of vital actions and of mental manifestations. That these vital actions and mental manifestations were the effects of vital and mental energy, and not of a force generated by material substances, is so self-evident as not to admit of a rational doubt, and is corroborated and substantiated

by all the laws of activity in nature. Without an acting or moving force there can be no action and no movement, and without resistance to action or motion there can be no effect and no result. A motion of the hand moves nothing and produces no effect unless it meets something.

Death is a great and important change. It ends the earthly career of man, leaves the body a useless, worthless, decomposing mass of matter, and the knowing-life to pass away without any visible tangible provision for the future.

This should, however, be no cause for worry, for in an immaterial or spiritual state man wants no material provisions. Even in this world it is not all of life to eat, drink and exist.

There are mental operations which are of the highest importance in making life worth living for. Take away the powers and operations of the mind, and what is left that is worthy of a human being's effort or desire to live? There is no difficulty in perceiving that a spiritual life needs no material substances for its support.

The conditions of human life in this world have been amply provided for. Every vital necessity of life, and every mental requirement of mind, from the first appearance of man upon the earth to the present time, have been fully provided for in nature. Man had nothing to do with his own coming upon the earth, nothing with his own capabilities of physical growth and intellectual development, nothing with the conditions and environments necessary for his existence, for his physical growth and comfort, and for the exercise and development of his mental faculties. These are matters beyond man's power to produce or control.

If we see that such ample provision has been made for all the conditions of life and mind for the brief existence of this earthly life, should we not trust with the fullest reliance that the same ample provisions are made for all the conditions of the knowing-life in a future state after its separation from the material body.

If these facts of the past can be any guide for the future, and if the immutability of the laws of nature can be relied on, then we have the comforting assurance that the same abundant provision is made for the continuance of the knowing-life of man after death, as there has been for its earthly existence.

"THE CHRISTIAN STANDARD."

BY THE ASSOCIATE EDITOR.

In the February number the readers of the MICROCOSM were notified that the attention of the editor of *The Christian Standard* had been called by Eld. Thomas Munnell, our old and valued contributor, to the claims of Substantialism in meeting the atheistical reasoning of materialists of the Hæckelian school, requesting the *Standard* to show the fallacy of such claims if possible or make such other comments as might be deemed justice toward the system of philosophy making such claims.

Attention was particularly directed to an article published in the first number of Vol. VI. of the MICROCOSM as setting forth these claims in a definite and forcible manner, to which the editor of the *Standard* pays his respects as requested, but we are led to believe in a very different manner from what was expected.

The article is an insinuating attack upon our work with which that paper has not lately had any sympathy, and shows the writer to be ignorant of the fundamental teachings and principles of the Substantial Philosophy as well as of the wave-theory as we will clearly show further on, and it also evinces a complete absence of the slightest philosophical ability in carrying out accepted results to their legitimate and unavoidable conclusions. Under such circumstances as these we could hardly expect any different rejoinder from that expressed by the following extract from the *Standard:*

"DOUBTS EXPRESSED."

"A brother—an able minister—for whose judgment on religious subjects we have much respect, calls our attention to an article in the MICROCOSM, by the associate editor, Robert Rogers. The aim of the article is to show the importance of the so-called Substantial Philosophy to Christian ministers. It will be remembered that the modern founder of this philosophy is Dr. A. Wilford Hall, of New York, and that his philosophy finds authoritative utterance in his book called *The Problem of Human Life*, which is a remarkable book—a very remarkable book indeed. There is nothing in the English language that can approach it *in some respects*.

"The Substantial Philosophy claims that sound is a *substance*, and that, therefore, when you speak, or ring a bell, or make a noise of any sort, an attenuated substance proceeds from the sounding instrument and fills the air as far as the sound is heard, if not farther. It is claimed that this philosophy—which teaches that heat and light are also substances—meets the atheistic and materialistic teaching of the times as nothing else can do. But we will give a liberal extract from the article in the MICROCOSM that its high claims may be seen. After stating that the scientist Hæckel, and others, claim that mind, life, soul and spirit are but the vibratory motions of the material molecules constituting the brain and nerve system, Mr. Rogers says:

"'That, however, which constitutes the invulnerable character as well as alarming religious aspect of this assumption of the materialist is logically based upon the scientific teachings of all the Christian colleges in the world as set forth theoretically in their text-books, in which the various forces of Nature, or at least many of them, are defined as but modes of molecular motion, which signifies the mere vibration of material particles, such as those of air, ether, or solid bodies.

"'Why,' exclaims Prof. Hæckel, in stating this aggressive argument, 'if sound, light and heat—forces of Nature whose phenomena are so sensibly observed—are but the varied motions of material air and ether particles, as physical science inculcates, why have I not a right to assume and teach that mind-force, life-force, and psychic-force are also but modes of motion of the material particles of the vibrating brain and throbbing nerves?'

"'By every system of analogy, and according to every principle of scientific ratiocination, insists Prof. Hæckel, if the forces of heat, light and sound, are but the vibratory motions of matter in various degrees of density and tenuity, then mind-force, life-force and soul-force, are justly and rationally explicable only on the same scientific basis of reasoning, as but the vibratory motion of brain and nerve molecules. On this impregnable foundation of natural analogy and intrenched behind these formidable walls of logic, the German and English materialists have finally taken their stand, and now boldly defy religious philosophers to jostle them a hair's breath by any argument they may bring, *so long as the science of the schools stands unimpeached.*

"'If sound, heat and light, says Prof. Hæckel, are only modes of motion and in no sense substantial forces of objective entities, then away with your religious nonsense that my life or soul or mind or spirit, which exhibits analogous material phenomena, can be anything more than a corresponding mode of molecular vibration! And if sound, heat and light, as the mere motions of matter, absolutely cease to exist the instant the vibrating particles come to rest, then (continues this invincible German materialist) the soul, life, mind and spirit, as analogous motions of brain-matter, must likewise cease to exist at death, when the brain and nerve molecules cease to move, and therefore that death, logically and unavoidably *ends all!*

"'Such was the aspect of scientific and religious philosophy when the editor of this paper hurled *The Problem of Human Life* like a thunderbolt from the sling of Jove into the defiant ranks of German and English materialists. The religious philosophers of both hemispheres, who had come seriously to face this triumphant argument of the materialists, stood absolutely appalled at its overwhelming conclusiveness against all scientific evidence favoring a future life.'

"Touching these words a few remarks will be in order. It will be noticed that Mr. Rogers, in one paragraph,

professedly gives a direct quotation from Hæckel, and following this are two paragraphs professedly giving Hæckel's arguments. These arguments are prefaced thus: "Prof. Hæckel insists" and "Prof. Hæckel says," and then it is asserted that "the religious philosophers of both hemispheres * * * stood absolutely appalled," etc.

Now, we propose to raise a few questions.

1. Is it true that Prof. Hæckel ever wrote the language attributed to him in the foregoing extract?

2. Is it true that he ever used the *arguments* that the extract credits him with using?

3. Is it true that the religious philosophers of either hemisphere stood appalled at the arguments referred to?

If Mr. Rogers will kindly name the book and the pages on which Prof. Hæckel writes and reasons as quoted he will oblige us. Neither the style of the writing nor the character of the arguments becomes Hæckel well. The thing is in great doubt. Then some reliable history reporting the consternation caused by said arguments will be in order. That Hæckel's real arguments are not easily answered from a scientific standpoint is well known, but the arguments attributed to him in the extract are not of any force whatever. Let it be granted that the *sound* made by striking a bell, for instance, dies out of existence in a minute, it does not follow that the human spirit that guides the stroke does not live on forever. A *spirit* that thinks, loves, hates, fears and worships is more than a *sound*, more than the result of the motion of material things. We do not need to prove that sound is an everlasting substance in order to sustain the revelation of the future life given in the Scriptures. If we could prove that when a bell is tolled the sound spreads as a substance through the air as far as it is heard and endures forever, this would settle nothing as to the future conscious existence of any living thing.

It is well known that sound is not "a mode of motion," but an impression made upon the mind, through the ear, by vibrations or motions of the air, or other conducting medium. When the impression ceases the sound ceases; *for the impression is the sound*, according to current philosophy. If any one thinks that because a given *sound*, or impression on the mind, ceases to be, "therefore that death logically and unavoidably ends all," he ought to cultivate his reasoning faculties, if he has any to cultivate. To attribute such reasoning to "the invincible German materialist" is not wise or right. What analogy between a thinking spirit and a sound or impression that comes upon it through one of the organs of sense?

In the first place we will show that this doubting critic has never yet studied the Substantial Philosophy sufficiently to understand even its primary law of distinction between material and immaterial substance.

He quotes Dr. Hall's philosophy as claiming that "*an attenuated substance* proceeds from the sounding instrument and fills the air as far as the sound is heard, if not farther."

If ever any one point has been made plain in the writings in this journal for the past eight years, both by the editors and contributors, it has been that the forces of nature are not in any sense material in their composition; not even to the finest shade of attenuation, but that being of the immaterial realm they are of an entirely different order of substantiality, being analogous to the immateriality but none the less substantiality of the mind, soul and spirit. The great endeavor of Substantialism has been to prove that by any system of logical and consistent scientific reasoning, all these varying incorporeal phenomena must be placed within the same realm, and that any difference which may exist between them is one of degree or complexity and not of natural constitution; while on the other hand, matter stands absolutely apart, forming another realm which is as different from force as the soul and mind are from inorganic substances.

There is no excuse after so much has been written on this subject for the culpable ignorance shown by this critic; we do not believe that this statement will be thought by our readers unnecessarily severe.

In a consideration of the nature of *matter* and *force* as the constituent elements of the universe, we are compelled, in order to be logical and consistent, to realize that there is between all the various manifestations of either element an underlying alliance or connection. We mean by this, that in the material realm there is a continued and direct connection between all its various phases, and that all its conditions, whether in the fluid form of simple hydrogen gas, or in the liquid form of water, or in the solid form of the diamond, any or all of these forms can be referred back to the primary condition of crude matter, which is the elemental basis running throughout the whole of the material realm. And likewise in the immaterial or forcial realm all the different manifestations of force in whatever phase presented, are analogous in their primary immaterial nature, and whatever difference exists, which is productive of the various phases, is not in the inherent constitution of such immaterial substances, but simply signifies a degree of complexity or modification of the elementary immaterial basis. Granting this, the conclusion is evident that if the primary condition or underlying basis of force or of the immaterial realm is shown to be evanescent in its existence or dependent upon the precarious and vacillatory motions of matter, then all the various phases or manifestations of this realm must be included in the same condition of dependency and uncertainty from the physical forces of sound, light, heat and magnetism, to the mental and spiritual forces of life, mind and soul.

All systems of scientific investigation recognize the necessity of this logical continuity in their philosophies concerning the physical forces of nature as well as the more refined organic forces, such as life, mind, soul and spirit; and with the result that the modern theories of scientific teaching being founded upon a materialistic and dynamical basis, the chief exponents of such theories together with those who exercise the consistency, which should characterize such investigators, to its ultimate conclusions, are forced to admit themselves to be in the same condition of infidelity concerning supernatural conditions of any kind. And all who teach these materialistic and motion-theories of science can be compelled by the necessities of consistency with their scientific foundations, to apply their doctrines to all the conditions which make immortality at all a reasonable probability, and so far as we are able to see such teachers can not possibly steer themselves clear of the atheistical mælstrom.

The *Standard* doubts the correctness of our quotation from Hæckel, but this doubt is simply a quibble upon words. As the readers of the MICROCOSM know this language has been used in this journal since its commencement and frequently in different forms, simply to give in gross the teachings of the German materialist, and these quotations can easily be upheld by even a casual study of Hæckel. Our object was to give the spirit of the German scientist's position without particular respect to the phraseology employed, a method which is adopted universally by literateurs, and which is never called in question when the spirit of the quotation is correct. The same plan is adopted daily in our conversations. In quoting a person we are not particular to mention exact words, but meet all the requirements of intelligence and honesty if we do no violence to the meaning of the person quoted. But the *Standard* editor being forced by the circum-

stances to say something, and not having the manliness and honesty to confess his inability to find any flaw in the argumentative part of the article in question, with that meanness which can only find its root in his own heart confines his attention to a point which is of no import whatever, as he should have known, and attributes dishonesty to the writer of this article and to Dr. Hall, when he might easily have seen by the quotations which we took the trouble to send to his assistant, that our language was not half strong enough to represent the positive current of infidelity and unbelief running through Hæckel's writings as the result of his belief in the materialistic theories of science. We here quote a few out of dozens of passages which might be cited, in order that our readers may see the smallness and meanness of the *Standard's* quibble:

* "*The life of every organic individual is nothing but a connected chain of very complicated material phenomena of motion.* These motions must be considered as changes in the position and combination of the molecules, that is, of the smallest particles of animated matter (of atoms placed together in the most varied manner). The specific definite tendency of these orderly, continuous, and inherent motions of life depends, in every organism, upon the chemical mingling of the albuminous generative matter to which it owes its origin." P. 199.

"The origin and development of the egg-cell in the mother's body, *the transmission of the bodily and mental peculiarities* of the father to it by his seed, *touch upon all the questions which the human mind has ever raised about man's existence.* And, we add, *these most important questions are solved*, by means of the Theory of Descent, *in a purely mechanical and purely monistic sense!*" Pp. 200-201.

"All these phenomena, considered in connection, clearly prove that the *transmission of bodily and mental peculiarities is a purely material and mechanical process.* By propagation a greater or lesser quantity of albuminous particles, and together with them the individual *form of motion* inherent in these molecules of protoplasm are transmitted from the parental organism to the offspring. *As this form of motion remains continuous*, the more delicate peculiarities inherent in the parental organism must sooner or later reappear in the filial organism." P. 202.

As the result of such materialistic ideas concerning the existence of life and the forces of nature the ultimate conclusion must, in the nature of things, be as expressed in the following quotation:

"As soon, in fact, as, according to this theory, we acknowledge the exclusive activity of physico-chemical causes in living (organic) bodies, as well as in so-called inanimate (inorganic) nature, *we concede exclusive dominion to that view of the universe, which we may designate as the mechanical, and which is opposed to the teleological conception.*" P. 17.

"*Hence, by our theory the mystic veil of the miraculous and supernatural*, which has hitherto been allowed to hide the complicated phenomena of this branch of natural knowledge, is removed. All the departments of Botany and Zoology, and especially the most important portion of the latter, Anthropology, becomes reasonable. *The dimming mirage of mythological fiction can no longer exist in the clear sunlight of scientific knowledge.*" P. 11.

After these quotations there certainly can be no "doubt" as to the position of the "invincible German materialist," nor can there be any "doubt" even with the Thomas of the *Standard*, as to our fair representation of his argument, as he includes life and mentality within the scope of his materialistic deductions and logically and consistently says, that "*as soon, in fact, as according to this theory*, we acknowledge the exclusive activity of physico-chemical causes (simply mechanical motions of matter) in *living bodies*, as well as in *so-called inanimate nature, we concede exclusive dominion* to that view of the universe, which we may designate as the *mechanical* and which is opposed to the teleological conception."

We thus refute the contemptible "doubts" of this carping critic, who can see no honesty of purpose nor understand any system of science which has not its origin in his own circumscribed cranium.

We now come to the real question at issue. Is a belief in the Biblical doctrine of the immortality of the soul at all affected by scientific and philosophical teachings? We believe that it is. We believe further, that the day is fast passing when *faith*, pure and simple, will be sufficient to uphold any system either of scientific or theological belief. Faith was an absolute necessity in the primeval conditions of human existence, in much the same sense as *faith* or acceptance upon simple authority is an essential element in the life of every child, but proportionately as knowledge is attained by the child, the acceptance by faith diminishes, and so it is with mankind in general.

Many of the superstitions of antiquity which were accepted by our forefathers without the slightest reason therefor, have been rejected and are being rejected each day as new light is being thrown upon the phenomena of nature. This is true in the theological as well as in the scientific departments of thought, and this experience will continue on until the end of time, and the phenomena of either science or theology which place their dependence and their defence upon the pure and simple faith of humanity, unassisted by philosophical reasoning, will sooner or later take their places among the mythical delusions which are continually being relegated into obscurity.

This fact, which is conclusively proven by the history of the times, indicates the necessity of a correct system of scientific and philosophical research, as upon this is largely dependent the future position of humanity to the truths of religion, which we now hold sacred, and this is the reason why so much space in this journal is devoted to the discussion of the nature of the physical forces. We feel that if the materialistic systems of philosophy are adhered to, the result upon mankind in general will be similar to that already produced upon the leading exponents of these systems, nearly all of whom are materialists; witness Hæckel, Huxley, Tyndall, Spencer, Darwin, etc., etc.

These men are logical and honest reasoners who are simply carrying their scientific philosophy to its ultimate and unavoidable conclusions concerning the creation, the existence and the end of man.

(To be concluded next month.)

* All these quotations are from Hæckel's *History of Creation*, Vol. I.

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The Microcosm

A MONTHLY JOURNAL OF SUBSTANTIALISM AND COLLATERAL DISCUSSIONS.
THE ORGAN OF THE SUBSTANTIAL PHILOSOPHY.
A. WILFORD HALL, Ph. D., LL. D., Editor and Proprietor.
(Author of the "Problem of Human Life," Editor of the *Scientific Arena*, &c., &c.)
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CAN MAN EVER IMITATE THE BIRD IN MECHANICAL FLIGHT?

BY THE EDITOR.

At no time in the history of the world has there been so much discussion and excitement among inventors and mechanical investigators as at present, concerning the possibility or impossibility of man navigating the air by mechanical means alone. Not a week now passes but some announcement appears in the papers of a new flying-machine that has been invented and which is soon to astonish the world by starting on its aerial flight.

True, most of these devices are based on the principle of supporting the weight of the apparatus and the navigator by some form of balloon charged with gas; while one inventor recently conceived the original idea of employing a vacuum-balloon in order to get something still lighter than gas, not dreaming of the fact that such a shell, to avoid the danger of collapse, would have to be so thick and strong as to make the machine itself many times heavier than the air.

The first practical device for navigating the still air by means of a balloon was the one invented by Prof. Charles F. Ritchell, of Bridgeport, Connecticut. It was a cigar-shaped silk bag, which, when filled with hydrogen gas, would exactly support the weight of the propelling and steering apparatus with a man of eighty or ninety pounds to work the machinery. Being, as thus combined, exactly of the weight of the air, a very slight effort by a suitable system of screw-propellers would suffice to raise, lower, rotate or move the machine forward or backward in any direction in still air. But to navigate the outdoor air, subject to the contingency of varying and sudden changes of current, was a very different thing even with this the smallest practicable device of the balloon kind possible to be employed. How much more impracticable must be the control of a balloon of sufficient size and buoyancy to carry passengers from city to city, and support a steam engine for propulsion, as a vast number of impracticable cranks have proposed to do at various times ever since the brothers Montgolfier constructed their first balloon more than 100 years ago!

Recently, however, the flying-machine mania has taken another and very remarkable turn. Quite a number of scientific investigators of considerable eminence, as by concert of inspiration, seem to have been struck by the sudden impulse of the possibility of flying by means of suitable soaring or kite-shaped sailing devices propelled by steam or other motive power, and without any support from gas or hot air whatever.

The first prominent advocate of this scheme was Prof. Langley, Secretary of the Smithsonian Institution of Washington, who boldly announced such a project in an address delivered before the National Academy of Sciences at its recent sitting in that city.

As proof that men will yet be able to fly by means of suitable sail-like planes, the professor urges the fact that eagles and turkey-buzzards when once at a considerable altitude can actually soar in circles and remain mechanically motionless, or without any flapping of the wings, even for an hour at a time.

The professor even intimates the novel theory that the higher the bird gets the more easily is it supported by the air without any mechanical motion of its own, a fact which seems flatly to contradict the physical laws in regard to the known density of the air and its consequent supporting power.

The truth is, Prof. Langley, like thousands of other superficial observers, has formed an entire misconception as to the mechanical method on which birds soar without seeming effort or apparent motion of the wings. Such birds, on the contrary, do more real and effective *flapping* than does the partridge with its audible whir; but instead of flapping with the entire wing, each individual wing feather does its work of beating the air, though so rapidly and through so short a space as to be practically beyond the observation of a person even

in a few feet of the bird, unless by aid of a powerful glass.

It is passing strange, to say the least, that an able scientist should reach such an unmechanical and absurd conclusion as that a condor weighing fifty or sixty pounds can soar in the upper and lighter air, performing circles in all relations to the air-currents, without any flapping or supporting motion!

Prof. Langley said in his lecture: "The air possesses elements of buoyancy which have not been recognized hitherto. There is no truth in the popular conception that a body heavier than the atmosphere *can not be suspended in that medium without motion.* A kite of sticks and paper is much heavier than the fluid which it displaces, *but it is sustained aloft.*" He then refers to the eagle and other birds which "remain poised in the sky upon extended pinions *motionless for hours together,*" etc., etc.

It is simply amazing that a professor who is capable of teaching physical science should not know that a "kite of sticks and paper" can not be supported in the air without motion, or in other words, without mechanical force. But this mechanical force is that of the wind, which by glancing past the lower side of the kite, held in a suitable angle by a string connected with the earth, is thus "sustained aloft" or even forced upward, alone by the mechanical action of such moving air-current. Let such wind instantly cease and how quick will the kite of paper and sticks come tumbling to the ground, unless the small boy at the other end of the string substitutes his own motion in a rapid run for that of the subsiding air!

Since Prof. Langley's lecture was delivered the *New York Sun* reporter has held a long interview with Mr. Maxim, a well-known inventor of electric light devices, etc., on this question of navigating the air. Mr. Maxim is another flying machine enthusiast, and has already about completed a powerful apparatus also on the kite or soaring principle, and without any supporting or buoyant aid from gas or heated air. According to the *Sun* report of the interview, Mr. Maxim's machine consists of a very nearly flat plane of silk, and metal ribs with which to stiffen it, with a suspended platform attached and so arranged as to keep this kite-frame at an angle inclining slightly upward—that is to say, the front end of the plane inclines above the rear about as one to fourteen.

The screw propelling device is attached to this platform and is intended to be driven by a steam engine of great power and of minimum weight. The fuel is to be petroleum to be first converted into gas and then to be directed against the boiler surface in 45,000 tiny jets.

The plane or kite portion proper is, as now nearly completed, 145 feet long by forty to fifty wide. Its two engines weigh 300 pounds each, and the entire apparatus, with fuel and water ready to "soar," will weigh about "6,000 pounds," and is intended to carry through the air at "100 miles an hour" an additional load of "8,000 pounds" of freight and passengers.

Reader, there is not the least doubt but that all this is seriously contemplated, and the farthest possible from a hoax or a jest on the part of Mr. Maxim, who gives his word of honor that he has already worked on the project for years, and has paid out in hard cash for the construction of this machine (now housed in a private park in England), the round sum of $45,000.

We know Mr. Maxim well, and have had the pleasure of examining in years past several of his useful and practical inventions. But we would not be frank nor friendly with an old acquaintance did we not here record the honest conviction that his $45,000 have been absolutely worse than thrown away. We say *worse*, because so much valuable time has also been wasted that might have developed many important inventions from such an active and energetic brain.

We do not mean to intimate that man can not yet contrive means to fly through the air by the application of mechanical force alone, or without the aid of gas for buoyancy. On the contrary we believe most firmly, and have for many years, that the time is not far distant when man will be able, by mechanical wings alone, and by his physical strength alone, to mount the atmosphere somewhat as does the sixty pound condor which is known to carry a thirty pound sheep in his talons.

There is not, we are satisfied, a bird or quadruped on earth as strong physically as a trained athlete in proportion to his weight,—that is to say, when his physical power is exerted in the direction of his greatest strength. It is only a question at the present time of the discovery of a simple mechanical principle by which this most advantageous line of greatest strength can be utilized in combination with the best and lightest form of apparatus, proportioned to its stiffness, for taking hold of the air.

For fifty years, almost incessantly, we have studied this question from every angle of consideration; and have investigated birds, bats, flying fishes and squirrels, besides studying the palæontological remains of pterodactyls and other species of flying saurian reptiles, some of them as heavy as athletic men, all in the view of reaching a probable correct conclusion as to the possibility of man ultimately mastering the air by his own physical strength.

From this long investigation we can only look with a smile of sadness at the puerile

suggestions such as those of Prof. Langley, and the worse than waste of money on such a ponderous monstrosity as that of our old-time friend Maxim.

The plain fact is, that the more formidable and powerful the apparatus is made in order to gain the supposed advantage of the great mechanical assistance of the steam-engine, the more is the whole affair exposed to the uncontrollable fury of the wind; while the smaller the flying apparatus can be made in order to do the work, and the more closely it can be confined to the flyer's own body without any superfluous weight and surface to catch the air-currents, while directing his efforts in the line of his greatest strength, the nearer will he come to playing the rôle of the bird and bat, and the sooner will be solved the problem of man's flight through the air by the same mechanical law which supports the bird.

Fortunately for the bird and other flying animals, their air-grasping apparatus was made a part of their own original selves, and was so adjusted as to work in the line of their greatest mechanical power. As man has been given the intellectual power already so to train himself physically as to be able to pull more than the best team of horses, to lift more than will crush the best horse to the earth, or to out travel in a six-day's race any animal in existence, so by the same intellectual supremacy we believe it to be his prerogative to do for his own body in the construction and adaptation of wings at least partially what nature has done for the bird, and thus, as we hope, he will in time be able literally to mount aloft "as upon the wings of eagles."

Set us down as another flying-machine crank if you will, but please note the prediction here made that while the great scientific cranks are recording their ponderous failures in defying gravity and the physical elements with screw-propellers, steam-engines, mammoth kites and queer-shaped balloons, the real flying athlete of the near future will slip upon the stage with his almost naked body closely harnessed to wings which, as nearly as his contour will permit, will adapt him to the work of the bird, when the reproach of Darius Green's lamentable collapse will be forever wiped out.

THE SUBSTANTIALITY OF LIFE.

BY J. I. SWANDER, D. D., PH. D.

The diligent and persevering student of the Substantial Philosophy needs not the information that while all force is one in its primordial essence, it is, nevertheless, manifold in its manifestations in the economy of nature. Well informed Substantialists are also in general agreement as to the correctness of the teaching that each one of these subordinate forms of force is also a distinct form of immaterial substance. It seems to have pleased the great Father of all to so ordain the variety of finite powers now manifesting themselves in the universe as to afford all rational creatures an opportunity to express their admiration in the language of the Psalmist: "O Lord, how manifold are Thy works! in wisdom hast Thou made them all."

These forces, in the way of general subdivision, have been classified into physical and biological. The biological may be distinguished from each other as vegetable, animal and psychological. In either section of this general biological domain life, "after its kind," is a form of force, a substance, an entity, and not the resultant of organization or the product of chemical play, as thoughtlessly assumed and ignorantly taught by philosophers of the materialistic school.

This reasonable assumption that life is a real substance, independent of any or all conditions of its manifestations in visible or material form, was the starting point and standpoint from which Dr. Hall wrote his masterly exposure of atheistic evolution. The correctness of that assumption was made clearly manifest as the theories of Darwin, Huxley and Haeckel were blown like chaff before the fanning-mill of "The Problem of Human Life." These men had perverted and dissipated their noble intellectual powers in their vain efforts to show that life, in its various gradations from the moneron to the monkey and from the monkey to the man, had been evolved from lifeless matter; and just as they were about to congratulate themselves upon their imaginary achievement the whole army of such men, monerons and monkeys, were driven from the field by the fire of this new artillery. The founder of the new philosophy announced the substantiality of life, and urged the truth of his proposition with such an array of evidence and reasoning that the fibers of evolution sophistry were soon brushed away before the resistless sweep of his power.

After the founder of this new system of thought and reasoning had advanced and defended the doctrine of the substantiality of life in the "Problem," it was discussed by himself and others in the pages of the MICROCOSM and *Scientific Arena*. Among the contributions bearing upon the subject there is one of great excellence in the October number of the *Arena*, 1886, by John Kost, LL.D., on "The Life Principle." That article is of great value in its corroborative testimony to the truth of Substantialism as it applies to biology, since it came from the pen of one so eminent as a lecturer in various medical colleges and so distinguished as an author of many valuable medical works.

All who have so far written upon this subject from the substantial standpoint agree with Dr. Hall that finite life must necessarily have come from a pre-existing fountain of life. See "The Problem," p. 472. It is also evident that created life can have no existence as such, except in some organic form. It can not hold its proper being as a mere quantity of elemental substance. The organism is as indispensible as a condition of finite life as the pre-existent infinite is absolutely essential to the genesis thereof. This is especially true of human life. Man is the highest form of the organism in nature. We can not conceive of his having a normal existence in an unorganized or disorganized form. He is more than a quantity of vital force in a lump of matter. He can live and move

and have his proper being in no other form than that of an organism. Disorganization is dissolution, and the dissolution of an organic being is practically its destruction or discontinuance under its proper form and in its proper realm.

Continuing on this line of thought it is correct to say that there was no vegetable life on earth prior to the existence of plants. The vegetable seed is a plant in germ or an organism in embryo. Neither was there any fully developed animal life before the existence of animals. So, too, as regards human life. Humanity never had a real and actual existence in the abstract. Human life became an actuality only when the Creator willed and spoke it into existence in the form of a human person. Humanity never became until man became a living soul.

Passing by the old theological controversy over Creationism, Traducianism and Emanationism, the writer reiterates the position taken in his "Substantial Philosophy," page 242. Under one view each living individual is a distinct creation. After creating the first parents or progenitors of each distinctive species by a creative act of his sovereign will, through the creative word of his omnipotent power, God now carries forward, in the form of providence, his creative work through the agency of such progenitors. Hence, living beings are still created, though mediately. This process of propagating the various species, each after its kind, results from the heaven-ordained fact that that peculiar type or order of life first imparted to the parental head of each respective species involves also, by divine ordination, the possibility of and tendency toward organic multiplication into innumerable individuals.

It is generally admitted that the physical or corporeal side of the human individual can have no existence as such except in the form of an organism. The human body depends upon the life-force acting as an organizing principle of plastic power. When this principle of plastic power is for any cause weakened or made to retreat before the assaults of outward violence, or overcome by the gradual gaining of the chemical over the vital forces of the body, at that very instant bodily dissolution begins, and the beginning of dissolution is the incipiency of death.

But it is not yet generally held by psychologists that the soul, mind, inner man or spiritual body can exist only as an organism. This truth was first brought out by Dr. Hall in "The Problem," pages 466–468. The soul of the human individual is a substantial organism.—Luke xvi: 22–31. It is higher in its immediate origin and more noble in its nature than the body with which it is joined in the normal condition of man. The soul is also constitutionally immortal, in the sense of everlastingness, because it is an immaterial and spiritual organism. As such it retains its integrity in that condition or state of humanity which intermediates between the hour of death and the morning of the resurrection. Of course it is not thus in its most normal and natural condition. Man is not in his normal state when his soul and body are by any cause put asunder. They are distinct, yet both are essential sides of his full and proper being. The body is not an outgrowth of the soul, neither is the soul a resultant of bodily organization, or, according to Herbert Spencer, of "perfect correspondence." Man, however, is not two organic beings, but only one. "A dualism," says Dr. Rouch, "that admits of two principles for one being offers many difficulties, and the greatest is that it can not tell how the principles can be united in a third. A river may originate in two fountains, but a science can not, and much less individual life."

Some of the reasoning contained in the foregoing paragraphs may be defective; yet one thing is fast coming to be generally conceded as true, viz., no theory of life, whether of the body or soul, which does not hold that life is a substantial entity, can be entertained as scientifically sound. As has been shown by Dr. Hall, a failure to recognize this fact has led some of the most gigantic intellects of the nineteenth century into the tangle-woods of Godless evolution. On the other hand, a clear view of the substantiality of life and distinctiveness of each order thereof enables the biologist to account for the preservation of all that is really essential to each species of living beings, and at the same time prevents him from wandering off into one of the several spontaneous development theories so popular in the world and so poisonous to the church.

It is freely admitted that this vital form of force is conditioned in its mission of manipulating matter into organic form. In fact, assimilation and development depend quite largely upon favorable surroundings; yet after all allowance is made for such modifying environments, it is ever borne in mind, by the correct reasoner, that no such modifying circumstances are ever allowed to make an encroachment upon the distinctive domain and peculiar mission which the giver of all life has assigned to that highest form of substantial force in the economy of the universe.

Fremont Ohio.

(Continued from page 107.)

THE WAVE THEORY OF ACOUSTICS.*

BY GEORGE ASHDOWN AUDSLEY, F.R.I.B.A.

But Gentlemen of the Colleges, I have not yet done in protesting against your beloved wave-theory, nor have I finished what I have to say on the labors of that marvellous sound-producing insect, the locust, about which you have all kept so suspicious a silence in your apparently exhaustive and straightforward works on Acoustics. But I will be charitable, and believe that you were not aware, though Darwin and Daniells mention it, of the existence of the stridulating locust, and, accordingly never dreamt for a moment that so insignificant an insect could, in its natural powers, put all your mathematical formulæ to flight and crush the wave-theory with its unaided volume of sound.

Before entering upon the consideration of what may be called the Locust Argument, it may be well for me to clearly state what the teaching of the Substantial Theory of Acoustics is. Up to the present moment I have been supposing that you are conversant with it through the agency of my friend Dr. Pearce's able papers, and my own published writings on the subject, including my recent paper before the Musical Association; but doubtless there are some present to whom the very name of the Substantial Theory is a novelty. To them, with the kind permission of the better

*A Paper read before the Members of the South Eastern Section, London, England, November, 1890.

informed of my audience, I offer the following explanation:

SOUND is one of the primordial forces of nature; it is a substantial force, an entity, immaterial so far as human perception extends, and in comparison with tangible and ponderable entities, governed by laws ordained and fixed immutably by the great Architect of the Universe. This form of force can only be generated or liberated from the force element of nature by one means devised for that end—namely, vibration of and in the sonorous body itself.

Now let me somewhat enlarge upon the definition just given.

When any sonorous body is set into vibration, sound-pulses or pulses of the substantial force-element are released and sent off from it. Such pulses are generated by the interaction of forces in the sonorous body, and depend on the sonorous properties of the body. In certain bodies the force stored up in them by the mechanical action of setting them into the required state of vibration, is partly converted into heat and partly into sound-pulses: and the difference between the quantities of these two forces constitutes the difference of sonorous property in any vibrating body. The cohesive force and other forces present in the body control the action of the mechanical force exercised, converting some of such force into heat, and some into sound-pulses. To aid you in grasping what I have affirmed, I may remark that the pulses of substantial, but immaterial sound-force, are analogous to electric discharges. Several of the common phenomena of sound fully support this hypothesis.

I shall now turn to the writings of the founder of the substantial theory, and briefly direct your attention to the reasoning which led him to reject the wave-theory as false and untenable.

The Substantial Philosophy teaches and lays down as its "central and cardinal proposition," says Dr. Hall, "that every force of nature, as a *phenomena-producing cause* must, in the very necessities of true science and of the relations of cause and effect, be a substantial entity or an objective existence."

Dr. Hall assures us that he found himself confronted, at the outset, with difficulties in essaying to reconcile such a radical assumption with the existing theories of science which teach that some of the most conspicuous natural forces, and the causes of observed phenomena, are the *mere motions of material particles*. He says: "To have admitted for a single moment the assumed basic facts of the current motion-theories of science—namely, that the forces of sound, heat, and light were but the motions of matter, and that there was nothing substantial about them as phenomena-producing causes, would have been to abandon the entire Philosophy of Substantialism which, from the very start, we had mapped out as of universal application.

"To concede to science as at present taught the truth of the position that any *force* could be but the *motion* of material particles such as air or ether, would be to make *force* an *effect* and not a *cause*. Surely no one is so superficial, after his attention has been called distinctly to the subject, as not to see that the motion of matter, which is intrinsically inert, can only be the *effect* of some applied *force* which is its moving *cause*.

"To suppose force of any kind to be the motion of matter, and at the same time to be the cause of such motion, was to our mind an absurdity, though it glared at us from every page of our physical text-books; and it was no easy task to invent or discover a system of natural philosophy or scientific reasoning which would harmonize such inconsistency and thus bring order out of confusion. For plainly, as the motion-theories of science had presented the subject of force, the whole question seemed to us but a jumble of incoherent and self-contradictory statements.

"To assume force of every kind or character to be a *substantial cause*, and the motion of matter under all possible circumstances to be its *effect*, seemed at once the entering wedge for the solution of the whole mystery. But how was it possible to regard the physical forces as substantial entities or objective things, especially the force of sound which produces the sensation of hearing? This was the serious obstacle which met us at the very start. We saw but little difficulty in assuming magnetism and electricity, for example, to be substantial or objective things, since it was self-evident that the physical effects produced by these forms of natural force, such as the displacing and lifting of ponderable bodies, could by no possibility be accomplished except by some real substantial cause. To suppose otherwise, as we reasoned, would be at once to fly into the face of all philosophy and even of common sense.

"But at this point a concomitant difficulty struck us. If these forces are substantial, and at the same time penetrate, pervade, and occupy other bodies at the same time and without any displacement of their material particles, as is the case with magnetism, how about the supposed law of the impenetrability of matter, or the impossibility of the double occupancy of the same space by two material bodies at the same time?

"Of course, this had to be met and reconciled with our new departure, or good-bye to Substantialism. But the task of unlocking this scientific door was easy with the key already discovered and in our possession. Universal substance, we assumed in the very rationality of entitative existence, must involve *immaterial* as well as *material* substances. Hence the idea of that grand classification was for the first time sprung upon the world—namely, of making two departments of the existing entities of the universe by dividing them into material and immaterial substances—placing all tangible and ponderable objects in the first division, and all the forces of nature in the second.

"This fortunate thought, though somewhat difficult to grasp at first, soon brushed aside that whole difficulty involved in the idea of two actual substantial bodies occupying the same space at the same time, since now the most impervious steel can be wholly occupied, pervaded, and penetrated by the *substantial* forces of heat, magnetism, electricity, gravity, cohesion, and sound in every part and particle of the matter composing it, and at the same instant of time."

As I have already stated, Sound is, according to the teaching of the Substantial Philosophy, a force of nature—*that form of force by which the sense of hearing possessed by men and animals is addressed and effected.* Such is sound in its true and primary sense—an external and substantial force, or *objective cause;*

but in common language it has a secondary meaning—namely, the *sensation* in our consciousness, which is more correctly called *hearing*—an internal sensation or *subjective effect*. Thus by a trope, which is designated metonymy, we have the *effect* put for the *cause*. It will be well to bear these facts always in view, and so avoid confusion of ideas. In all cases the true and unfigurative signification should be intended in using the word *sound*, when one is discussing matters connected with music, or the science of acoustics.

Let me now briefly consider how far sound, according to the definition given, bears the test of reasonable and logical comparison with the other forces of nature, which immediately address and affect the animal consciousness. *Sound* is that force in nature having definite laws of production and propagation, which by entering our ears, or coming in contact by any other means with our auditory nerves, produces in our consciousness the sensation of *hearing*. *Light* is that force in nature having definite laws of production and propagation which, by entering our eyes and coming in contact with our optic nerves, produces in our consciousness the sensation of *seeing* or *sight*. *Heat* is that force in nature having its own laws, which, by affecting any portion of our system of tactile nerves, produces in our consciousness the sensation of *warmth*. *Odor* is that force in nature which by entering our nostrils and coming in contact with our olfactory nerves, produces in our consciousness the sensation of *smelling* or *smell*. And *flavor* is that force which coming in contact with our system of gustatory nerves, produces in our consciousness the sensation of *taste*.

It will at once be realized that in removing sound from its time-honored place as a purely *mechanical effect* (for no logical reasoning on the part of the wave-theorist can, under the mechanical or undulatory theory, place sound or sound-waves as a *cause*), and placing it in the dignified position amongst the primordial forces of nature, we reconcile it at once with all the other forces which more immediately address and effect our animal consciousness, as well as with those greater forces which we call cohesion, gravity, magnetism and electricity. In such dignified position is it not infinitely more worthy of the musician's love and respect; and when viewed as a force direct from the hand of the Creator, does it not account for much which has hitherto been most mysterious in the power of music?

(To be continued.)

LE CONTE'S THEISTIC EVOLUTION.

THOMAS MUNNELL, A. M.

"Evolution and its Relation to Religious Thought," is a work both able and ingenious. He is a Theistic Evolutionist without evasion or a doubt. He considers himself as far from atheism as David, Paul or Spurgeon, nor does he seem to have cast the least suspicion upon himself as if trying to promote unbelief under the guise of agreement between science and the Bible. He believes that God created every vegetable, all the lower animals and man in the same way—by forces "resident" in matter—that ichthiology, ornithology and anthropology all have their origin in the natural forces without any *direct* interference from God. He thinks that God is immanent in matter, and that gravitation, magnetism, chemical and all natural forces are but the will of God—not in any pantheistic sense but as a personal, intelligent, omnipotent and omniscient Being. Still with him God did not make man as the Bible declares, but started the species out of material substances just as all other animal species were started. As water was made by bringing certain proportions of oxygen and hydrogen together at a certain juncture and as vegetable life, and afterwards the lowest forms of animal life were created by the natural correlation of certain material substances and natural forces, which forces are the will of God objectified, so these and other forms of life gradually arose toward the form and spiritual nature of man. He does not try to eliminate God as Creator, but holds that every species was the result of an independent, direct act of divine power—the source of all vegetable, animal and spiritual life. The impassible gulf between the highest animal and intelligent man is fully recognized by Prof. Le Conte, but this gulf he easily leaps, so that matter and force having been considered all sufficient to produce the instinct of animals, there must have been such union of *force* and *instinct* that, by "a single bound," soul, spirit and immortality were readily attained. This presentation, though brief, fairly, I think, gives the theory of our distinguished California professor, to which, plausible as it is, the following caveats may, nevertheless, be useful:

1. At best his book develops only a theory, a working hypothesis, that may or may not be found true by others who come after him. The professor speaks freely of the many positions theologians have been compelled by science to surrender, but what can he say of the multitudes of theories professed scientists have been compelled to surrender not only to the scholarship of theologians but also to that of other scientists of the various schools. As he claims an exclusive patent right to his theory and no partnership with any other scientist in its conception and development, and has not yet fallen under the sharp two-edged knife of keen critical dissection, its fate is not yet decided upon either by scientists or theologians and therefore is not to be hastily accepted.

2. The theory tends directly to discredit the account given in Genesis, and often recognized throughout the Bible, of the creation of man. Without the Bible the world would soon return to what it once was without it, and no theory should be readily promulgated or believed that wounds the faith of the world in the only book that has brought *redemption* to man from sin and its consequences. The world is not languishing for want of a new theory of evolution that, intentionally or unintentionally, discredits any part of the Book of God, whose influence upon the lives and hopes of men, wherever its teachings are accepted, is the best vindication of its heavenly origin. The assumption runs through his whole work, that wherever disagreement is found between science and the Bible, the latter, as a matter of course, as a foregone conclusion, must yield the victory to science. Does not the professor remember that science once held to the Ptolemaic system of astronomy, to the flat, square form of the earth; that the earth had four corners; that the sun and stars all circled round the earth every twenty-four hours? And if the church once held to these foolish notions, whose fault was it? Who first had to surrender these notions? Science has not left such a record be-

hind her as to command an implicit and unquestioning obedience to all her vagaries on the part of theology, and certainly the theistic evolution doctrine will have to stand at the door awhile and knock for admittance to our entire confidence.

3. But the profoundest objection to Professor Le Conte's theory lies in the bold position that immortal spirits are developed out of matter. Whatever number of refining processes said matter may have had to pass before reaching the state of pure instinct and spirit, the fact remains that, according to this theory, it started away down in the *azoic period*, where even chemical forces had not yet begun to change the face of matter. Then ascending through the lowest forms of animal life—that of fishes, reptiles and such like—and where the lowest forms of animal instinct were found, on these said forces of nature laid hold and at a single "bound" metamorphosed them into instincts of the next higher order, and so on through every geological age and through all species of animals until said azoic matter was landed on the plains of immortality—the last leap being from the monkey mind to immortal mind. This is the theory fairly stated I think. It is far more reasonable to agree with Paul that, in some higher, better sense than this, God is "the father of our spirits."

The professor illustrates his conception of etherializing matter first into vital force, then into instinct and finally into spirit by the formation of water out of oxygen and hydrogen —that if water, a complete *tertium quid*, can result from two gases, why may not *mind* be a resultant of the combination of material elements brought together at the favorable moment, be that mind ever so different from said elements. To this there are two insuperable objections:

(*a*) That such combinations of the finer and invisible elements of nature somehow always result in the production of coarser and more ponderable substances than themselves as seen in his own illustration. To suit his argument, the oxygen and hydrogen should have produced a substance far less ponderable and far more etherial than themselves, whereas water weighs sixty-two pounds avoirdupois per cubic foot and said gases almost nothing—many times lighter than air and looking far more directly than water in the direction of the immaterial. Paul gives it as a fact (Heb. ii: 2), that no scientists will doubt—that all "visible things were made out of invisible things"—not only water but rocks, hills and all—so that the professor's illustration works directly against his theory.

(*b*) A second objection is that water and all composite substances are readily resolved into their primitive elements which yield no farther to chemical tests, and if certain material elements unite to form the lowest order of animal instinct, said instinct must itself be a composite liable like water to be decomposed into its original parts which would destroy the instinct itself as an entity. Then passing through all the grades of instinct up to the dog, the horse, the elephant and the ape, are they not all composite substances, according to the Le Conte hypothesis, and subject also to decomposition and destruction? The reader will remember that each of these instincts rise out of matter under the action of vital, chemical, or some other natural force, selecting the elements suitable for the formation of this or that particular instinct, and hence destructible. And now from this view-point it is easy to ask what assurance have we that the mind or spirit of man, made up in the same way, by the action of the appropriate forces and out of the composite instincts of the higher animals—what reason have we to believe that the human spirit is not composite also and liable to the same decomposition and destruction that confessedly awaits all living animals this very hour?

THE WAY MATERIALISTS FEEL.

MONTMORENCI, Ind., June 4, 1891.

Friend Hall,—By accident a copy of your MICROCOSM came into my hands—Dr. Fahenistock, of Lafayette, gave it to me. I long since gave up the study of man's future destiny as an insolvable enigma and have settled down in that dread doctrine of hopeless materialism. This, from observation and analogy, seems to be the only rational and intelligent belief, yet still I don't want to believe it if I can help it—it's a gloomy thought.

Years ago I remember reading your "Universalism Against Itself," and was much entertained by its pungent, crispy argument, but now I never bother with *creeds*—they have lost all interest with me, the great question, "Does man live *at all* after death?" having taken their place in my mind. If I were but satisfied on that point, creeds would never worry me.

As I said before, I have about abandoned all study or reading on the unknown and mysterious subject, but as you well say in your pamphlet, "There is no excuse for not reading, when you offer to send copies free." I thought I'd send for any you might wish to send me. I will gratefully receive them, and it may be that they will help to enlighten my disbelieving and doubting mind.

I wish I *could* believe that man is immortal, but oh! the fearful array of argument against it!! If I *knew* the dead still live, it would afford me more pleasure than if I were the owner of worlds like this, and if you have ever written anything that would convince me of that one fact, your life has not been in vain, for you will bestow a pleasure on a poor, stricken heart, over which angels may well rejoice.

Fraternally, M. V. ROWE.

[Have sent Mr. Rowe the "Problem of Human Life," and Vol. VIII of MICROCOSM.—EDITOR.]

DR. SWANDER'S "INVISIBLE WORLD."

We are now receiving weekly advance proofs of this new book by Rev. Dr. J. I. Swander, of Fremont, Ohio, author of the "Substantial Philosophy," and a valued contributor for the MICROCOSM nearly from its commencement.

The "Invisible World" will be a valuable contribution to the literature of Substantialism, inasmuch as that it does what has never before been done for that grand cause, namely, give a succinct and accurate history of all the leading events and discussions, and in their very order, which have occurred since the first edition of the "Problem of Human Life" was printed.

Dr. Swander has proved himself a master student and analyzer of those discussions in their bearings on the near future of the Substantial Philosophy so conspicuously now looming up in Great Britain under the leadership of

its invincible champion, George Ashdown Audsley, LL. D., of London.

With two such apostles of Substantialism, representing the two great divisions of the English speaking race, no fear need be entertained of the ultimate triumph of that cause.

Those wanting Dr. Swander's "Invisible World" can have it by sending him in advance $1 as above. We shall take pleasure in forwarding subscriptions.

DR. AUDSLEY'S VISIT TO NEW YORK.

We are pleased to announce to our readers that we have just had the pleasure of a month's visit from the great English champion of Substantialism, George Ashdown Audsley, of London. For thirty days, while entertaining him as our personal guest, we have enjoyed a treat, intellectually and socially, such as we have never before experienced.

Dr. Audsley is a man of almost innumerable parts, and which relate to almost all branches of art, science and philosophy.

No wonder that his lectures in London on the Substantial theory of sound *versus* the Wave-theory, have produced such a marked sensation in scientific, and especially in musical circles in England.

Besides being the author of many important books, Dr. Audsley is admittedly one of the first organ experts in the world, and consequently knows whereof he speaks, when he points out the absurdities of the wave-theory as applied to music.

One of his chief objects in visiting New York was a personal consultation, as he declares, with the founder of Substantialism, and to compare notes with a view of an ultimate formula of the Substantial theory of sound in the shape of an elaborate illustrated text-book for the use of colleges, both here and in Europe. To this end he has been joined by Dr. Mott, Mr. Hathaway, Mr. Rogers (Associate Editor) and other Substantialists, in our various meetings for the purpose of mutual investigation and agreement upon all minor details.

Among other important matters for consultation, was the future of the MICROCOSM as the organ of the Substantial Philosophy, and its probable endowment by its editor to continue its work in perpetuity, of spreading a knowledge of true science throughout the earth. Dr. Audsley falls readily and heartily into this idea as a very fitting enterprise to aid in closing up the nineteenth century, so full of startling scientific discoveries.

Among the gratifying results of this unexpected visit to America is the fact that Dr. Audsley carries home with him the honorary title of "LL. D.," voluntarily conferred upon him by one of our appreciative American colleges—an institution which knows how to reward real merit in a brave defender of the truth. We may add, that from hints extorted from our welcome guest, we will not be surprised to number Dr. Audsley among our own fellow citizens before this last decade of the century shall close.

A SENSIBLE VIEW.

Dr. W. C. Cooper, of Cleves, Ohio, writes us on the new *Sound* revelation set forth in the "Substantial Philosophy :"

"If the wave-theory of sound be true, as set forth in the teachings of modern science, it can evidently only apply to air, while in water and solids it must explain sound-propagation on the molecular theory. Surely nothing resembling waves can go through a solid mass of wood or iron, or through a body of water. This also agrees with Mr. Sedley Taylor's idea that the augmentation of sound by a sound-board is caused by its molecular tremor. But this being so, it should cast doubt on the current system of acoustics which requires distinctly different theories of propagation for different media; while it is a logical argument in favor of Substantialism, which by regarding sound as a substantial force makes it equally applicable to all material bodies which conduct it."

This is a center shot, and only shows how the two theories must naturally strike a logical mind that is free from scientific bias.

TUNING-FORK INTERFERENCE.

BY THE EDITOR.

In the May number of this journal we entered into an exhaustive discussion of the mysterious phenomena of musical "beats," as they are termed, and gave numerous mechanical and acoustical reasons why these observed effects are not caused by the "interference" of air-waves as supposed and taught by advocates of the wave-theory of sound. If the reader has not seen that editorial, he should not fail to send for a free copy of the May number containing it.

The present problem as intimated in our heading, consists in the silence which is observed at the corners of a tuning-fork's prongs while sounding, when held in the fingers and slowly rotated in front of the ear. There is not perhaps a writer on acoustics, when questioned upon the truth of the wave-theory view of sound-interference, but would instantly refer to this phenomenon of silence at the corners of the tuning-fork in connection with that of musical beats as proof of the correctness of that law. Yet there is not a phenomenon observed in the whole range of acoustics, whatever this one may teach or whatever may be its real explanation, which could more flatly and directly contradict that law of sound-interference than the fact now under discussion. This we shall endeavor to make clear before this article is concluded.

Remember in observing the phenomenon we are considering that as the vibrating fork is held upright in the fingers and turned slowly in front of the orifice of the ear, there will be a point of silence at each corner *the same as if no sound issued from that part of the fork*, which is an absolute fact of observation; and though the ultimate reason for this non-issue of sound-force from the prong-corner may not be satisfactorily accounted for, as scores of ultimate acoustical facts can not be, yet as before stated the so-called law of sound-wave interference is so clearly laid down in the text-books as in no possible sense of that theory to be involved in this phenomenon. This we will now proceed to show beyond a shadow of scientific doubt.

According to the wave-theory law of sound "interference," as taught in every work on acoustics, the claimed *silence* can only take place between two sounding bodies vibrating in unison *when placed half a wave-length apart, so that the condensations from one instrument shall fall into and exactly coalesce with the rarefactions from the other.*

No one questions this being the law and the only law of sound-interference as taught in every college in the land, and there is not a wave-theorist who would pretend to claim any other principle than the half wave-length distance between unison instruments as a possible cause for this theoretic silence. As proof that this is the recognized law of so-called interference in sound-waves, we refer to Prof. Tyndall's *Lectures on Sound*, page 259, where he shows a diagram of two unison forks placed first a whole wave-length apart (52 inches) and augmenting each other's sounds; and then half a w ve-length apart (26 inches) and, as he coolly tells his audience of scientific students, *neutralizing each other's sound and producing "absolute silence" by producing "quiescence of the air!"*

Lest the reader may not be familiar with the scientific effrontery which characterizes the wave-theory advocates in setting forth this bogus law of interference in sound-waves—just as if it contained one particle of truth—we had better give the exact language of Prof. Tyndall in which he coolly compares his mythical sound interference by half-wave lengths to real interference in waves on the surface of water, as follows:

"In the case of *water*, when the *crests* of *one system of waves coincide* with the *crests of another system*, higher waves will be the result of the coalescence of the two systems. But when the *crests* of one system coincide with the *sinuses* or *furrows* of the other system, the two systems in whole or in part *destroy each other*. [Of course, no one doubts the truth of this statement as applied to water-waves, because there we have actual wave-motion.] This *mutual destruction* of two systems of waves is called *interference*. The same remarks apply to *sonorous waves*. If in *two systems of sonorous waves condensation coincides with condensation and rarefaction with rarefaction*, the sound produced by such *coincidence* is *louder* than that produced by either system taken singly. But if the *condensations* of the one system *coincide* with the *rarefactions* of the other, a *destruction* total or partial of *both systems is the consequence*. . . . If the two sounds be of the *same intensity* their *coincidence* produces a sound of four times the intensity of either; *while their interference produces absolute silence.*"—*Lectures on Sound*, pp. 284, 285.

Now we need not say here that this claimed law of interference, between unison instruments sounding half a wave-length apart, is perfectly consistent with itself and with the theory of which it is an essential factor. As water-waves interfere when the crests of one equal system of waves fall into or coalesce with the furrows of another system, in what possible way could two systems of sonorous waves interfere and produce quiescence of the air, which means silence, except by placing the two sounding instruments half a wave-length apart, thus bringing the *condensations* from one into the rarefactions of the other?

Had wave-theorists first made a single experiment and thus caught the sensible and self-evident hint before formulating their theory that there was not a word of truth in the supposed law of sound-interference, this very reference to water-waves would have opened the eyes of any logical man and convinced him that the whole wave-theory was without foundation in fact. But these mathematicians first formulated the theory that there ought to be and must be interference in air-waves from half wave-length principle, because there is similar observed interference in water-waves, and then they blindly, like veritable scientific lunatics, wrote out their theoretic results of "quiescence of the air" and "absolute silence" just as if the experiments had been made!!!

Was ever such stupid hardihood before witnessed in the establishment of a mechanical and mathematical theory of science? Yet this thing has been taught right along for centuries by the ablest scientific investigators of the world, not one man venturing to point out this and kindred fallacies of the wave-theory until it was imperfectly done in the "Problem of Human Life" a little more than a dozen years ago.

Having thus shown by the highest authority exactly what the interference of air-waves means according to the theory, how absurd must it be to teach, because we happen to find silence or absence of sound at a small space in the direction of the fork's corners, that the air-waves from the two prongs must, therefore, interfere with each other by the condensations from one prong falling into the rarefactions from the other! Are the two prongs half a wave-length, or, say, two feet two inches apart? No; they are not *one inch* apart, instead of two feet two inches, which is universally admitted to be the half wave-length of such a fork, as set forth in this illustration in every text-book in existence.

Although when two unison instruments are thus placed two feet two inches apart, and are in full interference with each other according to theory, there is not the slightest weakening of each other's tone in any direction from the forks, thus proving this wave-theory law of interference to be false in its very inception, yet the advocates of that theory are forced to abide by their own law as illustrated in their books, which absolutely requires the two vibrating unison bodies to be half a wave-length apart in order that the condensations and rarefactions of their two systems of air-waves can coalesce and thus produce silence by causing "quiescence of the air."

This simple and self-evident analysis of the wave-theory law of interference forever stops the mouths of its advocates from laying any claim to this silence or absence of sound. Yet how precipitately and eagerly they seize upon this observed silence as a conclusive demonstration of air-wave interference, and as proving the correctness of the wave-theory! They never stop to ask themselves the question, which the veriest beginner in philosophy should think of, where is the half wave-length of *two feet two inches* which is absolutely essential between these two prongs before the so-called condensations from one can coalesce with the rarefactions from the other. No; because they happen to find an absence of sound at these prong-corners, and without stopping to inquire as to its probable cause or even thinking of the basis of their own law, they blindly jump at the idea of the interference of air-waves when a moment's reflection would tell them that such pretended air-wave interference between two vibrating bodies less than an inch apart flatly contradicts their theory which requires a distance of more than two feet between the prongs!

Why, for example, do they not get Lord Rayleigh, or some other skilled wave-theorist, to construct a new mathematical formula by which to explain how two unison instruments, having an admitted wave-length of four feet four inches, can interfere by a coalescence of their condensations and rarefactions when sounding within less than an inch of each other? Better by far do this, even if the formula, like the rest, turn out to be moonshine, than jump like the hungry trout for a fly while paying no attention to the concealed hook.

But we shall now proceed further and not leave wave-theorists an inch of ground to stand on. We shall do this by the most positive demonstration that neither the fork nor any other instrument should produce sound in any direction if there is a grain of truth in this wave-theory law of interference. Let every believer in that theory now mark us well while we redeem this pledge to the letter.

If the wave-theory be true, an atmospheric *condensation* passes off from one side of the prong as it advances simultaneously with a *rarefaction* from the other side of the same prong as it recedes and "leaves a partial vacuum" as expressed in the language of Prof. Tyndall. That is to say, the *condensation* from one side of the fork, or stretched string, and the *rarefaction* from the other side actually occur at the same instant of time, as both are produced by the very same motion, *and consequently the two must pass off together simultaneously, thus traveling together through the air in absolute coalescence and interference, if there is a shred of truth in this wave-theory law.*

As the condensations travel in all directions—forward, backward, laterally and vertically—as soon as made, and as the rarefactions do the same and travel with the same velocity, it is absolutely demonstrated, according to the wave-theory, that no vibrating body ought to produce any sound whatever, since these condensations from one side and rarefactions from the other thus occurring simultaneously by the very same motion and thus traveling together in absolute interference, should neutralize each other by producing quiescence of the air, which the theory tells us means "absolute silence."

Now, is it not time, with such a crushing argument as this dead against the very foundation law of modern acoustical science, for its advocates to haul in the theory for repairs? The truth is the wave-theory can not move another step further till this damage is attended to. We referred to this fact in a previous volume of the MICROCOSM, and also in our article on "Beats," but not so definitely and pointedly as we do here. Years ago when we laid this objection before Prof. Robert Spice, one of our most popular lecturers on acoustics, he shrugged his shoulders and merely remarked: "That seems so." Yes it does seem so and no mistake. Yet Prof. Spice goes on delivering his public lectures in favor of the wave-theory when he ought to know and we believe *does* know that there is not one word of truth in that theory. Why is this thus?

We do not intend this disastrous state of affairs for the wave-theory to be passed over with a shrug. Advocates of that theory have right here and now got to abandon that theory by giving up the law of air-wave interference on which it is based. We know it looks like cruelty to animals to pin down such men as Tyndall, Helmholtz, Mayer, Rayleigh, Stokes, Taylor, etc., so mercilessly under a forked-stick. But their torture will be the world's benefit in an educational sense. They must come to this ordeal of their theory here and now, and we call upon Prof. A. B. Wood to speak out as honestly as he did in our March number on the "swiftly advancing" prong, and tell us if the wave-theory can live under this self-annihilating test of the claimed law of interference.

Let Prof. Wood place the end of a sound-board in a vise, then stretch a string attached so that the board stands edgewise in the direction of its length. Now let his assistant bow the string while he listens in a line with its longitudinal direction. We suggest this test so that the supposed air-waves from both sides of the *board*, as well as from all sides of the string, shall reach his ears at the same time, both condensations and rarefactions, thus producing absolute "interference."

Will not Prof. Wood or any other candid acoustician admit that the theoretic *rarefactions* produced from one side of the board and string by the same motion which produces the *condensations* from the other side and at the same instant, must of necessity travel in perfect *interference* to an ear thus listening in line? Why, then, is there not "quiescence of the air" and "absolute silence," at any rate in that direction if there is the least truth in the theory? The fact is, so far from silence there is not even the slightest weakening of the tone perceived—a fact which takes the last breath of life out of the theory.

Prof. Tyndall tells us, in his great text-book, that "the vibrating prong of the tuning-fork advances and compresses the air in *front* of it, thereby producing a condensation; and that *when it retreats* it leaves a partial vacuum *behind it*, thereby producing a rarefaction." But remember, it never entered the professor's mind to tell the student of acoustics that when the prong advances to produce a *condensation* it also, at the very same instant, retreats from the other side to produce a simultaneous *rarefaction*, and that if there were any truth in his law of interference these synchronous and simultaneous condensations and rarefactions, traveling precisely together, ought to neutralize each other and thus produce the absolute silence he claims!

Prof. Tyndall tells us all about a *system* of air-waves being sent off from one fork, and then he gives a graphic illustration of *another system* of air-waves sent off from its unison fellow half a wave-length from it. Then he elaborately explains how these *two systems* of air-waves at this half-wave distance must necessarily interfere, neutralize each other and produce silence. But it never occurred to his mind that according to the wave-theory each fork sends off *four* distinct and separate systems of air-waves at the same instant of time, the whole four being in absolute interference with each other from the very start and producing no sound at all if the theory be true.

This is self-evident on its face as we will here show. As the two prongs advance in opposite directions, they produce two systems of air-waves beginning with two simultaneous condensations, while at the same instant on the other sides of these prongs two other systems of air-waves are started, each beginning with a simultaneous rarefaction; and as the four systems of waves are all equal and must all travel together in all directions in absolute interference, "quiescence of the air" and "absolute silence" must result or else it knocks the bottom out of the wave-theory.

Thus Professor Tyndall's two unison forks, sounded half a wave-length apart, instead of producing *two* systems of interfering-waves as he claims, should actually have sent off *eight* systems of equal waves, all interfering from the start, and again interfering at the half-wave-length station.

Surely in such case "quiescence of the air" should result and "absolute silence" follow,

just as Tyndall teaches, if air-waves, with their supposed condensations and rarefactions, have anything to do with sound.

But, as not the slightest indication of silence, or even weakening of the tone, occurs in such experiment, as any sensible investigator must know, however delicately the test shall be made, and with eight systems of air-waves all interfering, it follows that Tyndall's elaborate illustration of what must take place, if the theory be true, proves to be the most disastrous overturn of the theory that has ever been presented.

Now, having shown by the most conclusive reasoning known to mechanical science, that the silence observed in holding the fork corner-wise to the ear in no possible manner can result from the interference of air-waves, there remains no other conclusion except that through the sympathetic relation between the two prongs in such close juxtaposition there is a *vacant space* in the direction of the prong-corners which the radiating sound-force does not fill. In other words, that the peculiar structure of the tuning-fork, hinged as the two prongs are at their junction with the stem, causes the sound-pulses to radiate from the sides and edges of the prongs instead of their corners, and this is all there is of the problem. But we need no more be expected to give a complete explanation of the ultimate cause of this peculiar action of sound-force than to explain why some bodies are opaque to light and others transparent, or why substantial pulses of electric force will pass freely through some bodies and will not pass through other bodies at all, such as glass, for example, unless accompanied by heat-force.

We are abundantly satisfied with our task in having thus triumphantly destroyed the wave-theory claim of the interference of air-waves as the cause of this phenomenon. Let all wave-theorists remember from this on, till the end of time, that the absence of sound-force in the direction of the corners of the tuning-fork's prongs, whatever may be its real explanation, must never again be referred to as offering the slightest proof in favor of the wave-theory of sound.

SEDLEY TAYLOR FINALLY DISPOSED OF.

[As Sedley Taylor is the only physicist of any prominence as an author who has ever dared to take upon himself a defense of the wave-theory of sound, it would seem cowardly on the part of Substantialists not to meet him in his utmost efforts to defend that theory. If the reader has followed this Sound discussion for the past several months he will have an abundance of food for reflection in the following reply to Mr. Taylor's May article, as appears in the London *Musical Opinion* of that date.]

DR. HALL'S REPLY TO SEDLEY TAYLOR'S MAY REJOINDER.

To the Editor of the "Musical Opinion and Musical Trade Review :"

Sir,—I am delighted with Mr. Sedley Taylor's May effort at defending the wave-theory of sound against my locust argument as was printed in your January issue. The reason why I am delighted is that every time he puts his pen to paper in attempting to defend that theory or to weaken the substantial view of sound, he only involves himself in deeper and deeper difficulty, until in this last effort his extrication becomes absolutely impossible. If I do not make this statement good by demonstrating the total break-down of the wave-theory based on his argument alone, then I will never ask you to print another line from my pen.

But first, by way of preparation for this collapse, one or two minor matters must be noticed to set Mr. Taylor right and show him the weakness of his general position. Lest your readers may forget his argument, or may not take time to turn back to your May number, I now quote one of his cunningest attempts at misrepresentation I have yet seen, as follows:

> "In dealing, in a letter published by you last January, with Laplace's correction on Newton's calculation of the velocity of sound in air, Dr. Hall represented *the entire mass* of air through which a locust's chirp is audibly transmitted as being, according to the wave-theory, condensed in virtue of the heat developed in each wave. I pointed out in your number for February that this view of the situation took no account of the fact that within each wave the rise in temperature in one half of it is balanced by an equal fall in temperature in the other half, so that the passage of each complete wave leaves the temperature of the air what it was before."

Now Sedley Taylor is too much of a physicist not to know that, according to the wave-theory and according to my representation of it, the mass of air through which the sound of the locust is transmitted, is *not* "*condensed in virtue of the heat developed in each wave,*" as he here states, but that the *heat* in each wave is developed *in virtue of the condensation* throughout the mass of air produced by the mechanical effort and physical strength of the locust! Mr. Taylor would gladly put the cart before the horse and thus try to show that as the mechanical *condensation* of the air is caused by the *heat* it would naturally be neutralized or balanced by the *cold* in the rarefied portion of the wave, and therefore, as he positively states in his letter to the March MICROCOSM, "*involves the exertion of no condensing or squeezing force whatever*" *on the part of the locust!* Any man knows that the free air is *expanded* in consequence of heat, instead of "*condensed*" as Mr. Taylor here asserts! Did he have an object in thus misrepresenting the wave-theory? He certainly knew that if the locust had to *condense* the air in order to generate the heat set forth in the Laplace formula it would require, according to Prof. Mayer, that insect to exert countless millions of tons of mechanical force before the heat and cold of the four cubic miles of air could make their appearance as factors. Hence, as the mechanical force naturally comes *first* before any heat can be generated, look at the unpardonable cunning of the man who deliberately tries to leave out the mechanical work of our locust by putting the effect (generated heat) before its mechanical cause!

I do not purpose in this controversy to let go the grasp of my pet locust upon the very vitals of that theory, by allowing Mr. Taylor thus to obscure the real points of the argument by a multiplicity of words. As my position will immediately be repeated it will abundantly appear that he can not make one intelligent investigator in England believe but that the wave-theory teaches, just as I showed in your January number, that, according to the formula of Laplace, the locust, by filling four cubic miles of air with its sound, must by its mechanical efforts and individual strength alone condense one-half of this entire mass of air enough to raise its temperature sensibly, and thereby augment its elasticity sufficiently

to add 174 feet a second to the velocity of its sound. It is universally admitted that this is the accepted doctrine of the wave-theory as agreed by Laplace and Prof. Mayer.

But here comes the exciting and fatal part of Mr. Taylor's involvement. He is now forced to admit (because he mistakenly fancies he has a way out of it) that if the locust, according to the wave-theory, *really accomplishes this condensation* throughout *the four cubic miles of air* by its individual strength, then that theory must ingloriously break down. He does not say this in so many cold words, but he says it plainly nevertheless by a desperate effort to show that the locust only gives the initial impulse to the air "in actual contact with its stridulating apparatus," and that all the condensation of the air which takes place, according to Prof. Mayer's $\frac{1}{6}\frac{1}{0}$ above its normal density, is the result of the mechanical action of the "molecular forces only!"

At last, thanks to the inexorable logic of Substantialism, our American locust has stridulated this prodigious fact into Mr. Sedley Taylor's ears, and consequently, as I will immediately quote, he is driven to the unavoidable extremity, after admitting the enormous amount of work done, of trying to relieve the locust of this task by attributing, as just stated, the condensation of one-half of the four cubic miles of air to the "*internal pressures*," of the medium and its "*molecular forces only!*" He says in the plainest possible English that the wave-theory "*is completely misrepresented*, nay, *travestied*," by the attempt to prove that the locust does this mechanical work of condensation throughout the four cubic miles of air according to modern acoustics.

Now plainly and conclusively if Mr. Taylor shall fail to relieve the locust of this task of condensation which he now admits to be required by the formula of Laplace and as figured out by Prof. Mayer, or if the assumption that the "molecular forces" and "internal pressures" do this work is shown to involve the most laughable absurdity ever promulgated as science, then it follows that Sedley Taylor admits the wave-theory nopelessly broken down. Can there be any other conclusion? But first of all, here is his argument in his own words:

"The "locust argument," in whatever shape I have met with it, takes for granted that according to the wave-theory it is *the strength of the insect which performs the mechanical process of the propagation of sound.* That theory is completely misrepresented, nay, *travestied*, by such an assumption. The most ordinary observation shows that when sea waves have once been set up (as, for instance, by a wind which has subsequently dropped) they travel on without any assistance from the cause which originally excited them, *solely in virtue of internal pressures communicated from particle to particle of the transmitting water.* The same thing is observable when a transverse jerk is given by the hand to a loosely stretched rope or chain at some point of its length: a bulging protuberance is seen to run along it, which is due, not to further exertion of human muscles, but to action of molecular forces in the substance of the transmitting body. Air can in like manner be experimentally proved to transmit, by molecular forces only, changes of density once mechanically impressed on any part of it. *The wave-theory assumes that the propagation of sound takes place by means of these molecular forces appertaining to the transmitting medium, and assigns only its o igination to the exertion of an externally impressed impulse.* According to that theory, therefore, all that the locust has to do is to set in motion the air in actual contact with his stridulating apparatus. In the *transmission* of his chirp it attributes to him no share whatever, well knowing that even were his performance and his life simultaneously terminated by the action of some locust eating neighbor, the air would still for a few seconds waft, quite unaided, his last chirpings to the limit of their audibility."

Here, then, at last, we have the final effort to save the wave-theory from the locust argument by the most ingenious advocate of the theory we know of. "All the locust has to do," he asserts, "*is to set in motion the air in actual contact with its stridulating apparatus.*" All the rest of the work of condensing the one-half of the four cubic miles of air, with an actual mechanical squeezing force of 2,500,000,000 tons, as Sedley Taylor is forced to admit after laboriously reducing my figures one-half, is done "*by means of these molecular forces pertaining to the transmitting medium.*"

Reader, look at this terrific position, that a quarter of an ounce pressure, as the utmost effort of this insect, is communicated to the "air in actual contact with its stridulating apparatus," and then look at the almost incalculable mechanical result of 2,500,000,000 tons of squeezing force set up, and propagated, and kept up for a whole minute at a time, throughout four cubic miles of air by the "*molecular forces only*," caused by this quarter of an ounce pressure!!!

The crushing blow I purpose to give this unparalleled absurdity will come in a few minutes, but before that final annihilation of the wave-theory, I wish to set Sedley Taylor right in regard to the action of water-waves and the vibration of a stretched rope, lest some reader might be weak enough to suppose there was any sort of resemblance between those operations and the mechanical compression of the air by which heat is generated sufficiently to increase the elasticity of one-half of the air "one-sixth," as the wave-theory requires.

First as to the action of water-waves which continue to travel on long after the first wave has been started by some mechanical force. I can not help remarking here that a man who can not see the difference between the continuous mechanical action of *gravity* (an ever-present and always active force of nature) in pulling down the ridge of incompressible water and thereby crowding up another ridge, and the action of squeezing together the compressible and elastic air by which to generate heat, is hardly the one to write a book on any subject relating to physics or mechanics.

The wind or any other mechanical action, which, at the start, lifts a ridge of water above the level, may instantly cease to operate, but this does not destroy the action of *gravity* in the premises. This ever-ready mechanical force seizes the mass of water constituting that ridge, and by pulling it down presses up adjacent quantities of the mobile and incompressible liquid, thus continuing to propagate the swell till the friction of the water neutralizes the action of this force and the ocean surface comes to rest.

This work of gravity on waves of water is almost precisely the same as its action on a pendulum when once started by some mechanical effort. The momentum of the pendulum or the stored-up mechanical force which gave it the impetus aided by gravity carries it past the center. It finally stops by gravity pulling against it, and then by yielding to gravity it is again carried past the center by its momentum, aided by gravity, and so on till it finally comes to rest.

But what is Sedley Taylor's novel view of the action of these waves of an incompressible liquid? He never once thinks of *gravity* as the sole cause of the motion, but to help out his assumption of the condensation of the air be-

ing caused by "molecular forces only" instead of the energy exerted by the vibrating locust, he assumes the onflow of an ocean billow to be "*solely in virtue of internal pressures communicated from particle to particle of the transmitting water!*"

But Sedley Taylor can not bolster up his "molecular forces" to compress and heat and cool four cubic miles of air after the locust has given its chirp by any such scientific perversion as the above-named "*internal pressures* communicated from particle to particle." Does the pendulum continue to swing by its "*internal pressures* communicated from particle to particle," or does it swing on by the action of gravity on the mass of metal aided by its momemtum? Does a chain or rope thrown into protuberances or undulations continue to bulge and undulate after the first impetus has been withdrawn "solely in virtue of the *internal pressures*," or does it continue to swing and bulge by the action of momemtum and gravity on its mass?

How strange that a popular author of a text-book on physics can be so muddled and driven into a corner by a stridulating locust, that he does not even dare to mention the force of *gravity* in its best-known mechanical operations! Modern physics is coming to a fine pass when its leading exponents actually fear even to name one of the forces of nature lest it put them into a hole, as we Americans express it.

But Mr. Taylor gives us no idea how the "molecular forces only" can propagate powerful mechanical condensations throughout such a mass of air, unless the full amount of force necessary to do all the work of such condensations shall first be imparted to the air by the initial impulse from the locust. Can not Sedley Taylor see this? To contend that air or any other substance can by its "molecular forces" propagate a pulse that is not communicated to it by a mechanical energy *equal to all the work such pulse is to accomplish in its travel*, in addition to the friction to be overcome, is such puerile nonsense as not to be tolerated in this age of applied mechanical science. Yet Mr. Taylor actually insists that these tremendous working sound pulses condensing and heating four cubic miles of air, travel alone by the action of these "molecular forces" and independently of any energy exerted by the locust, and for several seconds after the insect has perhaps been swallowed by some insectiverous bird!

Now mark me, I do not misrepresent Mr. Taylor. He admits, at least, 2,500,000,000 tons of mechanical pressure or squeezing force, exerted on the four cubic miles of air in order to cause this $\frac{1}{870}$ of additional density to the normal air, thus to generate the heat required by the formula of Laplace (see the last extract above). But he denies that the locust is the cause of exerting this force. In fact he, no doubt, supposes, correctly enough, that the insect with all its strength could not exert a squeezing force of more than a few penny-weights. Thus, therefore, we are obliged to deduct this *half-ounce* of squeezing energy exerted by the locust, leaving the remainder of the 2,500,000,000 tons, which he admits, credited to the "molecular forces" of the air itself *without any corresponding mechanical impulse to produce such enormous mechanical result!* Mr. Taylor should at once put his wits to work to invent some way of saving up this waste mechanical energy of 2,500,000,000 tons, and then send for one of our quarter ounce-power American insects to run all the mills in Great Britain! The dream-concocted perpetual motions of all the cranks and lunatics of both hemispheres do not half equal Sedley Taylor's reservoir of mechanical energy exerted and wasted by the "molecular forces," whenever started into action by one of our stridulating locusts!

Of course I admit that substantial but immaterial sound-pulses, emanating from the locust, would travel through the air as a conducting medium some seconds after the insect should be swallowed, just as substantial light-force continues to come to the earth from one of the moons of Jupiter even some minutes after it has been totally eclipsed. But this fact is of itself a demonstration that all the light which continues to come must have been the actual product of that moon before its eclipse. How absurd then to teach, as does Mr. Taylor, that any mechanical condensations could continue on through the cubic miles of air after the locust was swallowed, unless this insect before its disappearance had sent them on their mission alone by its mechanical energy!

But why consume further space with these self-evident principles of physics in meeting Sedley Taylor's positions where, as before intimated, we have a single argument which lets the entire bottom drop out of his theory? Here it is: Not only Mr. Taylor, but every wave-theorist on earth admits that the condensed pulse sent off from an exploding magazine is identical with its sound-wave. Will Mr. Taylor now tell us frankly if the exploding powder has or has not anything to do with the mechanical destruction of houses and windows miles away from the magazine?

Come, now, this high authority on acoustics must not try to dodge this point as he has just dodged the force of *gravity* in the propagation of water-waves. He has here voluntarily placed himself in the last ditch of the wave-theory dug by his own pen, and I purpose to keep him in it till he shall dig himself out with the same implement or unconditionally surrender to Substantialism. No raising of trivial side issues will meet this case, nor will any irrational talk about the "molecular forces" of the air accomplishing any work whatever, give Sedley Taylor one grain of comfort in this deep and narrow ditch.

I freely admit that the mechanical destruction of windows at a distance from the exploding magazine *is in virtue of the so-called "molecular forces"* of the air, or in other words, of its properties of *compressibility* and *elasticity*, and no sensible man would for a moment deny it. But is there a scientist in England outside of Cambridge University so badly posted upon the physical laws, as not to be able to see that it is the mechanical action of the exploding powder alone which utilizes and takes advantage of these "molecular forces," and thus does every bit of the distant work of destruction as really and truly as it gives its first mechanical impulse to the air next to "sounding apparatus?"

Not a pane of glass was broken in the village of Erith, miles away from the exploding magazine, as so graphically described in Prof. Tyndall's work on Sound, but was by him attributed alone to the mechanical action of that exploding powder—which he called the "sonorous pulse" and "sornorous wave"—literally and truly as if Erith had been built right

over the magazine. Yet the learned Sedley Taylor, whose work on "Sound and Music" is a standard text-book at Cambridge University, tells us that because this exploding powder made use of the "molecular forces" of the air to produce its tremendous mechanical condensation, and because this condensed wave took several seconds to reach that distance, *therefore the exploding magazine had nothing to do with that distant condensation!!!*

A beginner in a philosophy class in any school in England, who would explain on the blackboard that the exploding powder did not do the work of destruction at Erith, *because it had to take advantage of the "molecular forces," and because that disaster occurred some seconds after the explosion*, would be set down by his teacher as stupid, and would be laughed at by every member of his class. Yet Sedley Taylor makes this very statement in regard to a sound-pulse precisely the same as that explosion, according to his own text-book, only on a smaller scale!

This exploding magazine, according to every acoustical text-book in print, produced a single "sonorous wave" on a large scale, just as a separate vibration of the insect's stridulating apparatus produces a single "sonorous wave" on a smaller scale. Sedley Taylor, in the light of his own "Sound and Music," will not deny this. Then what is he going to do about it? Clearly he is forced to admit that as the exploding impulse of the powder upon the air in contact with the magazine and the "sound-wave," thus mechanically sent off, did all the work of compression both at the magazine and at Erith by taking advantage of the "molecular forces" of the air, just so certain can no mechanical condensation take place throughout the four cubic miles of air, in consequence of the sound of the locust which is not all due alone to the insect's mechanical strength.

If the millions of tons of mechanical pressure produced by the explosion throughout the range of its "sonorous wave" can only be attributed to the mechanical energy exerted upon the air by the initial pulse at the sounding magazine, then let it be forever settled in acoustical mechanics, as now admitted by Sedley Taylor, that the 2,500,000,000 tons of mechanical pressure produced by the sound of the locust throughout its range is only attributable to the mechanical exertion of that insect given in its initial pulse. Again I thank Sedley Taylor for his courage in attempting a defence of the wave-theory of sound.

A. WILFORD HALL,
Editor of the MICROCOSM, 23 Park Row, N. Y.

THE ANNULAR THEORY.

No. 17.

BY PROF. I. N. VAIL.

By this time the thoughtful reader must have recognized that the peculiar shape of the Hindu "world-mountain," proves that it was a remnant-belt of the earth's annular system. The combination and unintentional linking of circumstantial features, it must be seen, make it an annular survival with an absolute and sweeping demonstration. Where was this mountain? In the far north, under the pole star, just where in all annular times a celestial mountain system gathered, "Pelion upon Ossa;" and over which the storm-demons and giants of Grecian and Egyptian thought climbed against Jupiter, the sky. What was its shape? It was an inverted pyramid or cone, just the shape that every declining belt must assume as it retired to this original "Mount of Congregation." Where was its peak? Deeply hidden in the underworld, just as was the evanescent side of every belt, as it declined to the polar sky. How was it made? By the "*churning of the deep.*" What was its name? Mount Meru, or the "Meros," that was once "a part broken off from the element that surrounded the earth." What other features did it possess? It was "golden" in color and multiform in mass; each band or belt coiled around the great "central isle" like the coils of a helix; hence the sacred Helicon in Grecian legendary thought. The celestial Ganga or Nilus poured its floods upon it from the sky, and became the one grand source of all terrestrial waters. It *was the temple and home of the heavenly gods*, and about it, on "celestial fodder," fed the *flying coursers of heaven*, and, moreover, the "*great world serpent*" *was its sleepless custodian*, and most significant, this serpent was slain, just as were "Typhon" and "Pytho," and the "midgard serpent," and the "great red dragon," and the Mexican "huracan," etc., etc., *by the cohorts of the sun.* I challenge the world to look over the great volume of legendary evidence as it points to the "mountain," the "serpent," the "island," the "bridge," the "deep," the "river," the "garden," the "tree," and shun this eternal and immovable *rock* if it can.

The ancient Hindu would not have memorialized an inverted mountain if he had not seen it. He would not have sung of its sacred stream, and venerated it as a god, if it had not rolled around its table top, or lotus-shaped summit, and descended upon the earth. The extravagant and otherwise absurd allusions to these "*agitated*" waters, allow no other conclusion than that this most ancient people saw and worshipped the "ocean-stream that encircled the whole earth." To treat properly the great *illavratta* or *circle of encompassing waters*, from the Hindu elevated plain of thought, would require more than a hundred pages of the MICROCOSM. Place this circle of primeval water back in the celestial world of the Hindus, and such a flood of light bursts forth, and such an amazing field of research is revealed, that a whole army of investigators might work for an age and not close the era of discovery in the realms of annular fossils. As the pioneer in this fascinating field, I am bold to say, on the threshold of this new world of thought: *This earth once had an annular system, and geologists, astronomers, physicists and scholars* in almost every field of research, can not travel much longer without placing this beacon in their front. I am bold to say that geology can not be studied intelligently on any other basis, and the time is near at hand when geologists will *have* to build on this foundation, whether they want to or not. I have now presented sufficient evidence to make all classes of thinkers look in this direction; but I want to say that we have only crossed the threshold of this new world of thought. This most fascinating field is now open to every eye. With this grand illuminator all ancient mythology is converted into a magnificent storehouse of annular fossils. While the naturalist will take a bone or a tooth from a fossil bed and tell us what animal it belonged to and to what part of the body, so the annular philosopher, picking

up these ancient relics in any part of this new and untrodden field, can identify them and place them in their proper places in the annular skeleton. Could I bring before my readers in one grand view the mass of evidence yet unnoticed, in support of this theory, I am sure there would not be a man possessed of a lingering doubt of the great truth I have in these pages rudely presented. If every particle of evidence I have presented were now cast away, I would call up this reserve and prove it again. But I will keep it in store for the day of battle, and kindly thanking the patient editor and his patient readers, I will for the present draw these papers to a close by a quotation from the second volume of "The Earth's Annular System," *i. e.*, "The Gods Unveiled" (unpublished):

"We have it as the undoubted testimony of Plato, that Solon learned from the Egyptian priests, that the myth of Phæton, son of Helias, was to be explained '*by the fall of something that once revolved about the earth and in the heavens.*' Phæton attempted to drive the steeds of Helias, the annular sun, his father, and set the heavens on fire, which conflagration was but the bursting of solar flames through annular vapors, as Plato affirms, and which is now understood for the first time. Now it is plain, if solar flames then burst through, the clear sky was coming in view again, and the sky-god, Zeus or Jupiter, asserting his power. These two features necessarily go together as a *consequence of any conflagration produced by the sun*, and these *three* features harmonize most felicitously with the *fall of bodies from the heavens.* Nothing can be plainer than this. But suppose we inquire why Helias, the sun, should have a *son to take his place.* Such would, indeed, be a myth, if it were not for the fact that Helias, the vapor-veiled sun, no longer ruled when the veil was removed. The very fact that the solar steeds were put into new hands, *proves* that the canopy was removed. That *it did fall.* That the clear sky did come into view. That Jupiter did then come into power again. And now, when this legend closes by saying: that Jupiter fearing the conflagration might consume heaven and earth, he brought his *thunder* into use, we are compelled to admit a dovetailing of facts, that, * * *," etc.

Elsinore, Cal.

Important.—From a Lady Correspondent.

A. WILFORD HALL, PH. D., LL. D.,

Dear Sir,—I have been so long in sending you a second communication, that I fear you will have forgotten the first. But I have been working under difficulties which, had I been less surely convinced that in the direction of the "Substantial Philosophy" lay both truth and duty, would have been very likely to have proven insurmountable. * * *

The first statement of your position, in the "Problem of Human Life," was a disappointment; and it was in order to investigate more thoroughly, that I began the study of "Vital Force in Plants;" by means of which I was able to satisfy myself of the *fundamental* truth of your Philosophy, while at the same time I was compelled to differ with you in some of its details.

I send you the result of the investigation, but with some misgivings, since with so much to distract my attention, I have not been able to write so clearly, and accurately, as I might otherwise have done. Still I hope you may find the article useful, if only as a statement of some objections, which will inevitably be made, and which must be met before the Philosophy can find the acceptance which its merits deserve. Then, too, I can not help but hope that what has helped me, may help others. Moreover, whichever way we may ultimately decide, with regard to the immateriality of the forces at work in the material universe, the decision does not affect the integrity of the "Substantial Philosophy," which is, I believe, *fundamentally*, unassailable. For, let it once be proven, *as it can be*, that we *necessarily think all phenomena of every kind* as inhering in some substantial entity, and the Philosophy is proven.

To my mind "Keely's Motor" is an absolute demonstration of the *forceful substantial* nature of sound; but had it not been for my own discoveries in the *metaphysical line*, this *might* not have seemed so clear. You have *repeatedly*, and *most conclusively*, proved that the "mode of motion" theories of science are indefensible, and scientific discoveries are demonstrating the presence of forces, which produce effects hitherto ascribed to varying "modes of motion." But such demonstration is only possible, under the laws of thought, which connect every observed change with a force which produces it, and the force itself with a substance to which it belongs.

Let it be once clearly shown that these laws of thought exist and the metaphysicians will be compelled to come into line. Before that, not seeing the way clear to hold to the *old metaphysics*, and at the same time accept the *new physics*, they are not to be expected.

The proofs which have been advanced do not convince them, although clear and forcible, because they have not been along the lines of thought to which they are accustomed; and tender charity for human limitations, as well as the grand courage born of profound conviction, is necessary in a work so far reaching in its revolutionary character.

The metaphysical line of proof I should like to take up. The "Law of Substance" as a controlling law of thought, is, it looks to me, an *essential part* of the "Substantial Philosophy," the corner-stone upon which you have builded. Your Philosophy has given me a great uplift, a widening of intellectual vision, is it too much to hope, that what I may have to offer, will be of some little help to you.

With gratitude for the past, and hope for the future, and praying that you may be spared yet many years to continue the work so well begun, I am, very truly, Laura A. Luse.

We have received from this lady an article entitled "Vital Force in Plants," which on account of its length we had laid aside. We shall, however, try to divide it and give the first installment next month together with our comments. Mrs. Luse is a very intellectual writer and has advanced some new ideas which will be considered in the light of the Substantial Philosophy. We are inclined to advise that substantialists had better quit referring to the famous Keely Motor as a demonstration of the correctness of their doctrine. Mr. Keely has been at work for over thirty years, and thus far has not given to either science or mechanics a single idea that has been demonstrated to be of the least practical value.

ASSOCIATE EDITOR.

NO LET UP.

We here make the assertion that no remedy or device has ever received the universal recommendation that has been accorded Dr. Hall's Health-Pamphlet. As a rule people are careful concerning their signatures and endorsement, and many a good cause lacks support through this cautiousness, but with our health treatment the testimonials have never ceased even for a single day to arrive at this office although we have never yet solicited one. We might easily fill this whole paper, but the following few will serve as a sample. Further information concerning the remedy will be furnished by our Extra number, copies sent free.

Elder G. E. Mayfield, of Elgin, Oregon, writes, July 15th:

"Dear Dr. Hall,—I received, some time since, your special offer. I should have written long ago, but did not wish to be hasty, I wished first to thoroughly try your health discovery for myself. As soon as I read your Pamphlet the rationale of your treatment commended itself to me, and now after nearly one year of faithful application of your treatment I can say this: I know it will cure indigestion or sour stomach, for before I used your treatment I was much troubled with sourness of the stomach and had to be very careful of what I eat, but since using it I have scarcely felt a symptom of the old trouble. Inclosed I send you a Post Office Money Order for which please send me ten of your Health-Pamphlets and also pledges with some circulars. Truly yours, Elder G. E. Mayfield."

Miss Carrie Grey, of Fredonia, N. Y., Box 1153, writes, June 17:

"Dear Dr. Hall,—I think I am safe in saying that your treatment has cured my complexion of a disease which the doctors never could understand; my face looked so bad most of the time for eight years that I would not leave home. I commenced your treatment the last of November, and since the first of April have not stayed at home a single day on account of my face. The blotches are gone and nearly all the redness; words won't express how thankful I am. My father says he would not take a good horse for what it has done for him. I am pleased with your terms to agents and will act for you when I return home where I am well acquainted. Very thankfully yours, Miss Carrie Grey."

A. H. Seymour, of Chehalis, Lewis County, Wash., writes, June 29th:

"Dear Dr. Hall,—My wife and myself have been using your treatment for six weeks or more. I must say the effect has been truly wonderful. My wife has been troubled for years with liver complaint and kidney difficulty and also with severe headaches very often, all of which are fast giving away under your hygienic treatment. I was also suffering with kidney complaint, indigestion and rheumatism, but have been free from these difficulties since taking your treatment; I am now sixty and have not felt so well for thirty years. I have no hesitation in recommending it to the sick as a curative and to the well as a preventive of disease.
"Truly yours, A. H. Seymour."

Prof. D. B. Easter, of Randoph, Macon College, Ashland, Va., writes, June 26th:

"Dear Dr. Hall,—Though an extra testimonial may not be of much value when you already have so many, I beg to add my mite to the evidence already in. To my mind after I have conscientiously tried your remedy, and seen its effects on myself and others, it is a fact axiomatic that a proper use of your discovery can not fail to produce the best results. My business of teaching and studying is, of course, sedentary; your method adds health and strength; all are noting my improved condition, and all at our college who are using your remedy are as loud in its praises as I.
"Very truly yours, D. B. Easter."

Rev. M. H. Negus, of Sandwich, Ill., writes, June 6th:

"Dear Dr. A. W. Hall,—After using your Hygienic Discovery for more than two years, I am glad to say that under God, I believe it to be the chief cause of the continuance of my life and health during all that time, and I could not consent to part with it at any price. Now at seventy-six and a half years very few people can equal me for good health and activity. Every one using it here gives the most decided testimony in its favor.
"Yours truly, M. H. Negus."

Charles W. Price, Esq., McLuney, O., writes, June 22d:

"Dr. Hall,—I have used your treatment for over one year with the most satisfactory results. When I began I was almost helpless because of constipation and dyspepsia, in fact my life was despaired of. Having been a victim of these troubles for over ten years my cure is remarkable. It seemed exactly suited to my case and I began to improve from the start, and now my health is better than I can ever remember it having been and my diet has changed from hot water and crackers to meats, beans, potatoes, etc. I look upon you as my benefactor and my services are at your disposal.
"Sincerely yours, Charles W. Price."

W. F. Coombe, Esq., Goodnight, Ky., writes, June 22d:

"Dear Doctor Hall,—Enclosed find money for ten Pamphlets. Your health treatment has snatched me from the jaws of death. My condition was well-known all through this vicinity and all are astonished to see how young and healthy I look after going down for ten years from a complication of diseases in spite of the treatment of the physicians. I am in my seventy-fourth year, and am getting stout. Am enjoying fine health.
"Truly yours, W. F. Coombe."

Mr. Wm. W. Harnden, of Boulder, Mont., writes, June 18th:

"Dear Dr. Hall,—I have been using your Hygienic Treatment for about three months and I consider that $4.00 the best investment of my life. I have been troubled with catarrh and dyspepsia for upward of ten years and neither one troubles me now. Please forward me ten pamphlets. Respectfully yours,
"Wm. W. Harnden."

Mr. A. E. Miller, 204 Ege Ave., Jersey City, N. J., writes, June 17th:

"Dear Dr. Hall,—I have used your treatment for the past three months and must give it my most enthusiastic endorsement. I was a great sufferer from indigestion having severe nausea at least three times a week. My agony of mind and body beggared description, I feared a cancer was growing in my stomach and consulted different physicians who prescribed for me, but even their temporary relief failed and I was utterly discouraged. I am now enjoying life as never before and think so much of your treatment that I wish to take an agency for it if you will kindly send me terms.
"Yours respectfully, A. E. Miller."

Mr. P. Gillies, of Nooksack City, Wash., writes, June 7th:

"Dr. Hall,—About two days after I applied the treatment my voice improved so much that I was perfectly surprised; that was February 1st, 1891, and it continues so that I can sing with as much ease as I could thirty years ago. Am now sixty-one years old, have no colds now, appetite good, sleep well and have such a color in my face that some of our neighbors wanted to know if I had taken to drinking liquor. Had lumbago twelve months previous to applying the treatment; it is now much better and in a little while expect it to be entirely well. I have sent out all the extras enclosing a pledge, and recommending parties to send their money to you and get the Pamphlet I speak of, and I recommend it when and wherever I can. Respectfully yours,
"P. Gillies."

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The Microcosm

A MONTHLY JOURNAL OF SUBSTANTIALISM AND COLLATERAL DISCUSSIONS.
THE ORGAN OF THE SUBSTANTIAL PHILOSOPHY.

A. WILFORD HALL, Ph. D., LL. D., Editor and Proprietor.
(Author of the "Problem of Human Life," Editor of the *Scientific Arena*, &c., &c.)
ROBERT ROGERS, Ph. D., Associate Editor.
Address all communications to A. WILFORD HALL, 23 Park Row, New York.

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PROF. WOOD ON PULSE-VELOCITY.

With Reply By the Editor.

CLYDE, June 17, 1891.

DR. A. WILFORD HALL:

Dear Sir,—In the June MICROCOSM you ask me to "carefully explain why a loud sound having a powerful pulse does not travel faster than a faint one."

First let me prove by a clear indisputable *fact* that it *does not*. Early one Fourth of July morning I heard the reports of a cannon more than two miles distant. Just before each report I heard a loose pane of glass in my window move from the nail that fastened it in, up against the sash and back again to the nail. I heard it every time as plainly as I heard the cannon. Mr. Willison, in the December MICROCOSM, says that at the distance of twenty rods from the cannon when fired *he* felt a pulse in advance of the sound. This pulse and the one noted by me then were the same pulse. The cause of this pulse was the evolution of a cubic yard or two of gas by the burnt powder. The gas suddenly expelled the air from this amount of space, thus forcing it into a deep condensation which moved off, we see, at the rate of sound. This pulse, as Mr. Willison and I can both affirm, was *soundless*.

You tell us in the May MICROCOSM that ten pulses per second will not produce sound, hence *one* pulse one-tenth of a second ahead of others will not produce sound. This advance pulse being so plainly noted, must have been much further ahead of the sound than one-tenth of a second, and could not, from your statement, give sound. The reason one pulse can not give sound is because the vibrations of the sounding instrument in the internal ear are *sympathetic*, and it takes several pulses to bring them to the sound pitch. Sound is produced always by a *series* of pulses.

Immediately behind the great advance pulse spoken of followed the sound pulses. How were these formed? The evolved gas above mentioned forcing the air outward into the advance pulse, is again compressed by the returning pressure, and thus a series of rapid oscillations at the surface of the gas are produced.

These oscillations produce the sound, *low* in tone for the cannon, because the larger volume of gas gives fewer oscillations per second, and higher in tone for the rifle, for the smaller volume of gas gives more rapid oscillations, and higher still in tone for a popgun for the same reason.

These smaller oscillations giving sound, were just behind the advance pulse at twenty rods from the cannon and just the same distance behind it at two miles.

But let us keep our eye upon the *actual observed* pulse. We find at two miles, although a thousand times less in amplitude, it is still moving on at the regular *sound rate*. Hence *pulses of great amplitude and small amplitude do travel at the same rate.*

Now for the reason why. It is because the vibration of the particle back and forth is a *pendulum* vibration.

All vibrations great and small occupy *the same space of time.* The vibration of a particle like that of a pendulum, begins at zero and increases to the central point and then diminishes to the zero point again. If the particle kept its rate of motion *constant* the velocity of great and small waves could not be equal. There is your error. The particles having a more rapid motion at their centers of oscillation do *not continue* in that rapid motion, but immediately *slow down* to the zero point. That fact prevents the greater pendular motion getting through sooner than the smaller, since both motions are completed in *the same time.* If the amplitudes are performed in equal times the progress of the pulses will be equal.

Hang a row of ivory balls on strings with the balls touching each other. Now if your theory that the more powerful pulse will go through quicker, be true, when one end of the row is struck blows differing in force there will be *just the same* difference in the speed of the pulse. You will find on trial there is no difference at all between a weak and a powerful blow. Just so of the air particles. Take a long row of toy balloons and strike one end of the row the pulse will go through the entire row in the same time whether the blow be weak or strong.

Your instance of the air-gun is the same in principle as that of the cannon above mentioned. The ball does fly with greater velocity the more condensed air there is in the gun, but the expanding air does not follow the ball; it is stopped by the resistance of the external air.

But the velocity of the ball does show the velocity of the expansion. This velocity is at once checked by the resisting pressure, and the pulse caused by it goes on at the uniform rate of all atmospheric pulses.

I had much to say in reply to your criticisms, but am denied space.

Respectfully,
A. B. WOOD.

REPLY BY THE EDITOR.

We are always glad to have a wave-theorist write for the MICROCOSM a concise and short article, without unnecessary repetition, embracing any one of the salient features of the wave-theory, and the stronger and more plausibly the argument in favor of that theory can be presented the better we like it.

Prof. Wood dies hard, scientifically speaking, or in other words he gives up the wave-theory very reluctantly. We have offered him in private letter to print his articles in the MICROCOSM so long as each article is brief and confined to a single phase of the current theory, in order that there may be no rambling, while each particular phase may be treated exhaustively. A man may make a dozen erroneous statements in a single paragraph which will take a dozen long paragraphs to set right. Hence the length of our replies must not be taken into account in estimating the value of Prof. Wood's assertions.

In the foregoing letter he has done very well in confining himself to a single aspect of the theory, and his argument is no doubt the best thing that can be said in favor of this phase of the current theory of acoustics; but like every other attempt to defend that view it is simply self-annihilating. If we do not in this answer show that Prof. Wood has literally and flatly abandoned the wave-theory, we will forever forfeit all our claim as to logical thinking.

Before undertaking to make this statement good, it is quite necessary to remind the reader that Prof. Wood's criticism relates to our article headed an "Overwhelming Argument" against the wave-theory, as printed in the June MICROCOSM, in which we claim to have shown that if sound consists of air-pulses then a loud sound, consisting of powerful condensations should travel faster than a soft sound consisting of weak condensations.

To prove this we referred to the propagation of an air-pulse through a tube by the movement of a piston into one end, which pulse, according to Prof. Mayer, in his article on Sound, in "Appleton's Encyclopedia," must travel with the exact velocity of sound. This, of course, is according to all authorities, and should be true if there is any truth in the wave-theory; and consequently, according to that theory, a weak pulse, caused by pushing the piston half an inch into a tube, should travel through it with the same velocity precisely as a powerful pulse made by pushing the piston say six inches in the same instant of time.

As the possibility of sending a pulse through the free air by the movement of such a piston is absolutely denied by us on account of the mobility of the air and which can not be proved by any experiment within the reach of wave-theorists; and as we cheerfully admit the propagation of a pulse through air thus confined in a tube, hence this tube experiment, as proposed by Prof. Mayer, is the legitimate ground on which to test the truth or fallacy of the current theory of air-pulse propagation. Let all talk, therefore, about sending a pulse through the unconfined air by the slow movement of sounding body cease, while we contest the battle upon the pulse which we all accept as true, and the speed of which the highest authorities make identical with the velocity of sound.

Prof. Wood himself also recognizes and tries to maintain this principle of uniform speed in all kinds of air-pulses, because he plainly sees if a powerful condensation will send a pulse swifter through a tube of confined air than a weak one, it must follow that a loud sound, constituted of powerful condensations, should travel, according to theory, swifter than a faint one, and consequently that the wave-theory totally breaks down in its fundamental law of pulse-propagation.

As the piston in the end of the tube acts on the air the same precisely as if a charge of compressed air had been confined and instantly liberated in this closed end of the tube, it follows, as we showed in our June article, that a powerful charge of compressed air thus liberated should not, according to the theory, drive the pulse any faster through the tube than a weak one. But right there we drove the last nail in the coffin-lid of the wave-theory by reference to an air-gun which is exactly such a tube as Prof. Mayer illustrates,—the ball in which is driven through it by a condensed pulse liberated behind it.

Now, even to attempt the salvation of the wave-theory from this fatal fact, its advocates must assume the monstrous absurdity that a bullet in an air-gun, *which can travel along this tube no faster than the condensed pulse which drives it*, will actually travel no swifter or be carried no further when driven by a powerfully condensed charge of air than by a weak one!

This final blow against the wave-theory Prof. Wood could not help seeing; and feeling that he must say something in reply rather than *honestly* admit that it had crushed the life out of the very foundation on which that theory is based, he wildly and confusedly gives vent to the foregoing criticism which, as we will now show, accepts the situation and admits all we claim. Here it is:

"*The ball does fly with greater velocity the more condensed air there is in the gun!*"

Why, Prof. Wood, does it "fly with greater velocity?" Clearly because there is a more powerful condensation behind it! Can the *ball* travel through the tube faster than the *pulse* travels which drives it? Come, professor, we have given you credit for honesty in these pages, but if you do not now admit frankly and explicitly that an air-pulse has a velocity in exact proportion to the strength of the condensation behind it and which drives it, we shall be compelled to take back every word we have said in regard to your honesty as a scientific investigator, or else lose all faith in your intelligence as a logical reasoner.

But the professor, in his desperate involvement, tries to obscure the force of his luckless admission in these words:

"But the expanding air *does not follow the ball; it is stopped by the resistance of the external air.*"

In the name of common intelligence, who says the expanding air of the condensation follows the ball after it leaves the gun? None but a scientific lunatic or a confirmed wave-theorist would think of such a thing. The truth is, Prof. Wood added this meaningless and wholly irrelevant remark in the stupefaction which his own fatal admission had for the

moment cast about his normally lucid intellect. Then recovering himself for a second, he adds:

"*But the velocity of the ball does show the velocity of the expansion!*"

Of course it does, professor, which kills the wave-theory, since if that theory be correct, the velocity of the expansion or pulse should show the velocity of sound, because the expansion or pulse caused by a condensation is all there is of mechanical sound-force! Don't you see? Now let it be remembered that Prof. Wood, driven by our argument, is forced to give up the whole controversy by admitting that the velocity of the expansion or pulse depends upon the amount of condensation behind it, which is the same thing as saying that a loud sound consisting of a powerful condensation must travel faster than a soft sound if there is any truth in the wave-theory.

But confused and tangled as was the professor in having thus abandoned the wave-theory by sapping its very foundation law of pulse-propagation, he saw that it would not do thus to leave the matter entirely to the tender mercies of the MICROCOSM. He therefore concluded he must modify his fatal admissions in some way, at least to appear not to have surrendered. So he proceeds again to put his scientific foot in it by the following words:

"This velocity [of the expansion or pulse] is at once checked by the *resisting pressure* and the pulse caused by it *goes on at the uniform rate of all atmospheric pulses.*"

How natural it is for a wave-theorist to contradict himself! In fact, it is impossible for him, as we have frequently illustrated, to avoid self-contradiction in attempting to defend a theory so honey-combed with absurdity, as is this. Look at him: First he admits that the "atmospheric pulse" or "expansion," while passing through the tube, travels with "the velocity of the ball," and that of course this velocity varies according to the force of the atmospheric condensation behind the ball; and, then, as soon as this "atmospheric pulse" gets out of the tube its "velocity is at once checked" and "goes on at the *uniform rate of all atmospheric pulses!*" How in logic's name can "*all* atmospheric pulses" have a "*uniform* rate" when he has just admitted a variety of different rates of velocity while the pulse is passing through the tube, according to the strength of condensation behind them, and then a "checked" rate of velocity after the pulse gets out? Surely the way of the scientific transgressor is hard.

Now, having Prof. Wood's forced admission that the atmospheric pulse driven through a tube has a velocity in exact proportion to the strength of the condensation which causes it, and consequently that the wave-theory has broken down, since it teaches that all atmospheric pulses travel at the same "uniform rate" of sound, whether in a tube or out, it is but an easy matter to dispose of all the remaining scatter-brained assertions he has made in his letter about the rates of pulses from the firing of a cannon, pulses through ivory balls, through toy balloons, etc. In fact, every statement he has made, in all this rambling attempt at displaying his scientific learning, is stultified and made null and void by his admission just quoted that at least one class of atmospheric pulses—to which Prof. Mayer gives the exact velocity of sound—*travel with all varieties of velocity from* 20 feet to 2,000 feet a second, that being the diversity in rates of balls projected from an air-gun!

What better proof, however, do we want that all his talk about pulses from the cannon or the magazine explosion is pure scientific fog, than his own words as follows:

"Your instance of the air-gun is *the same* in principle as the *cannon* above mentioned."

Thank you, professor. Yes, it is the same in principle exactly. And as you admit that the pulse in passing through the air-gun travels with a varying velocity proportioned to the force of the condensation behind it, so must the atmospheric pulse from the cannon or from the magazine explosion, whatever your own defective observations may have seemed to suggest. Is it reasonable to suppose that a pulse two miles from a cannon, or from an exploding magazine, with its condensation not a thousandth part as strong as it is within twenty feet of the exploding powder, will travel as swiftly as at the start with the full force of the powder right behind it, especially when a powerful condensation, as he admits, will carry an air-pulse and a bullet on "the same principle" a hundred times swifter in a tube than will one sufficiently weaker? Prof. Wood decides the two cases to be "the same in principle," which only reiterates his abandonment of the wave-theory, and thus again we write him down as a convert to substantialism, provided always that he is an honest man.

To suppose that Prof. Wood is so badly posted in the operations of the mechanical laws as not to know that a pulse from an exploding magazine travels with greater velocity near to the explosion than at a great distance from it, is to write him down an ignoramus. What but the greater *velocity* of the air-wave caused by the exploding powder produces the greater destruction witnessed near to the magazine, and which destructive effects become less and less as the distance from the source of the wave becomes greater and its velocity decreases? Yet a large portion of the professor's letter is absolutely wasted in trying to show that a pulse from exploding powder travels till it dies out at the one uniform velocity of sound, only to end in his own absolute abandonment of the whole thing when he comes to the air-gun.

His supposition that a pulse will go through ivory balls, through rubber balls, or through toy balloons at a uniform velocity for each medium, whatever the impetus of condensation causing it, is so unreasonable on its face, and so unsupported by any scientific facts (however, we ourself may once have supposed it to be true science) that we marvel that the absurdity has never before been detected. The very fact that a pulse travels through such an elastic medium as air when confined in a tube with a velocity exactly proportioned to the strength of the condensation behind it, as now admitted by Prof. Wood, is proof positive that all elastic bodies must be governed by the same unvarying principle, though in very dense substances such as ivory, glass, etc., the difference in rates of velocity from different condensations is impossible to be measured owing to the great velocity of the slowest pulse that can be produced and the short distances within reach of our experimentation. Yet Prof. Wood in his childlike simplicity suggests as triumphant proof of the truth of the wave-theory the crucial test of measuring the

difference between the velocity of two pulses from differently delivered blows to a row of half a dozen ivory balls! He sagely suggests: "*You will find on trial that there is no difference at all between a weak and a powerful blow!*"

We will "find on trial" no such thing, but exactly the reverse judging from the effects of different blows, the same, precisely, as in the case of bullets discharged from an air-gun. Let one of the end ivory balls fall against a suspended row and it will be observed that the pulse will drive away the farther end-ball a distance proportioned exactly to the distance of the blow and the force of the condensation thus produced by the falling ball. What, in the name of reason and science, causes these varying distances imparted to the farther end-ball, save the difference in *pulse-velocity* sent through the row? Yet Prof. Wood has to have this simple fact pounded into his superficial brain.

Everything in the nature of a pulse or condensation throughout the entire range of mechanical science teaches the same commonsense lesson. The untutored Indian knows if he wants to give a greater velocity to the pulse which drives his arrow, he must create a more powerful condensation behind it by taking a turn of his bow-string at the end, thereby to obtain a more powerful compression. The six-year-old boy, who shoots beans at passers by from his rubber strap, has mechanical knowledge enough to understand that the more powerful the condensation he creates behind the bean the swifter both the pulse and the bean will travel. Yet at this late day we are compelled to teach this elementary lesson in mechanics to such physicists as Tyndall, Helmholtz, Mayer, Rood, Lord Rayleigh, Sir William Thomson, President Stokes, Sedley Taylor and Prof. Wood, thereby to demonstrate that a loud sound, being nothing but an air-pulse, and requiring a more powerful condensation of the air than a faint one, should travel faster if there is any truth in the wave-theory.

In conclusion, we remark, Prof. Wood in his March article, by the convincing force of our arguments and facts was compelled to admit that the whole school of acoustical scientists were in error on the "*swiftly advancing*" prong, agreeing finally that the fork sounds audibly when it is travelling slower than the hour hand of a clock, and since he now admits from the same invincible force of our logic, if the air-pulse theory be correct, that a loud sound, composed of nothing but air-pulses, ought to travel very much faster than a faint one, based on the practical working of the air-gun, is it not now time for Prof. Wood to avoid further strain upon his scientific reputation and come over at once to the ranks of Substantialism? Again we extend the offer to welcome him with open arms.

ROBERT ROGERS, Ph. D.

We are no little pleased to announce that the President and Board of Directors of Rutherford College, N. C., one of the most enterprising educational institutions of the South, have deemed it in the line of their duty to confer the academic and honorary title of Doctor of Philosophy on our very worthy Associate Editor. President Abernethy, as well as the entire Board, has our thanks and best wishes for this distinction which we take in part as applying to the MICROCOSM so ably supported by our young associate.

EDITOR.

OUR PROGRESSIVE CAUSE.

[In the May MICROCOSM we headed a brief letter from a new contributor—"A CANDID ATHEIST." This letter was from Dr. Cooper, of Cleves, Ohio. It breathed such a tone of candor we felt the greatest encouragement that an intellect so open and free for the influx of truth from whatever source, would lead its owner directly on to the fountain of Substantialism. Such has been the result, and here presents the reader with one of the most thoughtful papers that has ever appeared in this journal.—EDITOR.]

The Substantial Philosophy Extended.

BY W. C. COOPER, M.D.

For years, a set of elements, fundamental to a theoretic system, has been running through my mind. It took an acquaintance with that irresistible Philosophy, founded by that irresistible man, Dr. Hall, to enable me to make them intelligibly presentable. As briefly as possible, I shall attempt to transfer this mental picture of my own, to the mind of the reader. Any appearance of dogmatism in style will please be excused, as necessitated by perspicuity.

The universe seemed to be divided into *Matter* and *Nothing*, the Nothing part being as important as the Matter part. The idea is illustrated in mathematics, where the *cipher* has as much value as *all* the other digits. The cipher represents the *Nothing* and the "significant" figures the *Something*. Space, which is simply the absence of Something, is Nothing. But Something* could not exist without it. Motion, which is a *changing* of *place*, is Nothing, for *changing* is *motion* and *place* is *space*—a point (?) in space.† Yet the importance of motion is such, great thinkers that have concluded there is no such thing as perfect quiessence, and that the integrity of all created things depends upon it. Total darkness—absence of light—is Nothing, but light (Something) could not exist without it. A shadow is Something, because it has in it *some* of light.

By intuitive recognition of this great general fact, students have naturally (by force of different temperamental peculiarities) divided into two great classes, materialists and immaterialists—Idealists. The Idealist views positivism from negativism. Objectivity is made secondary to, and is finally absorbed by subjectivity. Subjectivity is eliminated by the substitution of objectivity (for rigorous logic will have it so), but this does not take place till subjective processes have established the non-existence of objectivity. In other words, Nothing assimilates Something, and thus reduces Something to Nothing. This is the *end*, in two senses, of idealism. It starts in Nothing, and by a legitimate chain of sequences, consistently ends in Nothing. The Idealist's reasoning is all right: his conclusion is all right: only his premise is wrong. Primary instinct is against him, every-day matter-of-factism is against him, and the ultimate fact of his philosophy is against him, unless it is

* It will be seen that I endow the words "Something" and "Nothing" with a technical defining function. This is scientifically necessary, as is evident.

† The absence of a *Meta*physical nomenclature necessitates this inconsistent use of language, but the reader will catch my idea.

reasonable that this fact was established through the *reasoning* process of a nonentity!

Because Something does not end in a defined shape, apprehensible to us, there *appears* to be a middle region occupied by doubtful existences, or abstract (?) elements. Here, owing to the infinite refinement of matter, it becomes exceedingly difficult to distinguish between something and nothing. There can be no middle ground between Something and Nothing, for neither can be any part of the other. Nothing is indivisible and matter is (theoretically) infinitely divisible. In coarse apprehension, it would seem that a point should be reached in material divisibility, where Something and Nothing merge, becoming identical. This, of course, is self-evidently impossible, and only illustrates our absolute incapability of grasping the infinite in either direction.

Nothing is insusceptible of specializations, hence there is no nomenclature in this field. Language is evolved from *physical* necessity, and none of it from metaphysical needs, for *no thing is metaphysical.* Something is substance, and Nothing is not metaphysical (above matter), but is simply the absence of Something. There would be a metaphysical technology, if there were such a thing as metaphysics.

We all use the word "quality," but what does it represent? Is it Something in that realm, where Something and Nothing *nearly* meet, or is it Nothing? Neither hypothesis diminishes its value. If it is true that the universe, in a sense, is made up of Something and Nothing, there can be no such *thing* as an abstraction, in its philosophic sense. The very word makes that, which it is intended to represent, an entity, and only Something can have entity. "Abstractions" depend for their existence upon substance; are evolved from substance. Is it *rational* that substance can evolve *nonentity?* If *quality* is neither *substance* nor *Nothing,* and can not partake, in its constitution, of either, what is it? may it not be substance in its force-form? It has functions, and is not negative like space. It is *natural* to think of it as Something—it *can not* be thought of as absolutely nothing. It appears to accomplish something—space does not.

Love belongs to the "abstract" family. It seems to be a force, a powerful energy; it *does* things. It is drawn from the infinite store-house of Force by a substantial structure, created by God for that office. As a special material condition (vibration) is necessary to *manifest* sound (a form of force), so a special material condition (an impressed nervous structure) is necessary to *manifest* love. How *natural,** that God's sweetest attribute, *love,* can, under easy conditions, be drawn from the universal reservoir of Force?

Pain is an "abstraction." It is defined as a *state* of consciousness. In current philosophy, a "state" reduces to Nothing, in final analysis. Nothing can not act upon Something—it can not *act* at all. Nothing holds merely a negative relation to Something—as darkness does to the material world. Is it not astounding that being Nothing, it can locate a site, occupy a body, and endow it with *itself* unto death? Does it not agree a thousand times better with common sense, to suppose that pain is a substance (technically called an immaterial substance) in its force-form? We can in a sense conceive it to be matter, dynamized almost infinitely, and energized in ratio with its sublimation; but can we think of it as Nothing? Of course, there are realities beyond our intellectual perception, but they are necessarily *reasonable,* since nothing in that upper realm can *be* that is *not* reasonable.

Beauty is called an abstraction. It must, however, be Something, compounded, mainly of form and color. Form, bearing merely a negative relation to substance, is Nothing, but color being *derived* from something is Something. It is reflected light, and light is Something. Every object in the universe depends for its distinctiveness, one-half upon Something and one-half upon Nothing. This is sequential to the primal fiat of the great unconditioned.

Thought and feeling seem to be substantial as truly as stone is. The difference between them (and it is incalculably vast in favor of the former, as to importance) is that thought and feeling are material essences, *beyond* the need of gross conditions. Nothing is common to thought and feeling but material genesis. They are substantial because they exist *positively;* they accomplish results, tremendous ones, they *act,* and as action is impossible without reaction, they are acted upon. Action and reaction are characteristics of substance. Thought and feeling accomplish more than all the other specialized forces together, their high *manifest* birth making this a consequence. Their initial expression is in the first term of the subseries of the grand formula which comprehends all the facts of the universe. That formula dictates itself, and (in descending scale) is this:

FIRST CAUSE (substance coeval); DOMAIN of GENERAL FORCE (vito-material essence); CORRELATIVE CONDITION (link between General and Special Force), the latter becoming the basis of a subseries, reaching through the *vito-psycho-organic, vito-organic* and *inorganic* to —*Nothing.*

Thought and *Feeling!* All other specialized forms of force are their servants, and *they* are messengers whose potential home is in that triune marvel—the *Soul!* This precious trinity—*life, intellect, emotion*—these three in one and this one in three (a distinct potential personality) is in *direct* relation with the universal fountain of *Force.*

Will, being one of the children of Intellect must, of course, seem to be substantial. *Volition* is *movement,* related to *will*-force, and *movement* is nothing. The words are improperly used interchangeably by some writers. A sigh, being one of Emotion's children, is, in a sense substantial, and so on clear through the list of emotion's offspring.

There are thousands of "abstractions" in that tenuous sphere, where Something and Nothing *all but* shake hands upon the borderland of *existence,* but as we have seen, they must fall into the realm of Somethings, or into the yawning gulf of Nothing. This is fundamental and is without variation. I have said that all objects are "compounds of Something and Nothing," which but for phraseological exigency, would be self-contradictory. Of course, Nothing can not unite with Something, and "compound," in this connection, simply comprehends *negative relation.*

Philosophers of the dominant school agree that psychic manifestation is a *force,* but deny

*I put stress upon the word *natural* for reasons that will be seen later.

that it is a substance. According to the Substantial Philosophy it is a substantial entity, and therefore capable of actual existence. As matter can not be annihilated, it follows that the soul will *exist* forever. From birth to release it must exist as a distinct, self-limited entity. Except the eternal basic forces, gravitation, cohesion, magnetism, electricity, etc., this vito-psychic force is the only specialized one whose expression is constant—not intermittent. Those grand, *original* forms of forces, gravitation, etc., are derived directly from the Creator, and as vito-psychic force is constant like them, and not called into fitful requisition subserviently to *its* needs, it possesses a *quality* of eternity peculiar to itself.* It is easily conceivable too that this quality is preparative to its entrance into *naked* relationship to the source of all manifestation. It has taken all the steps but *one* toward immortality, and that one is made *natural* and easy by temporal expedients.

I have tried to show that the doctrine of Substantialism, in its farthest reaches, is in parallelism with analogy, with *natural* feeling and with common sense. The acceptance of the doctrine is not difficult—that of abstract nothingism is. It is not cold and repellant like the motion philosophy that ends in atheism. A belief in atheism is *unnatural*, because it does not fit our nature—it does not satisfy our reason nor help to still the eternal yearning in our hearts. "Unnatural" is only a convenient term, for nothing *can* be unnatural, and as a word is not a truth, what we call unnatural can not represent a truth. To call a thing unnatural, is equivalent to nullifying it. Therefore an unnatural doctrine is an untrue one. The doctrine of atheism is chilling and peace-destroying, even to the bravest and most self-abnegating natures. We want something to *reach for*, aspire toward, and this is not a mere conservative *expedient* evolved out of dumb, insensate matter—the result of "a fortuitous concourse of atoms." It is an *attraction* between creating and creature-substance—*natural* like the attractions between all other matter and God. The generous warmth of a belief in God, is *natural* because according to the eternal fitness of things, and is a response to the eternal question in every human being's breast.

The material universe is made up of *questions* and *answers*, and all *phenomena* depend proximately upon action and reaction.† Darkness in the Mammoth Cave was a question, the answer to which involved the inutility of eyes. It was answered by the instant creation of eyeless fish (for fish were an answer to water) or by the slower process of God-directed *involution* in imported fish. If there was a time when the horse had no tail, the presence of insects was a question (in the horse's behalf) and was answered by direct flat, or God-imminent evolution. Why in favor of the horse, both insect and horse being equally God's creatures? It was in strict conformity to the Creator's endless beneficence through all the steps up "being's piled gradation," from the polyp to man. The comfort of the insects was less important than that of the nobler horse, because God willed it so. The atheist recognizes the *fact*, but explains it thus: "by force of environment." That ends it with him. The explanation is cold as a wedge, having nothing of God or humanity or emotional sympathy in it. The other explanation in extenso, is full of vito-mental fitness. The fact that the horse is more important satisfies reason and justice. But if they had been of *equal importance*, some of the elements of both justice and mercy would have been lacking, thus to have provided the gnats with a means of self-protection (wings), and left the horse without any. One definition is vague, Godless, containing in it nothing of goodness. It appeals weakly to only naked reason; the other *strongly* to reason and *irresistibly* to feeling, thus satisfying our higher (improperly called supra-physical) nature.

If there *was* a time when the horse had no tail (and there never was), it was *not* a horse, and did not need a tail. Is it more thinkable that *thought*-less matter, which could not *anticipate* a contingency, could *discover* and satisfy a want when it came, than that the animal was created perfect, at once, by a Supreme intelligence? Slowness of evolution can make no excusing difference, since the quality of an idea can not be utilized in sections, even if it were evolutionarily possible that the *highest* form of matter (*really* so-called abstractions) was reached before its gross form was differentiated. And anyhow, would not utilitarian evolution have solicited the easier, readier and more effective method of developing an insensitive cuticle? This would have certainly suggested itself as better than forcing the poor brute to spend several million years in wagging its coccyx into a tail that would bring with it a *superfluous* æsthetic feature. This would have better satisfied utilitarianism, than the creation of a tail with its needless flowing beauty. Where beauty increases life-serving function, the beauty being merely incidental, evolution can *consistently* allow it a place: only then. The utilitarian principle plants cabbage, not flowers, in the front yard. Æstheticism is high-born, and carries with it the memory—the *very reflection* of high design, which is the prime ray of Supreme intelligence.

The Substantial Philosophy (and my theory, which is only the Substantial Philosophy followed to its ultimate refinements) necessitates the existence of a God, and the immortality of the soul, thus confirming human intuition (God's hint) and satisfying reason and our sense of right. It reaches the grandest conclusion of all: that, according to *true* philosophy (a correct reading of Nature's volume), *the* question of questions—that yearning which is central to our being and which can be satisfied by immortality *only*—will be graciously answered by the unconditioned propounder of all Nature's questions.

THE EDITOR'S PHOTOGRAPH.

The demand for the imperial size photograph of the Editor still continues, although over 10,000 copies have been distributed in less than two years. We take this fact as an encouragement, and as an additional evidence that Dr. Hall's work, both in this journal and in his wonderful Health-Pamphlet, is making for him a warm spot in the hearts and homes of those who have profited, both in mind and body, by his labors. It is well not to have lived in vain.

*Another aspect makes it still plainer. Sound, for instance, is fourth in a series that starts from the Supreme source, while psychic effluence is *third*, there being only the Sea of Force between it and the primordial cause—the Creative Will.

†It is undeniable that *all* phenomena are the immediate result of action and reaction, and this alone proves the substantiality of ALL THINGS, for Nothing (not being a thing) can not act nor be acted upon.

DR. HALL'S REPLY TO MR. CHARLES LUNN'S "DOMINO" ARGUMENT.

To the Editor of the "Monthly Journal:"

Sir,—In the April number of your paper, Mr. Charles Lunn attempts what he supposes to be a sharp reply to my locust argument against the wave-theory of sound as used by Mr. Audsley in his London lectures. As his "domino" illustration of how the locust condenses, rarefies, heats and cools four cubic miles of air is very briefly expressed, I judge best to reproduce it to refresh the memories of your readers before crushing the life out of it. Here it is:

"Force is indestructible, it is only transmissible and convertible. I have long held that the 'wave-theory' is imperfect and inadequate to explain all things in sound; but do not let it be attacked by sophistry instead of logic. When a boy, I have set on end a domino, then pushed it down. Enough force was put out to overcome its equilibrium, and it fell by its own weight. If I put another domino up within reach of its length, in falling, it knocked this other one down by its own weight, and so on with any quantity of added numbers. But I did not put out twice as much force to knock down two as I required to knock down one; nor yet two hundred times as much force to knock down two hundred dominoes; I only overcame the resistance of the one! Yet this multiplication of strength is the argument (?) against the wave-theory! This interesting little locust, that has been dragged into ephemeral fame, only uses sufficient force to overcome the resistance and weight of the air on the surface of its wing and the extent of its motion. Mind, I do not admit that the wing *is* the cause of the sound because Darwin said so; I have seen so many errors in his romantic and fascinating hypothesis, that I distrust him."

Now this whole "domino" argument is very stale, at least in this country, and was one of the first quibbles attempted at the time my locust-argument first appeared thirteen years ago in the "Problem of Human Life;" but it now seems to be just starting in England, as young scientists over there are not yet familiar with the replies to this class of arguments which Substantialism has at its fingers' ends.

Has Mr. Lunn ever heard tell of the mechanical force of *gravity?* If he has, he certainly ought to know that when he pushes a domino beyond its equilibrium or center of gravity it falls by virtue alone of this mechanical force, and that in falling, or more strictly in being pulled down, it accumulates momentum sufficient to press the next domino beyond its center of gravity, where this same ever-ready and ever-active mechanical force seizes it, carrying it against the next, and so on to the end of the row, even should it extend clear around the earth. It is precisely the same as if a separate finger should mechanically push each separate domino in succession with the same required amount of force. True enough, Mr. Lunn did not at that instant put out "*twice as much force*" to knock down two as to knock down one, but can't he see that he had already "put out *twice as much force*" in overcoming gravity by setting the two dominoes on end, thus storing up that much force for future use? Such children in science should study the elementary principles of physical philosophy before attempting to write for public journals.

Of course this view of gravity is a new revelation to Mr. Lunn. Look carefully at the passage just quoted above. "*But I did not put out twice as much force to knock down two as I required to knock down one!*" Of course he didn't, because his already stored-up gravity took the job off his hands and did the knocking down for the second one without requiring his finger to touch it.

Mr. Lunn adds: "*Enough force was put out to overcome its equilibrium and it fell by its own weight.*" What an expression for a scientific critic to employ,—as much as to say "it fell by its own tendency to go down." Surely in strict science a thing falls because it is *pulled down* by the mechanical force of gravity. But for the action of this force not a domino in a row of a thousand would fall only as it was individually pushed over by Mr. Lunn's finger.

Critics who attempt to discuss this locust-argument should first form a true conception of the nature and office of gravity as contrasted with that of mechanical pressure. They should grasp the idea, for example, that a mighty boulder weighing hundreds of tons can be so equipoised by some mechanical force on the crest of a mountain that its equilibrium can be overcome by the pressure of the tip of one's finger, when instantly this mechanical force of gravity takes it in hand and carries it down the steep, cutting off the largest forest trees as if they were but straws. But in all this work of the boulder Mr. Lunn sees the action of no mechanical force except that of the slight pressure of his finger in overcoming the equilibrium of the stone, since it "fell by its own weight!" This illustrates a score of similar misapprehensions on the part of wave-theorists in their attempted criticisms of my locust-argument, such for example as the stereotyped reference to water-waves, etc.

But there is not the shadow of resemblance between the mechanical work attributed to the locust by the wave-theory in the compression of an elastic fluid in *equilibrio*, like our air, and any operation in which gravity plays a part. Air receives no motion or effect from gravity by any mechanical compression or pulse imparted to it. Whether immediately at the compressing body or at a distance from it, no pulse or condensation whatever can take place that is not due solely to such condensing mechanical cause, as witness the destructive effects of a powder explosion miles away from the magazine. Not one iota of such direct condensing effect takes place at a distance by the action of gravity, or that was not mechanically impressed upon the air by the exploding powder as its condensing cause. How foolish, then, to pretend to illustrate the mechanical compression of an elastic fluid in *equilibrio* by the action of a mechanical force like gravity in pulling down dominoes or ridges of water that had first been raised by some other form of mechanical force!

If Mr. Lunn really thinks that the locust only uses sufficient force to move the air "on the surface of its wing," and that the rest of the millions of tons of mechanical pressure caused by its sound throughout the four cubic miles of air, according to the wave-theory, *does itself*, will he kindly tell us if the exploding powder only moves the air in contact with the magazine and that the distant windows crush themselves "by their own weight?"

The slightest elementary knowledge of mechanics should teach Mr. Lunn that gravital operations, such as he illustrates in the falling of dominoes, after he has conserved gravital force by placing them on end, have nothing whatever to do with the mechanical condensation of an elastic and compressible fluid in *equilibrio*, and that whatever condensation is

claimed at a distance by the wave-theory can only be attributed to the mechanical force actually exerted by the condensing body. Until physicists can master this distinction between the compression of an elastic fluid in *equilibrio* and the falling of heavy bodies by the active force of gravity, they had better stop writing for the press on questions of natural philosophy.

Surely Mr. Lunn will take this free lesson in physical science kindly, and try to profit by it. If he does so he will at once see the almost infinite absurdity of supposing an insect, that can't exert a quarter of an ounce pressure, capable of squeezing four cubic miles of air into condensations and rarefactions with millions of tons of mechanical force, thereby generating heat sufficient to add "one-sixth" to the elasticity of the air and the velocity of its sound, as absolutely required by the wave-theory. If he wants to see this thing demonstrated beyond all quibble, I refer him to my last two or three replies to Mr. Sedley Taylor in the London *Musical Opinion*.

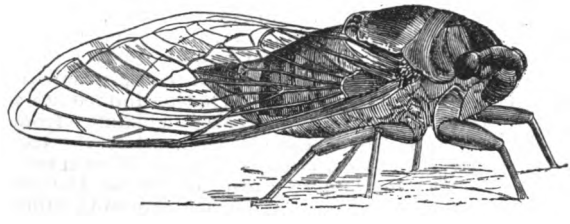
A. WILFORD HALL,
Editor of the MICROCOSM.

23 Park Row, New York.

OUR GREAT AMERICAN LOCUST.

BY THE EDITOR.

One of our subscribers in the south has very considerately sent us a splendid specimen of the loud-sounding locust which has occupied such a conspicuous place in our discussions with wave-theorists on the probable correctness of that theory. This insect—an accurate



engraving of which we herewith present—can be heard singly or alone a distance of more than a mile, as we have personally observed on different occasions, while a swarm of them in a clump of bushes have been distinctly heard across the Narrows, below this city, at a point where the measured distance is almost three miles.

We have shown in numerous arguments in the MICROCOSM, which no wave-theorist has been able to shake, that if the mechanical theory of sound be correct this insect, by its physical strength alone, must be able to condense and rarefy at least four cubic miles of air, thereby causing in the condensed half of this entire mass sufficient heat to raise its elasticity "*one-sixth*" and thus add *one-sixth* (174 feet a second) to the velocity of its sound!

This is the doctrine of the wave-theory as formulated by Newton and Laplace, and as now taught for actual science in every college in the civilized world.

The mechanical energy or squeezing force which this state of facts requires this insect to exert upon the mass of air permeated by its sound, we have recently shown to involve an actual physical pressure of 5,000,000,000 tons —more than the compressing power of all the locomotive engines on earth!

This, however, is but a single phase of the prodigious absurdities which honey-comb the wave-theory from bottom to top. Yet we are coolly asked by the authors of our text-books to accept that monstrosity of science in lieu of the simple and common-sense proposition that sound is a *substantial* though immaterial form of force somewhat analogous to electricity.

Persons desiring to see this locust-argument in all its force should read our reply to Mr. Sedley Taylor in the July MICROCOSM—last month. It will be sent free on application.

THE "MICROCOSM."

BY THE ASSOCIATE EDITOR.

This is the ninth number of Vol. VIII., and the critical scientific character of the publication may be judged by this specimen.

Substantialism in the physical realm points infallibly to Substantialism in the spiritual realm. For example: If all the forces or phenomena-producing causes in physical nature, such as heat, light, sound, gravity, electricity, magnetism and cohesion, are substantial, though immaterial entities, as Dr. Hall was the first to teach, then, by every analogy in science, life-force, mind-force and spirit-force, which move and control our bodies, must be equally substantial which, as the thinking world is beginning to see, forms the only real or conceivable scientific basis for human immortality.

To teach a theology which does not include this substantial or entitative nature of all force in whatever realm of investigation, is to teach an illogical, asymmetrical theology which can only appeal to the superficial, and which will not have the weight of a feather with any man or woman who does intelligent consecutive scientific thinking. Yet, humiliating to state, ninety-nine out of every hundred clergymen who teach theology from our pulpits, have never conceived the elementary thought that a theology which does not recognize the substantiality of all force in physical nature is without one shred of proof from either science or analogy that the soul of man can be immortal.

How an educated clergyman can satisfy himself with teaching year in and year out a theology without one scintilla of scientific analogy in its favor—believing as he does in the motion-theories of science and rejecting as he does the Substantial Philosophy—is more than we can understand.

The scientific Atheist looks appealingly up to the tens of thousands of pulpits in this land and begs of the undoubtedly sincere clergy to give him one proof from science, one link from the chain of natural analogy, to show that his soul, his intellect, his spirit has anything substantial about it on which to base the hope of a possible conscious immortality after the death of the body.

What have these tens of thousands of clergymen to say in reply to this pathetic appeal? They have nothing but records of proofs 1,800 years old, and these proofs so far from being severely scientific and according to the analogies of nature are merely historical and of a supernatural character! and are, therefore, exceedingly difficult for intelligent sceptics to believe.

Not so with the theology of the Substantial Philosophy. It holds out all that Christianity teaches, all that is revealed in the word of life, and as a confirmation of the truth of this, it points to God's book of nature which, up to the day when Dr. Wilford Hall gave the first announcement of Substantialism in the "Problem of Human Life" was a *sealed book*. It was that first blast of the substantial bugle which broke the seal and invited all men to come and read their title clear to an immortal and substantial existence both here and hereafter. It was that breaking of the last seal that announced to the clergy and to all thinking men for the first time in the history of science that every form of force in nature, even including sound-force, heat-force and light-force, is a *substance* and not a mere "mode of motion;" and if this demonstrated revelation of law and science in the physical realm be true, as the founder of Substantialism has been showing during these fourteen years through the MICROCOSM and through other journals, what a magnificent foundation, what a bed of rational cement does it lay for believing that the human life-force, soul-force, mind-force and spirit-force, like the other natural forces in the physical realm must also be substantial, and if substantial *indestructible?*

It is slow work to get the clergy to see in all its fullness the bearing of this astounding revelation from the book of nature. A few have seen it in all the beauty of its far-reaching significance, and are amazed at their own stupidity in not having seen it before. Others are just beginning to see men as trees walking. Let Dr. Hall continue as he is now doing to smash the wave-theory of sound, as the ideal mode-of-motion-theory in physical science, and upon which all the other modes of motion depend for their existence, and very soon the most indifferent clergymen who can be induced to read those arguments will begin to see that Substantialism is not a passing craze, but that it has come to stay.

Unfortunately for the immediate triumph of the Substantial Philosophy, its founder is still living. Great and revolutionary discoveries in science and philosophy do not find recognition during the lifetime of their authors. While the life of this discoverer stands somewhat in the way of the immediate and general acceptance of his discoveries, we are more than thankful that he lives on to continue the work of iconoclasm in a manner which none of his disciples can yet accomplish. Judging from his present robust health we may fairly hope to retain him with us until the cause he has founded shall be able to stand alone.

THE "PROBLEM OF HUMAN LIFE."
Its Value to the Clergy.

This was Dr. Hall's first scientific and philosophical book, written fourteen years ago. It has met with unprecedented sale for a book of that character—more than 75,000 copies having been called for without even one dollar having been spent in advertising. Many of these copies have found their way into the hands of the clergy and have produced a profound impression on the minds of those who have candidly grasped the religio-philosophical tendency of the work.

Its overwhelming arguments against modern materialistic evolution make it one of the most useful missionary books for circulation among advanced thinkers of the atheistical school. No better proof of this need be asked by any clergyman than its marked effect upon the mind of Prof. M. V. Rowe, of Indiana, an educated materialist, as pathetically related by himself in this number of the MICROCOSM. We ask every clergyman to turn to that letter and weigh the impressions made by a single chapter of the "Problem of Human Life" upon this cultured, intellectual atheist, and then ask himself if he is doing his whole Christian duty by treating with indifference a work that is calculated to do so much good?

The book is a large double-column octavo—525 pages, containing the portraits of Tyndall, Darwin, Huxley, Hæckel, Helmholtz and Mayer—the six great modern scientists reviewed by the author.

It retails for $2, but Dr. Hall insists that for a short time at least it be sent to all who would desire to possess a copy, at $1 by mail, postpaid. We add, that any person receiving the book on these terms and not satisfied with his purchase after reading it, shall have his $1 refunded by returning the book.

ROBERT ROGERS, Associate Editor.

"LIVING MATTER."
BY THE ASSOCIATE EDITOR.

Through the kindness of a friend we have been permitted to examine a book called "Living Matter," by C. A. Stephens.

This author attributes all the manifestations of power and intelligence in the universe from the first deposit in the formation of planets to the acme of intellectual ability in the philosopher to what he is pleased to term the *sentience* of matter. By this is meant that matter possesses in itself the intelligence and power necessary for the formation of the myriad manifestations of inorganic and organic substances, that it is the creator of itself, and that what we are pleased to term the physical forces of nature, such as gravitation, heat, light and electricity as well as higher forces of life and mentality, are nothing more than properties of matter which it has the power to guide and govern to affect whatever ends seem to its "sentience" most desirable.

This view of the conditions of the universe is directly opposite to that maintained by the Substantial Philosophy, which regards matter, *per se*, as an absolutely inert and passive entity dependent primarily and ultimately for all its manifestations and conditions upon the action of a realm of substantial existence which, although not material in any sense, is nevertheless the guiding and controlling power of the universe.

In order that our readers may see for themselves the teachings of Mr. Stephens, we give the following quotations from his book, which represent very fully but briefly the general principles upon which his theory is based:

"Man, if you please, began in lowly, minute forms, and there has been a constant progress up to higher forms; in other words, what once stirred feebly as an amœbold particle of biogen, now walks the surface of the planet as a man; which means that the *child* as a rule is better than the *parent;* that as a rule, the child is more highly developed and more intellectual than the parent; or that there has been more than a mere repetition of the parent in the child, that the rule is, in the long run, that the child is of a higher type than the parent; and this means nothing less than that there has been a *creation in the child of something not possessed by the parent.*

"The sentient theory of phenomena offers but one primary assumption, namely, that matter is not inert

but sentient, this sentience being the first cause of all phenomena. In other words, the universe is not an insentient apparatus, a blind machine controlled more or less perfectly by an agent outside it, but sentient in itself; and that all its phenomena are the result of its sentience, from eternity.

"That the primary sentience of universal matter thus passes into motion in biogen, is the keynote in the development of life on the earth's surface."

This theory is certainly opposed to all our observation and investigation as under all circumstances matter has been regarded as inert and lifeless, and while through its direct and immediate connection with life and the forces of nature, some have regarded these higher natural manifestations as being resultant upon the motions of matter, yet there has always been a distinction between matter and its controlling influence which we call force. No philosopher has hitherto been rash enough to consider the invisible phenomena of life and mind as identical with matter in its gross sense.

The human mind from past experiences is compelled to associate activity, power and control with the invisible and immaterial; the revolution of worlds, climatic conditions, growth and decay, life and mentality, however intimately they are associated with matter, can never be reasonably reduced to the position of phenomena of matter, *per se*, but are manifestations of a great and powerful invisible realm of which materiality as we understand it is but a passive subject.

This invisible world of force by its action upon matter produces these various conditions as well as all the forms in which the material world is manifest. For example, by virtue of the action of cohesion and adhesion, which are properties of force, the consistency of matter is obtained, otherwise there would be an infinite degree of formless and lifeless material attenuation; by virtue of the action of heat and life the material conditions are so ordered that growth and development are obtained and the inorganic elements transformed into the organic; by virtue of mind and soul, artificial development and selection are obtained and natural phenomena, both material and immaterial, are controlled and ordered for the further development of themselves and for the production of entirely new phenomena.

All these are results not of "sentience" in matter, but of the controlling power of invisible but substantial force guided by some infinite Power which the human mind can not comprehend. We must regard as a scientific and philosophical axioms that the fundamental principle underlying matter, *per se*, is inertia and passivity, while the principle or condition underlying *force* is activity. Unless this be so it is impossible to explain the countless forms and conditions assumed by matter, and still less is it possible to understand the operations of or the necessity for the great invisible and powerful realities as manifested by the universal forces which every sane mind must know to exist.

By referring to the quotation given it will be seen that Mr. Stephens also believes in the evolution of the higher from the lower forms of life, we can not do better than to refer him and all readers who wish to see this question fully considered and settled, to the seventh chapter of the "Problem of Human Life" by Dr. Hall. One point, however, may be taken up briefly and the advantage will be that there is no necessity for the usual tactics of evolutionists to "examine into the mysteries of antiquity or presume upon the peculiar conditions of the tertiary or glacial periods for proof, as we have the conditions now before us under the best possible circumstances. The principle to be considered is the foundation-stone of the doctrine of evolution in which Mr. Stephens does not differ from Darwin and others, namely, "that the child is of a higher type than the parent; and this means nothing less than that there has been *a creation in the child of something not possessed by the parent.*"

If there was any real truth in this assertion there certainly ought to be some radical difference, both physically and intellectually, between the present generation of mankind and that of say, the earliest records of intellectual civilization. But is this so? Is there any great distinguishing difference between the Egyptian of three thousand years since and the creation of the present century? We emphatically assert that if there is any truth in the doctrine that "the child is of a higher type than the parent," or "that there has been a creation in the child of something not possessed by the parent," that there ought to be such a distinction both physically and mentally between the ancient Egyptian and the present American that even the possibility of a doubt would be ridiculous.

But the facts in the case show no change whatever in the physical structure of the sons of the different centuries, and, so far as we can perceive, there is not the slightest improvement intellectually *except such as may be fully explained by the different conditions of life.* The Egyptian possessed all the science and learning that was necessary in the peculiar struggle for life in his particular station, possessing many fine arts of which we in the nineteenth century are ignorant, notwithstanding our boasted advancement. As instances of this, consider the embalming of bodies, reducing them to a condition of petrifaction in which state the features are preserved in proportion perfect enough for identification after centuries, the ability for tremendous mechanical work, such as we with our steam and electric appliances can hardly understand, let alone accomplish, their masonry in which the dividing line between two stones can not be discovered with a microscope, and dozens of other arts which are dead to all other peoples. All these arts and accomplishments were essential to the conditions of life at that time, and were, therefore, the results of the mental actions induced by these conditions. In the present century we live under a different state of affairs, and the development of mind is in other directions in which we surpass the Egyptians and confound their intelligence, much as they have ours. All these differing abilities are traceable to the differing circumstances and conditions of existence, which are the determining factors of intellectual as well as physical change.

The development of mind presents much the same phenomena as that manifested in artificial selection in plants and animals. By bringing about the best and most congenial conditions the products will improve proportionately, and any deterioration in environment will be apparent in its contrary effect.

The human mind in the newly-born child of the Egyptian of 2000, B. C., and of the Greek of 500, B. C., and of the Anglo-Saxon of 1891, have exactly the same natural mental potentiality, and possess precisely equivalent intellectual possibilities if guided and operated

under precisely the same environment, and if it were possible to transport the children of the Egyptian and Greek when born to the shores of America or England, it would be discovered that their development would not be influenced according to hereditary necessities, but would be according to the European or American standards, while the American child similarly transported to either Egyptian or Grecian civilization would show no signs of Anglo-Saxon parentage so far as mentality is concerned, but would develop entirely according to the standards of his surrounding conditions. Of course, in such an experiment climatic and physical conditions would be necessary considerations.

The only reason why the intellectual product of the present century is an improvement upon all preceding time is by virtue of the increased quota of intellectual development, furnished by the preceding ages, which it is at hand ready to be taken advantage of.

The thousands of phenomena, which to preceding ages were mysteries and which were only solved by incessant toil and investigation, are to us understood and demonstrated facts, and act as lights guiding and directing our steps toward the discovery and solution of other enigmas which never were presented or even thought of by our ancestral investigators.

Our intellectual vision expands as our knowledge increases. The principles of logical induction and deduction are dependent entirely upon our experience and education, and according to the extent and completeness of our knowledge in any given lines will be the value of the deductions made. The discoveries and improvements in all departments of life since the world began can be likened unto a great chain in which the second link is dependent for its development upon the first, the third upon the first and second, and so on down to the present time when a discovery made to-day is the result of all the education and advancement that has been made in the world's history.

No discovery in either mechanics, science or philosophy has ever yet been made until the conditions of the age were such as to have prepared and paved the way for its necessity.

This fact is well illustrated by the development in electrical science. Thousands of years ago manifestations of the presence of this force were noticed in amber, rubber, etc., but no thought of its mechanical or practical value ever dawned upon the mind of man till less than a century ago, when steam reached the acme of its capability and thus paved the way for more powerful and immediate methods to keep pace with the improved mechanical development in other directions.

This we believe to be the correct philosophy of the development of mind; that whatever improvement is manifest is not due to any natural, inherent increase in potency by virtue of heredity, but that its improvement or deterioration is entirely the result of more or less favorable environment.

THE "INVISIBLE WORLD."

This new book, by the Rev. J. I. Swander, D. D., Ph. D., of Fremont, Ohio, a completed copy of which has just been received, is certainly a work of great literary, scientific and theological merit, and one that is calculated to create a genuine sensation.

We have had the pleasure of reading the advance proofs of the book as it progressed, and in this way were able to form a more correct comprehension of its critical and far-reaching character than if the entire work had been submitted at one time. By this means we were enabled to study its pages at leisure moments, when riding on cars or when resting after the labors of the day were over.

From this opportunity our judgment is deliberate that the "Invisible World" will rank with "Natural Law in the Spiritual World," by Drummond, or with any other religio-philosophical work of the nineteenth century.

We have no room in this number for extracts from the book. We simply say to our readers, and especially to the clergy of all denominations, if you want a treat,—a book that combines all the fascination of the novel with that of a work of profound instruction from the pen of a genius,—send $1 to the author as above and receive a copy by mail before the price is raised by the publishers to $1.50, as will be done about the first of next month.

To say that the library of any minister, and especially any believer in Substantialism would be incomplete without the "Invisible World" is only to put on record what every eader will cheerfully concede when he shall come to read the book.—EDITOR.

A PATHETIC LETTER.

FROM PROF. M. V. ROWE.

[Last month we printed a short letter from Prof. M. V. Rowe (page 119), showing "How a Materialist Feels," and as stated, we sent him, as a token of our sympathy, the "Problem of Human Life" and the back numbers of this volume of the MICROCOSM. The result is the following letter which, including the postscript, should be read by every one.—EDITOR.]

Dear Dr. Hall,—Your book and MICROCOSMS at hand, and I must say I did not expect so *generous* a response to my request. If grateful feelings can be any evidence, then be assured that the favor and honor done me are duly appreciated.

Oh! it does seem from the very title-page and chapter-contents of your book, that it is just what I have wanted!—a sensible, scientific, common-sense work on religion and philosophy. It seems to give me at the start a new hope that religion and common-sense are yet consistent terms. I have read the copies of the MICROCOSM through, but have reserved the "Problem" for a *close* and more *critical* perusal, and be assured I'll read it with much avidity and interest, for it seems even now that we've been *friends* for years! How strange! In fact, when I wrote you so briefly before, I felt strangely impressed to do so. Something seemed to say that *you* could do me good, and so it has turned out.

I was raised by Methodist parents, though I never belonged to any church, and while in college I resolved to become a minister of my parents' church; but in floating in that theological current I struck some orthodox *boulders* that threw me out of the clerical idea. I then married and began teaching, and became attached and devoted to my family and home. Two boys were born to us, and we led a happy, cheerful life. Our home was our world—our *all* in *all*, I was happy in my calling and our home was my ideal heaven—all I thought about or cared for. But oh! bald delusion,—fatal mistake.

About three years ago, my oldest son—a young man—came home from the telegraph office sick, it proved to be that dread typhoid-fever and, after being given up by all the doctors, he began to rally—his reason came back, but just as the walls of his gloomy room began to brighten up his dear mother, after a sleepless, ceaseless vigil of twelve long weeks—a vigil such as *mothers* only can keep,—took the same fever and in fourteen days we laid her in the cold grave and the poor boy was not able to look upon the face of her who had died that he might live!

Oh! cruel fate. In my madness and grief, when I thought that for her love and self-sacrifice, she received nothing but suffering and death, is it any wonder that in my agony I cried out there is no God? No wonder I felt there was no Providence to protect; that all in this world is but the result of fixed and inexorable law, with the decree gone forth: if you don't want to be crushed, simply "stand from under."

But still, from habit and education, I had a vague *undefined, dreamy* hope that the grave in which we had laid the loved one was not—*could* not be all; and for the first time I took up the subject of a future and another life. Oh, with what earnestness did I study all religions! But alas, each effort left me more heart-hungry, more soul-thirsty than before. They but relegated me to that mysterious cloud-land of faith, and I was wholly incapable of comprehending the lesson.

I found that *all* religions were a matter of speculative faith rather than *evident* conclusions of demonstrative science. In my search I met many kind correspondents, among whom was the editor of the *Christian Herald*, of your city; but I'm still a Paul on his way to Damascus—still a Thomas calling for the prints of the nails in the wounded hands!! But I do not triumph in such unbelief; I do not exult in it by any means, as do some. I'm not happy in my doubts. So far am I from such a feeling that I'd give worlds were they mine to give—even suffer death itself to know that my dear departed one still lives, and that I will meet her over there; for when *she* died (?) *I* ceased to live.

But see what I've done?—taken up your time and forced my private grief upon you, a total stranger, but then I *know* you will forgive me, for something tells me you will. I know I have your sympathy, not only in my sorrow and bereavement, but in my fruitless search after light. Oh, how my poor feet are blistered by the hot sand in this cheerless desert of doubt! In my anguish and doubt I sometimes cry out like a forsaken child—I'm *weary!* let me rest! for I'm nothing but a floating, aimless waif, cast adrift upon a shoreless sea.

But to the book. Well, I can't give you my views upon it yet, for I've not read much of it. I want to make it a *study* when I do begin it. I have, however, read your correspondence with Rev. Sheldrake, and my only comment is that I don't know whether you are liable under the act forbidding cruelty to animals, but the "under dog" has my warm sympathy, at all events.

Your definition of instinct and human reason, on pages 426-427, is new to me and original, and though on first view it seems open to criticism in some respects, yet it deals Darwin a fatal blow, indeed I might say in general terms that there is one omission in the make up of the work and that is *your* picture should appear above that of the six scientists whom you so completely vanquish.

I believe I have not given you the grounds on which my want of faith is based. Well, if they be well founded, it were better I keep them to myself, and if they be ill-chosen, they avail nothing at last, so I'll say no more on the subject.

I regard your remarks on Spiritualism quite diplomatic, cautious and non-committal. Well, I feel the same way.

By the way, there is something there which I deem worthy of investigation, though *Hypnotism* bids fair finally to solve the whole mystery.

But I *must* close for the present, and so again thanking you for your kindness and hoping you will think me grateful, I remain,

Yours fraternally,
M. V. ROWE.

P. S.—Since writing the foregoing letter I have given the seventh chapter of the "Problem" on Spontaneous Generation, a careful, quiet, close reading, and I now open my letter to inclose my thanks for the pleasure that perusal gave me. Had the subject not been a serious one your *caustic* review and cutting answers to Hæckel would have provoked a spirit of mirth and fits of laughter. Poor Hæckel! I hope he may survive, but certain I am his "vocation is gone." Hereafter, spontaneous generation will be but a punctured scientific humbug.

I must say, if the Christian church would spend some of the money in circulating this book among some of the *cultured infidel heathens* at home, instead of sending missionaries abroad, they would subserve the interest and advance the ends of Christian effort far more effectually than they now do. It is the "fire in the rear" that the church has the most cause to dread. The attack there is being made by enemies whose mental caliber and destructive cannonading are not to be ignored. I've read their books and noted the replies, and I must say that *yours* is the only satisfactory one I've ever seen. I thought Drummond's "Natural Law in the Spiritual World" was good, but in comparison, it is but a *primer*, and if you do no more, or never had written anything but that seventh chapter of the "Problem" the Christian world would owe you a monument. If Talmage would use a little of your logic instead of indulging in so much word-picturing and "poetic imagination" about the old exploded dogmas of a literal, material resurrection, etc., he would be read with more patience by intelligent men. I regard your illustration of the Lord's Prayer in the sand and the Hoe press and Howe sewing-machine as the most convincing proof of the existence of a God I ever read. How I have struggled in the effort to reconcile the well-known and oft-repeated and much-observed workings of the natural, fixed laws, with the theory of the *supervising* presence of a personal God!! and yet here it is made perfectly simple.

I see one of the copies of the MICROCOSM (May) contains your picture. Now, be assured I'll have it framed and hang it upon the wall as the picture of one who has given me more pleasure than all the sermons, Bible comments, "Clark's on the Romans" included, that I ever read. You teach immortality and a future life in such a manner that the reader is not

required to sacrifice common-sense and reason in following you, nor to commit intellectual suicide as a "condition precedent" to belief in a future for humanity.

I shall read the other chapters as soon as possible. Poor Darwin, Huxley and Tyndall, I presume, await their sad fate also.

Again accept my thanks, M. V. R.

THE WAVE THEORY OF ACOUSTICS.*

BY GEORGE ASHDOWN AUDSLEY, F.R.I.B.A.

Time will not permit me to go more fully into the direct teaching of the Substantial Philosophy with reference to Sound, but I shall again and again have to allude to it in my forthcoming remarks.

Now I come to the Locust Argument, and here we may settle down to a little hard thinking and some startling calculations.

By way of introduction, it is advisable that I should say a few words on the velocity of sound in air, and some of the difficulties which have beset mathematicians in reconciling their theoretical with the actual observed velocities. I shall be very brief. The velocity of sound in air has been found by careful experiment and observation to be as follows: At the freezing temperature it travels about 1,090 feet in a second of time, whilst at the temperature of 26·6 degrees Centigrade it travels at the increased velocity of 1,140 feet a second. These calculations show that sound receives an increase of velocity in air of about two feet a second for each degree Centigrade above freezing point. At all temperatures below freezing point (0°cent.) its velocity is less than that first given.

These remarks bring me to the consideration of a matter which has always been discanted upon with gratification by the teachers of the wave-theory. This matter embraces Sir Isaac Newton's calculated velocity, based on theory, its disagreement with the results arrived at by direct experiment and accurate observation, and Laplace's ingenious correction or, rather, appendix thereto, reconciling Newton's theoretic velocity with the actual velocity.

Newton, basing his investigations on the known density and elasticity of the air at a given temperature, calculated that sound should travel through air at the freezing temperature at the uniform velocity of 916 feet a second, be the distance what it may between the origin of the sound and the ear which receives it. Now, whilst it was not easy to dispute the apparent accuracy of Newton's calculations, it was evident from the results arrived at by practical experiments and observations that his theoretic velocity was only about five-sixths of the true velocity. It was natural that so great a discrepancy should give rise to much discussion in the scientific world; and that many theories should be started to in some way account for the missing sixth. Newton, fully recognizing the importance of this matter, attempted to square it by throwing out a conjecture that sound only took time in passing from particle to particle of the air, and that it occupied absolutely no time in passing through the particles themselves. This supposition compelled him to assume that the path through which sound passed was occupied by air-particles only for a portion of its length.

*A Paper read before the Members of the South Eastern Section, London, England. November, 1890.

Professor Tyndall alluding to this question says it is "one of the most delicate points in the whole theory of sound;" and I agree with him that it is a "most delicate point," seeing that, if it is properly considered and worked out, it leads to the overthrow of the theory alluded to by Professor Tyndall. Everything remained in an unsatisfactory state, notwithstanding Sir Isaac Newton's attempted explanation of the missing sixth, until the great scientist, Laplace, came forward with his heat hypothesis, and received the congratulations of his brother philosophers. As Professor Tyndall says, the "great French mathematician, Laplace, was the *first to completely solve the enigma.*" It is advisable that I should briefly explain how he solved "the enigma."

All acousticians seem to have accepted the following rule as correct, namely, that the velocity of sound in air depends upon the *elasticity of the air in relation to its density.* The recognition of the facts under this law, however, failed to account for the missing sixth in Newton's apparently correct and reasonable calculations. A greater elasticity than the air was known to possess under ordinary conditions was required to account for the known velocity of sound. Heat was necessary to create this increase of velocity, but where and how could it be generated? Certainly this was a "delicate point" in the wave-theory—a veritable "enigma." Its solution was reserved for "the great French mathematician, Laplace." He never for a moment questioned the truth of the wave-theory, but came boldly forward with his heat hypothesis, which has linked his name forever with a theory now destined to be associated with failure. Laplace pointed out that as each sound-wave consists of a condensation and rarefaction of the air, both heat and cold must be generated in every wave. He calculated that the heat generated in the *condensed* portion of the sonorous waves imparted an increased *elasticity* sufficient to account for the missing sixth. Professor Tyndall points out that Newton only recognized in his calculations "the change of *elasticity* resulting from a change of *density;*" and further points out for our instruction in this "delicate point," that "over and above the elasticity involved in Newton's calculation, we have an additional elasticity due to changes of temperature produced according to Laplace's heat hypothesis in the sound-wave itself. When," continues the learned acoustician, "both are taken into account, the calculated and observed velocities agree perfectly." Laplace assumed such changes to exist; and by a self-satisfied argument and a mathematical formula, arrived at the calculation which gave 174 feet a second as the increase of velocity created by the *heat* generated in the *condensed* portion of the sound-waves.

Neither Professor Tyndall nor any other European scientist has given us poor outsiders any information respecting the amount of *increased density* caused by the *condensation* of the sound-wave; and this, to say the least of it, is an oversight hardly pardonable in such accomplished mathematicians. We have, under such circumstances, to consult an American authority. On turning to the article on "Sound," in Appleton's "American Encyclopedia," we find that Professor Mayer—America's highest authority on the wave-theory—supplies the deficiency. He says: "This compression gives for the *compressed half of the*

wave an increase of $\frac{1}{6}\frac{1}{5}$th to the ordinary density of the atmosphere."

I am, however, bound to admit that Mayer has not proved his case; for when some very startling calculations, based on his increase of density, were submitted to an accomplished scientist in one of our own learned colleges, he, whilst not disputing the calculations, *per se*, did not admit Professor Mayer's increase to be correct. He, however, was too wise to commit himself by giving any ratio of increase of density, and so far saved his scientific reputation. I shall not mention this cautious scientist's name. I am afraid I must leave the startling calculations alluded to alone to-night. But I have some others.—Now for the insect.

The tiny insect whose exertions, and, indeed, herculean labors I am going to speak of is one of the *locustidæ* (a saltatorial family of the order *Orthoptera*), whose stridulations can be heard distinctly at a mile distance. This insect is mentioned by Darwin and other naturalists, and its marvellous sound-producing powers recorded. An ordinary specimen of this insect weighs less than a *quarter of a pennyweight*. By the natural exertion of its sound-producing organ it produces a sound of immense travelling power, so much so that it can be heard, as has already been stated, at a distance of a mile in all directions. This simple fact is in itself sufficiently wonderful—very very wonderful when viewed in the light of the Substantial Theory of Sound; but absolutely overwhelmingly so when considered under the mechanical and impossible wave-theory.

According to the latter theory, this tiny insect, which is scarcely able, by the exercise of its full strength, to move a half an ounce of matter, is believed to create by the invisible exertions of its sound-producing organ a physical agitation and displacement of the air which converts four cubic miles of atmosphere into waves consisting of condensations and rarefactions, the compressed portions of which contain a sufficient augmentation of heat above the normal heat of the atmosphere to add one-sixth to the elasticity of the air and the velocity of sound. Just think of all this and then pin your faith to the wave-theory of acoustics if you can. But I am only beginning my exposition, so kindly give me your best attention. But before I proceed, it is right that I should acknowledge the source whence my exposition is derived. The source lies in the publications of my valued friend, Dr. A. Wilford Hall, the founder of the Substantial Philosophy, who has placed those publications freely and unreservedly at my disposal. Although he was by no means the first student of nature to observe and record the marvellous powers of the insect now under the lense of scientific and common-sense reasoning, he was the first to discover that those marvellous powers formed a peg upon which could be hung an argument unanswerable against the truth of the old and commonly accepted theory of acoustics. His argument on this subject was given to the scientific world in the year 1877, and, although it has not passed altogether unquestioned by some superficial reasoners, it stands, amongst many other unanswerable arguments, in this present year of grace (1890), a rock against which the waves of the wave-theory dash in vain. *It stands absolutely unrefuted by the acoustical world.* With this just and proper acknowledgment, I may proceed.

As the sound of the locust can be distinctly heard more than a mile away in any direction, it is a certain fact, and one that has not been disputed, that it fills, under ordinary circumstances, about four cubic miles with the sound it produces by the wonderful sounding organ or instrument of its thorax. I say under ordinary circumstances, for the insect is always close to the ground; but if it was placed one mile high in the air, its stridulations would unquestionably fill about eight cubic miles of atmosphere. I have used the word about, because there are the corners of the cubes to consider; but as the sound of the locust can be distinctly heard, on a favorable day, at more than a mile distant, these corners need hardly be taken notice of in the calculations.

Within the four miles whic are filled by the sound of the insect, there are, in round figures, *sixteen thousand million* square inch columns of air, each exerting a pressure on the earth and in all directions of about *fifteen pounds*, or in the aggregate, say, *one hundred and twenty million tons.*

Now, since sound can *only travel* by means of air-waves, and as air-waves can be *constituted only* of "condensations and rarefactions," and as a condensation can *only take place* by the particles of air "*crowding closely together*," as Professor Tyndall assures us, or a rarefaction can *only occur* by the particles of air separating "*more widely apart*," and as every particle of air constituting a sound-wave, according to the same high authority, must necessarily make "a small excursion to and fro" every time a wave passes, it evitably follows, if the wave-theory be true, that this insect by the imperceptible movement of some portion of its body displaces all the air particles constituting these *sixteen thousand million* inch columns for a mile high, and restores them to their place again say 900 times in each second of time; and continues this practice or process of churning the atmosphere into "condensations and rarefactions" for a full minute at a time.

No one will pretend to doubt, who admits the truth of the wave-theory, or, in fact, any theory involving the motion of the air by the passage of sound, that the stridulations of this locust must absolutely displace and cause to move "to and fro" every particle of air 900 times a second throughout these four cubic miles of atmosphere, since it is manifest that there is not an inch of space anywhere within this vast body of air wherein the sound would not be heard if an ear was present; while no one will think of questioning the physical fact that it must necessarily require an appreciable amount of mechanical force and energy to shake even a single inch-column of air for a mile high, displacing all its atoms for a certain distance (I care not how small that distance, if it be but the millionth of an inch), and then restoring them the same number of times each second.

(To be continued.)

J. M. PEEBLES, M. D.

We have just received notice that another honorary recognition of the ability of this justly celebrated physician has been shown by his election as a Member of the Victoria Institute, or Philosophical Society of Great Britain. This institute is the compeer of the Royal Society, and numbers among its members the elite of intellectual celebrities.

It will be remembered that our Health-Pamphlet received an enthusiastic and unconditional indorsement from Dr. Peebles, and for the benefit of those who have not already noticed it we re-print it on last page of this number.

A COMMON SENSE VIEW OF ETERNAL PUNISHMENT.

BY REV. JAMES A. SCATES.

There is no denying the teaching of the Scriptures in regard to the future state of the finally impenitent. It is one of unmitigated suffering—one of eternal horror—one of utter and hopeless ruin. Infidels object very seriously to this doctrine.

But there is no sufficient ground for the objection. It necessarily results from that radical and essential difference between truth and error—a difference that is absolutely irreconcilable—and which must in the very nature of the case lead to opposite results and conditions. If virtue leads to heaven and happiness, vice leads to hell and misery. If the happiness of the one is eternal, the misery of the other must be likewise. If we will carefully examine the constitution of things around us, we will observe that the great doctrines of the Bible are interwoven into the whole fabric of human affairs and are accepted and acted upon by the whole human race; and that no man can reject the Bible without at the same time condemning himself.

To show that all men accept in principle the Bible teaching upon this subject of future punishment, I need only refer to the practice of all governments in reference to their worst criminals. They have all found it necessary to cut off *forever* from citizenship some of their criminal subjects, either by taking their lives or by shutting them up in prison as long as they live, that is forever so far as this world is concerned. There is not a shadow of difference in the two cases as relates to the principle of government.

If the one is right and necessary so is the other. It is a necessity in government, both human and divine. Experience has shown that there are characters whom no law will restrain—whom no motives of love or gratitude will bind. Their presence always endangers society and is a menace to government.

I ask the infidel what is to be done with them. If he says, shut them up in prison for life, then that is just what the Bible teaches in regard to the finally impenitent. If he says, execute them, then that is the same thing, for they are thus cut off forever from all enjoyment of life, light and liberty, so far as earthly government is concerned.

If he says, let them go free, then that is the end of all law, government, justice and safety for the law-abiding. Not only are governments and peoples in the mass committed to this principle, but each individual of the race sanctions it every time he crushes a flea or any other antagonistic insect;—for he thus cuts off this insect forever from the enjoyment of life and happiness. This is eternal separation, and doubtless was one object in the creation of those little pests, that every man should by his own voluntary action be led to stamp with his approval the principle of the Bible that "eternal banishment from the presence of the Lord and the glory of his power" is in justice according to the nature and fitness of things.

We thus see the doctrine of the Bible upon the momentous subject of the impenitent sinner's final destiny, is the result of the eternal antagonism between truth and error. It is founded in the very nature of things and finds its basis in the character of God himself. And we further see that it could not be otherwise without a change in the nature of God and that of the whole constitution of the universe.

And we likewise see that upon the principle of this doctrine, as shown in the examples cited, the whole fabric of human affairs has been erected and that it is accepted and acted upon unconsciously by every human government and by every individual of the race.

Center, Texas.

PROF. A. B. WOOD,

whose letter with our reply appears in this number, writes us as we go to press that we may look for two short articles from his pen for September and October MICROCOSMS, one to prove that *sympathetic vibration* in a unison fork, as taught by the wave-theory, is alone due to the air-pulses dashed against it from its vibrating fellow; and the other article to prove that a vibrating prong of a tuning-fork, though having but an exceedingly slow motion, is nevertheless swift enough to condense the free or unconfined air and send off pulses at the velocity of sound.

This is the kind of pluck we like to see in a wave-theorist, not to shirk real difficulties. Prof. Wood knows that the two phases here named are essential to the existence of the mechanical theory of acoustics. Let either one of them break down and he well knows that his theory can not survive the catastrophe.

Plainly, if the unbowed fork remains entirely motionless notwithstanding all the air-pulses that can be forced against it by bowing its unison neighbor in close proximity (when the vibrational number of the two forks is below the sound-producing pitch,) then it follows as an absolute demonstration that air-pulses are not the cause of sympathetic vibration often observed in a unison fork *two hundred feet away from its sounding fellow.*

We are ready for Prof. Wood's best efforts to maintain the breath of life in the wave-theory of sound yet a little longer. But the reader may depend upon it, the same fate awaits his arguments on these phases as was in store for his attempt to sustain the pulse-velocity doctrine of that theory as seen in the first article of this number. We hope the professor will come to time with his two articles, so that our readers can see these essential phases of the wave-theory exhaustively ventilated.

MR. ISAAC HOFFER.

We are sorry we have not room in this number for a most important article from the pen of our old contributor on the "*Invisible and Immaterial Forms and Forces.*" Mr. Hoffer is a solid substantialist, and his articles are full of thought. Those of our readers who are not subscribers, and who may wish to see Mr. Hoffer's article can have the September number containing it free on application.

TO THE CLERGY.

We mail this number to a good many ministers who are not subscribers with the view of inducing them to look into the intrinsic value of Substantialism to the Christian work in which they are engaged. Should any clergyman after reading this number desire Vol. VIII. complete, including all the back numbers, let him inclose twenty-five cents in stamps (half price) and he will be entered upon our books as a paid subscriber. We are certain that this number alone is worth more than that to any minister who will read it.

DR. SWANDER ON "HERESY."

We have a very interesting paper from this old contributor on the above-named subject. It will appear next month.

OUR SCIENTIFIC LIBRARY.

Since the "Problem of Human Life," our first scientific book, was issued, we have published ten other volumes, making eleven in all, bound substantially in cloth, namely:

1. Problem of Human Life	$2 00
2. Seven volumes of MICROCOSM	9 00
3. Two volumes of Scientific Arena	2 00
4. Text-book on Sound	50
Total	$13 50
All these volumes will be sent by express for	7 00
Or by mail, prepaid, for	8 50

We make this offer at actual cost for the purpose of spreading a knowledge of the Substantial Philosophy.

☞As the pictures of Tyndall, Darwin, Huxley, Hæckel, Helmholtz and Mayer appear in the "Problem of Human Life," many insist that Dr. Hall's picture should also appear. For this reason we are sending his imperial photograph at cost—twenty-five cents. See page 134. ASSOCIATE EDITOR.

TESTIMONIALS.

Testimonial from Charles F. Webber, Esq., the celebrated tenor singer, late Professor in the Beethoven House College of Music, London, England:

"Dr. A. Wilford Hall, My Dear Sir,—It is my duty and pleasure to thank you sincerely for the benefit I have derived from your hygienic treatment. A year ago I was given up to die. To-day I am well and in better voice than ever before. During this time I have taken no drugs. I wish your remarkable discovery might be adopted by every vocalist, *well or ill*, as it improves the quality of the blood and in so doing must always benefit the voice.

"The supplement which you commissioned me to write, *particularly addressed to singers and speakers*, and which contains explicit and exhaustive explanations relative to the effect of the treatment on the vocal organs, deduced from personal experience and much thought, is already in press, and may be had by any one giving evidence of *owning your book* for one dollar, enclosed to the Humboldt Chemical Company, 149A Tremont Street, Boston, Mass. Believe me always gratefully, Charles F. Webber."

Dr. J. M. Peebles, who admittedly is one of the most learned physicians and surgeons now living, has sent for our Pamphlet and has received it as a physiological revelation. He writes:

"Your Health-Pamphlet dropped in upon me like a healing ray of sunshine. I read it with avidity, and at once put your treatment into practice, and it is scarcely necessary to say I found it all you recommend it to be and more. It is not only pathological, physiological and hygienic, but rational. Already have I derived great personal benefit from your discovery.

"Truly yours, J. M. Peebles, M. D."

[Dr. Peebles is a graduate of several medical colleges, has circumnavigated the earth three times in the interests of therapeutical and pathological science, and is the author of eleven volumes on these subjects. The indorsement of our pamphlet and treatment by such a distinguished authority, surely needs no comment. We learn that the doctor is thinking of opening a large sanatarium at San Antonio, Texas, thus giving his patients the advantage of a salubrious climate as well as his unexcelled curative skill. Good luck, Doctor!]

W. A. Summerill, Editor of *The Record*, Penn's Grove, N. J., writes July 20th:

"Dr. Hall,—Your "NEW PLAN" for selling your Health-Pamphlets is at hand and approved. You might send me 100 Extras with Pledges for distribution. After using your treatment a month last winter I was cured of piles of six months' standing, and have been cured of constipation from which I have suffered for several years. It is worth its weight in gold, and I would not part with it for any price. Every household should have it to guard against chronic troubles which result from indulgent eating and drinking.

"W. A. Summerill."

[Circular explaining NEW PLAN above referred to can be had on application. This is of great importance to the clergy.]

Rev. J. M. W. Farnham, D. D., Cor. Secretary of the Chinese Religious Tract Society, Shanghai, China, writes July 1st:

"Dear Sir,—I give you very hearty thanks for the copy of your "Health Treatment." I have waited till I could fairly test it, which I have done, and I feel free to testify to its value. While it may not permanently cure all the ailments flesh is heir to, I do sincerely believe that in almost in any case one would derive great benefit from its use. Yours faithfully, J. M. W. Farnham."

A testimonial from the city of the coming World's Fair:

June 10, 1891, 4 Park Row, Chicago Ill.

"Dear Dr. Hall,—If there is such a thing as taking on a *new lease of life*, I feel confident the treatment unfolded in your Health-Pamphlet has put me in possession of it.

"I am approaching my sixty-second year. I bought your Health-Pamphlet about six months ago. Within that length of time by the use of the treatment I feel at least fifteen years younger. The $4 I paid for it is by all odds the best investment I ever made. An offer of one thousand dollars to stop the treatment entirely would be no inducement whatever. No more headache. No dyspepsia, no more constipation and much less rheumatism and catarrh and a great deal more mental and physical activity are the results of its use.

"Very truly, J. L. Sheaffer."

Thos. G. Taylor, Cobden St., Pittsburg, Pa., writes May 11th, 1891:

"Dr. A. Wilford Hall,—Allow me to state a fact that may be of value to many families. I and my wife have been using your hygienic treatment steadily for many months, and we became anxious as to its possible effects on her as her parturition approached. On the 8th of March a bouncing boy was presented to us with so little suffering on the part of the mother (only thirty minutes) that she is very much elated over the value of your remedy in such troubles, having suffered fourteen hours with the birth previous, and before having adopted your treatment. So much is she delighted with your discovery that our boy is now named G. Wilford Hall Taylor and is so recorded at the Board of Health in this city. * * * Your grateful friend,

"Thos. G. Taylor."

Price of Health-Pamphlet giving full information concerning this drugless remedy is $4.00

CONTENTS OF AUGUST NUMBER.

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AIR-PULSE FORMATION.

BY PROF. A. B. WOOD.

With a Reply by the Editor.

CAN A VIBRATING PRONG OF A TUNING-FORK SEND OFF AN AIR-PULSE?

Dr. A. Wilford Hall, Dear Sir,—In a private letter you ask me to explain how a vibrating tuning-fork prong can create atmospheric pulses.

I answer, it does it in the very same manner that any movement creates one. Large movements and small movements are in their measure precisely alike in their effects upon the air. You represent that in the case of the vibrating prong the effect is only wind. The air in front of the prong you think moves sidewise and off the prong's edges, and no movement of the air forward takes place.

My reply is, I do not care in the least what becomes of the wind produced by the prong's movement, whether it flows off the edges of the prong or moves forward, as stated by Prof. Stokes in the experiment of moving the hand back and forth in the air.

If the air moves forward from the hand why should it not move forward from the prong? I think it does. You think it moves sidewise and off the prong's edges. It is no matter about this wind; it is the *pulse* we wish to trace. Is there any pulse in this case? You quote Prof. Stokes as saying that the effect "is *almost* the same as if the air were an incompressible fluid." Afterwards you give his statement again but without that important "*almost*" in it, as if you were almost afraid of it. That is the word that represents the minute pulse originated by the push of the hand. Both wind and pulse are produced by the movement.

For illustration, take a little poplar stake driven into the hard ground with the hammer. Each stroke of the hammer crushes down the end an inch, while the stake is driven into the ground one-tenth of an inch. The crushed down end is like the air made wind by the forward movement of the prong. The slight movement of the stake downwards is the long pulse movement of the air in front of the prong. Whether this wind in front of the prong moves forward or sidewise off the prong's edges, makes no difference. If it moves sidewise then, before it can get to the prong's edges, the pulse has gone forward some distance. So this very wind had to take part in the pulse movement as the crushed down end of the stake moved downward with the rest of it. Thus *every* movement in air creates a pulse.

Our conception of these minute processes would be aided by a study of mathematical infinitesimals, or by a study of animalculine organisms, each one of which is composed of millions of atoms. *If an atom be moved the smallest fraction of its diameter toward another atom, that one moves on an equal distance; and the others beyond it also move on in long procession.* This onward movement is the pulse movement.

These minute pulses push easily through the solidest bodies. For the atom is *compressible*, and if we suppose with you that atoms in solids are in contact, being compressible, a pulse may go through, because the movement is so minute. In this *minuteness* the secret lies. It is molecular. When an iron rod is struck at the end so that it is moved ahead the *one-vigintillionth* of an inch, the movement is not *instantaneous* all along the rod; the further end is a little late because it was a pulse movement. Let us keep our thought fixed upon this *minuteness* too small even for imagination to picture, for these minute quantities are just as real as the greatest ones. With our thought fixed here it is easy to realize that every body, however solid, is *elastic*, and a pulse can go through it as it goes through a mass of rubber.

The fork prong, when it strikes the wall of air before it, *splashes* some of it like a stone dropped into the water, pushing it forward or off its edges, as you like, as wind.

At the same time the elastic air in front is minutely pressed forward in a pulse. If the prong moves forward *one-vigintillionth* of an inch the particles ahead must move forward *that same distance before they have time to move from the center off the edges of the prong.*

This pulse amplitude may be too minute to move the tympanum of the ear, still it is *pulse* and will make its way with equal ease through iron, stone or air. You may think I make the pulse amplitude too minute for anything, especially after going a hundred miles or so, diminishing as the square of the distance, still even then the amplitude is a positive quantity. Thus a vibrating fork prong creates a pulse.

REPLY BY THE EDITOR.

This letter of Prof. Wood consists chiefly of statements, assertions and assumptions, with a little theoretic illustration, all of which is totally inapplicable to the question in controversy. In fact not one of the assertions made, so far as relates to the possibility of a tuning-fork's prong

generating and sending off a pulse in free air, contains an iota of scientific proof or rational consistency as will at once be made apparent. For example, in giving his answer to our question as to how a tuning-fork's prong sends off a pulse, he says: "It does it in the *very same manner* that any movement creates one!"

This, to put it mildly, is a childish begging of the question in dispute. Let us now put a quietus upon all this bald assumption by denying unconditionally that the movement of any body, however swift its travel in the free or unconfined air, ever did or ever can generate and transmit a pulse as assumed in the wave-theory.

A very swift bodily movement of an object through the free air may produce a slight condensation in front of it, and a correspondingly slight rarefaction behind it, according to velocity; this condensation and rarefaction however only re-act in producing an equilibrium in the disturbed or displaced air in the immediate vicinity of the moving body, *but never in the slightest degree to transmit a pulse even a single foot in advance of the compression thus produced.*

It is time that wave-theorists should begin, even at this late day, to do a little logical *proving*, and try to show by some sort of mechanical experiment that even a swiftly moving body will drive a pulse through the unconfined air, a thing which we now deny on the most common sense mechanical principles, though we have formerly conceded something of the kind in order to attack the wave-theory on its own ground.

While we thus deny that a pulse, in the wave-theory sense, is ever transmitted through the unconfined air by a moving body however swift its travel, we all know that an atmospheric disturbance of the nature of a local wind can be created by a body moving on the principle of a fan, and which disturbance will travel from four to six feet in a second, or possibly more, according to the size and velocity of the disturbing body. This wind-movement Prof. Wood himself has fully distinguished from what the wave-theory calls an air-pulse, the existence of which up to the present all physicists have assumed, but not one of whom have ever succeeded in proving. We therefore at this very essential juncture in the discussion stop all further controversy until some Helmholtz, Lord Rayleigh or Prof. Wood shall take up this startling denouncement of the fundamental assumption upon which the mechanical theory of sound is based, and prove for the first time in the history of science, that such a thing as an air-pulse in the free air ever occurred or ever can occur as the result of a body moving through it!

Now we respectfully ask Prof. Wood not to elevate his eyebrows in astonishment at the effrontery of this position, so annihilating if correct to the whole present theory of acoustical science, but that he proceed at once to do a little sober casting about as to some way of demonstrating this essential phase of the wave-theory before indulging in further assumptions about it. To aid him in meeting the cost of the necessary experiments, we here agree to give him *one hundred dollars* just as soon as he can show by any mechanical proof that an air-pulse can be sent through the open atmosphere by the movement of any body I care not how swift.

Let him remember that the *mobility* or *fluidity* of the air means something and performs some office in the equalization of disturbances which wave-theorists are bound to respect, while it is a remarkable fact, that no physicist from Helmholtz down has ever even referred to this property of mobility as performing any office whatever in such atmospheric disturbances, while they have complacently and almost stupidly continued to assume all sorts of impossibilities about the generation and propagation of air-pulses which mobility alone must neutralize. A single moment's logical thought given to this all-pervading and all-efficient property of atmospheric mobility would totally annihilate all their assertions on the subject of pulse-propagation, since proof of any such phenomena is entirely out of the question.

This correction clearly stands as an unanswerable reply to all the fine-spun theorizing in the foregoing letter, concerning the propagation of supposed air-pulses by a vibrating prong, *until our challenge shall be met.* We denounce the whole theory of free-air pulses as a ridiculous self-deception on the part of wave-theorists based on physical impossibilities.

Although we admit that a *swiftly* moving body will slightly compress the air in front of it, this compression aided by mobility only acts to equalize the local disturbance caused, as Daniell describes it in his great work on physics, as a "*local flow and reflow,*" but in no sense to drive a pulse ahead of this compression.

Remember, as we have often explained in the MICROCOSM, any compression in the free air caused by sudden displacement, can only occur when the velocity of such moving body shall *transcend* the normal *mobility of the air* by which ordinary disturbances are equalized without compression.

Any compression of the free air must necessarily require a considerable velocity of the moving body, when we consider that even the velocity of a cannon-ball through an incompressible fluid, like water deprived of all air, *would produce no condensation whatever, but on the contrary, a displacement thus caused would be restored by the mobility of the liquid alone.* Is it reasonable then to suppose that the air's fluidity—it having still greater mobility than water—would be insufficient to restore without condensation the disturbance of a tuning-fork's prong *moving* 25,000 *times slower than the hour hand of a clock,* as admitted by Prof. Wood in his June article?

As we wish to enlighten Prof. Wood as well as wave-theorists generally, and not merely to refute their assumptions, we should say here, to keep up proper physical distinctions, that the propagation of a *pulse* in the free air is possible only in one way—not by the movement of a body through it as just shown—but by the sudden addition of some substance to the air at a given point, in which case the whole surrounding air is moved away in a condensed pulse in all directions, as in the case of exploding powder. In this case there is no place for the surrounding air to go, but to get out of the way of the expanding gas; whereas, in the movement of a body through the free air, without adding anything to its quantity, there is a place for the disturbed air to go to get out of the way, just as disturbed water gets out of the way of a fish's tail, and that is behind the moving body. Surely this is decidedly easier and simpler than for the air to form itself into condensations and rarefactions, traveling a mile in advance of the moving body as it does in the case of our locust, according to the wave-theory!

Further, to enlighten Prof. Wood by keeping up the proper mechanical distinctions, a moving body can produce an air-pulse in only one way, and that is when the air is confined in an open tube and acted upon by a piston in one end as fully shown in reply to Prof. Wood last month. In this case, as in that of exploding powder, the air has no place to go except to move ahead and get out of the way being confined by the walls of the tube, and hence, the condensation caused by the suddenly moved piston proceeds through the tube as a pulse traveling the length of the tube with a uniform velocity exactly proportioned to the force and distance of the piston-movement which causes it, and not with the uniform velocity of "sound" as wave-theorists so ridiculously teach whatever the strength of condensation causing it. (See last month's article.)

To suppose, as does Prof. Wood, that a trifling body like the stridulating apparatus of a locust, moving at its swiftest only at a velocity of a few inches in a second, can drive pulses of condensation and rarefaction a mile in all directions in the free air, is so superlatively unmechanical and unphilosophical that we are astonished that an intelligent investigator can be found who would dare to commit himself to such an absurdity especially after his attention has been called to the subject.

It is for this dawning suspicion of its absurdity that President Stokes, of the Royal Society of Great Britain, said in a recent lecture as quoted by us in reply to Prof. Wood in the March MICROCOSM:

"Suppose a person to move his hand to and fro through a small space, the motion which is occasioned in the air is almost exactly the same as would have been if the air had been *an incompressible fluid. There is a mere local reciprocating motion*, in which the air immediately in front is pushed forward, and that immediately behind is impelled after the moving body," etc.

Prof. Wood thinks he has discovered a mare's nest here, and tries to console himself with the fact that President Stokes makes the action of the moving hand upon the displaced air "*almost* exactly the same as would have been if the air had been *an incompressible fluid.*" What a sorrowful quibble for a scientific man, when President Stokes immediately explains that no pulse at all is sent off since the disturbance of the air is "*a mere local reciprocating motion!*" How desperate must be a cause that will blind a critic to such language as this, which was given purposely to explain the immediately preceding "*almost exactly* the same as would have been if the air had been an incompressible fluid!"

But we will not allow Prof. Wood to have even the poor consolation of this attempted misrepresentation of President Stokes. Here is what Prof. Tyndall says, and which will take the very breath of life out of this attempt to evade President Stokes' fearful but unintended blow at the wave-theory:

"When a common pendulum oscillates, it tends to form a condensation in front and a rarefaction behind, but it is only a *tendency*; the motion is so *slow*, and the air so elastic, that it moves away in front before it is sensibly condensed and fills the space behind before it can become sensibly dilated. Hence *waves or pulses are not generated by the pendulum.*"—(Third Edition of "Sound," p. 38.)

There is no "almost" about this statement Prof. Wood! Look at it: "Hence WAVES or PULSES *are not generated by the pendulum!!!*" Yet a clock-pendulum that beats seconds actually moves more than 1,000,000,000 times swifter than the prong of a tuning fork while still sounding audibly as admitted by Prof. Wood in his June article! How in reason's name can such a slow motion send off "*waves* or *pulses*" when a pendulum moving a foot a second can not do it? Come, professor, be honest and give it up as you gave up the "*swiftly* advancing" of Tyndall and "very much faster" of Helmholtz in your March article. You there appeared to act like an honest man, but we now fear it was because you thought you still saw your way clear to maintain the wave-theory, after your forced admission that we had shown both Tyndall and Helmholtz to be mere babies in science in supposing as they did that the prong must necessarily advance "swiftly"—"*very much* faster" than a pendulum in order to produce sound.

We shall not let Prof. Wood go without taking him once more over this terribly hot piece of acoustical ground even though it should blister his theoretic feet. Listen again to what Tyndall says:

"Imagine one of the prongs of the vibrating fork, *swiftly advancing*, it *compresses the air* immediately in front of it, and when it retreats it leaves a *partial vacuum* behind, the process being repeated at every subsequent advance and retreat. The *whole function* of the tuning-fork is to *carve the air into these condensations and rarefactions.*"—*Lectures on Sound*, p. 12.

Surely this supposed "*swiftly* advancing" was regarded as essential to the wave-theory. Suppose Prof. Tyndall at that moment had been informed, as Prof. Wood now admits, that the tuning-fork's prongs, instead of "*swiftly* advancing," will actually sound audibly while moving slower than the hour hand of a clock, would he not as an honest man have been obliged to abandon the wave-theory?

But Prof. Helmholtz was in the same boat, and hence it was not a mere inadvertancy on the part of Prof. Tyndall. Listen again to this leading sound investigator of Europe:

"The pendulum swings from right to left with a uniform motion. . . . Near to either end of its path it moves *slowly*, and in the middle *fast*. Among sonorous bodies which move in the same way, only *very much faster*, we may mention *tuning-forks.*"—*Sensations of Tone*, p. 28.

Is it not perfectly evident that Prof. Helmholtz considered the velocity of the tuning-fork's prong—as enormous—"very much faster" than that of the swiftest pendulum—and that this velocity was essential to the existence and tenability of the wave-theory? And is it not certain, had Prof. Wood stood by his elbow and demonstrated to him at that moment as he now admits, that the prong, while still sounding, moves millions of times slower than the pendulum, that Prof. Helmholtz as an honest man would then and there have abandoned the wave-theory as a physical and mechanical fallacy?

This swift motion of the tuning-fork was the belief of all physicists and acousticians the world over, accepted as the real and self-evident basis on which the wave-theory of sound could be maintained, and this was the universal teaching of the colleges up to the time the "Problem of Human Life" made its appearance. Prof. Wood admits this, and what confession has he to make in regard to the overwhelming discomfiture of the world's greatest scientists by our humble discovery and demonstration that this "swiftly advancing" prong—"very much faster" than the pendulum; on which the wave-

theory was founded—was the most prodigious and inexcusable error then taught for science? Here is what he says in his letter in the March MICROCOSM, referring to our January article:

"Your article, page 24, *clearly beats Tyndall and Helmholtz as to the rate of motion of the prongs of a tuning-fork. That side might as well admit their error. There is no 'swiftly advancing' about it.*"

Thus Prof. Wood, after admitting that we had swept the very foundation out from under the wave-theory by showing that the prong sounds, while moving millions of times slower than the pendulum, still continues to try through his meaningless pulse-theorizing to defend that which he practically admits to have been killed by our arguments.

Remember, that when president Stokes declared that the moving hand produced no air-pulse, only "a *mere local reciprocating motion*," and when Prof. Tyndall declared that "Hence *waves* or *pulses are not generated by the pendulum*"—neither of them had heard of the revolutionary discovery that the prong will sound while traveling slower than the hour hand of a clock! But Prof. Wood has no such excuse. He has heard of this discovery and is forced by our arguments to concede it, as just quoted. Yet, still finding himself in the forlorn last ditch of the motion-theories of science, he is so reluctant to surrender the lost cause that he goes on reiterating over and over in his short article: "Thus *every movement in air creates a pulse*," in absolute contradiction to Tyndall that "*waves* or *pulses are not generated by a pendulum*." Also in absolute contradiction of President Stokes, that the disturbance caused by the moving hand "is a *mere local reciprocating motion!*" Who, in reason's name, is most likely to speak the unprejudiced truth in this controversy—those two world-renowned physicists who knew nothing about Substantialism and the destruction in store for the wave-theory, or Prof. Wood, who in his last extremity is compelled to resort to these monstrous pulse-absurdities to avoid an unconditional surrender?

Professors Tyndall, Stokes and Helmholtz admit on universal mechanical principles that the slow movements of the pendulum or hand through the air will not generate a condensed *air-wave* or send off a *pulse*, or produce anything more than "a *mere local reciprocating motion*," though they no doubt honestly imagined that the tremendous velocity of the tuning-fork's prong—"*swiftly advancing*," "*very much faster*," than a pendulum—must condense the air into atmospheric sound-waves, *since they knew of no conceivable explanation of sound phenomena except the wave-theory.* Some excuse for these men.

But here comes the inexcusable Prof. Wood, fully informed upon the substantial theory of sound-force, and knowing perfectly well that every observed phenomenon of sound can be readily explained on that theory without any necessity for impossible air-pulses, and yet he tries in the desperation of his ingenuity to maintain the air-pulse theory, notwithstanding he is forced to admit a million times slower movement to the prong than that of the pendulum *which is too slow to generate "waves or pulses" according to the highest authorities on earth!* Was ever a man before placed by his own voluntary admissions and by the inexorable logic of scientific facts in such a pitiable and deplorable predicament?

In his March letter, after admitting our defeat of Helmholtz and Tyndall, he tries to neutralize the logical effect of the slow motion of the prong by urging its *great number of motions to and fro* as helping the wave-theory. But we pointed out in our following remarks that if a single slow motion will not produce a pulse, then certainly any number of motions a million times slower will not. Since that reply he has not even referred to the great number of motions of the prong as in any way improving the status of the wave-theory.

Prof. Henry A. Mott, Ph. D., LL. D., one of the brightest scientific minds of this country, writing upon this subject in the *Scientific American Supplement*, June 13th, 1891, says:

"It is clear that all we have to consider is *one* forward and backward motion of the prong of the tuning fork, for if the air is not compressed at the velocity with which it moves, then there is no need of considering any other forward and backward motion; for if one forward and backward motion at a given velocity fails to produce a condensation and rarefaction, then ten or one million would fail at a like velocity."

Dr. Mott in the same connection goes on to show that it was the c' ar teaching of all physicists up to the announcement of Substantialism that a slow motion of a body, though a million times faster than the demonstrated velocity of the tuning-fork while still sounding, could not compress the air or send off a pulse. He quotes Daniells, the leading text-book on physics, as follows:

"Air will not oscillate in waves such as can be pro pagated to a distance, unless there be some *well marked compression* or *rarefaction* produced at the center of disturbance. * * * A vibrating body, before it can act as a sounding body, must produce alternate compressions and rarefactions in the air, and these must be well marked. If, however, the vibrating body be so small that at each oscillation the surrounding air has time to *flow round* it, there is at every oscillation a local rearrangement—a local flow and reflow—of the air, bu. the air at a little distance is almost wholly unaffected by this."

Dr. Mott then quotes Sir William Thompson:

"If I move my hand *vehemently* through the air I produce a condensation."

The Doctor then adds:

"It is perfectly evident, then, according to the supporters of the wave-theory, that to produce a 'well marked' compression, the motion of the vibrating body must be 'faster' than the motion of the pendulum, and, in fact, must be 'swift' or 'vehement' motion."

But in conclusion what will all those great physicists think when they come to learn for the first time that no motion of a body, however swift or however it may condense the air in front of it, can after all send off a pulse through the free or unconfined atmosphere, and that such a supposition is pure fiction and an unmitigated assumption that has never been proved and never can be proved.

Strange that physicists have gone on for ages building their fictitious theory of acoustics upon this baseless assumption of air-pulses, taking for granted that because sympathetic vibration in a unison fork is produced in free air at a distance, therefore air-pulses must be sent off in order to produce it. But as we have demonstrated in the May MICROCOSM that air-pulses have nothing whatever to do with causing sympathetic vibration, it is now time for physicists to prove the possibility of producing a pulse in the free air by a moving body however swift, or else abandon the wave-theory.

P. S.—Since sending us the foregoing letter, Prof. Wood writes us an explanatory letter and urges us to take into consideration his theory of pulse-propagation as a pendulous swing or

oscillation of the air-particles. The following gives the gist of his theory:

"Does not a particle, when it moves in any pulse, *start* from zero? *i. e.*, from a state of *no motion?* It starts from *rest* like a *pendulum*. The pendulum starts from rest, at first moves *very* slow, gets *faster* down to the *center* of *oscillation*, and then slower to its rest at the other end of its amplitude. So a particle of *air* moved in a pulse, starts from *rest*, at first moves *very slow*, increases in its velocity to its center of amplitude, then moves slower again to the other end of its minute amplitude. As any pulse passes, every particle makes this minute excursion. However *fast* the *wave*, and however deep the condensation, the particle *in it* only makes this short excursion."

Prof. Wood is totally mistaken in his conception of the motion of an air-particle in the transmission of a pulse, wherever a pulse is possible. There is no pendulous swing or oscillation, or excursion about this motion. It is like a pulse through a row of rubber balls precisely. Take the pulse sent through the air in a tube by a piston moved instantaneously into one end. As this is the only pulse possible to be produced in air by a moving body *it is* a very good illustration. The air-particles in contact with the piston of course move swiftest at the start, and go slower and slower till they stop and they do not return at all. Hence there is no excursion, no pendulous motion, no oscillation about them.

This supposed pendulous oscillation of an air-particle in a pulse is a pure theoretic figment of the imagination—a small offshoot from the mother-absurdity that it is possible for any moving body to send a pulse through the free air. Let Prof. Wood attend to the mother absurdity before dabbling with her imaginary and fictitious offspring. Will the Professor take notice? The $100 are waiting for him.

HERESY.

BY REV. J. I. SWANDER, D. D.

The present is peculiarly an age of moral and intellectual unrest. Many of the foundations upon which the fathers built are no longer generally regarded as unquestionably imbedded in the solid rock of eternal truth. New thoughts are in bold conflict with old theories. The world is full of anxious inquiry. Men wish to know the relation between the commandments of God and the traditions of the past. Upon what basis of truth, according to what standard of truth, and at what point in the historic onflow of man's apprehensions and teachings of the truth will there be a general reconciliation between contending parties, and harmony between all the various elements in the conflict? Is the present state of unrest an indication that the night is far spent and that the day is at hand, or does it rather mean a fierce renewal of the old conflict between orthodoxy and heresy?

What is hetrodoxy? The terms heresy and heretic are not of frequent occurrence in the sacred Scriptures; and there has been no little mooting and discussing of the question whether the word heretic as found in the Bible means primarily an individual who has swerved from sound doctrine, or, rather, one who by sowing the seeds of dissension becomes a schismatic in the church. The best exegetes and most learned commentators hold that there is no ground for any such distinction. A radical departure from the truth naturally leads to schism, just as a radical departure from unsound theories, whether in religion or in science, may lead to reformation.

Heresy is an evil; but it does not follow that all new apprehensions of the truth are necessarily untrue. In the essential constitution of the world, progressiveness of human thought and a progressive interpretation of God's revealed thoughts are no less essential and not necessarily any less orthodox than truth itself. From this standpoint Dr. William Rupp has (perhaps unintentionally) paid an excellent tribute to Substantialism as one of the orthodox heresies of the nineteenth century. Hear him: "A few prominent individuals, who stand nearer to the heart of the age and have inherited higher *aptitudes* for truth than others, take the lead in giving expression to the new conceptions. Then the common mass of men either, recognizing in these new conceptions ideas that have been vaguely floating in their own minds and ineffectually struggling to take shape there, at once accept them as supplying a long-felt intellectual and moral want; or else, receiving something of a mental shock from the difference between the new and the old conceptions, the majority at first meet the new with some grumbling and resistance, and perhaps go so far as to make martyrs of the advocates of the new doctrines, by way of indemnifying themselves for their own poorer mental endowments; but at length the opposition dies out, and the majority of men accept the new doctrines and presently forget that they have ever believed anything else: while a few individuals, perhaps, whose minds are unhappily so constituted as to be incapable of change, drop out of the current of living thought, and, if they can get others to join them, form eddies along its banks."

In order to determine what is orthodoxy and what is hetrodoxy, there must be an acknowledged standard of truth before which all claims must appear and be tested. In theories of science this standard is God's works, or rather, the facts, forces and laws of nature as manifested in the phenomena thereof. In religion this standard is the Bible, or rather the Word of God as enshrined therein. Much, however, depends upon the use that is made of the Canonical Scriptures in determining every man's doxy of what sort it is. The Council's or the Pope's interpretation of the Bible is orthodoxy for a large part of Christendom. On the other hand, and in the other extreme, each man is his own pope without any reference to or respect for the interpretations reached and given by the cumulative and continuous consciousness of Christendom, which, though it may never sit in judgment upon God's inerrant Word, must ever be the supreme court in determining what the Bible really teaches on any given point in doctrine or practice.

Besides this individual or private exercise of biblical interpretation, history is full of evidence that there has always been an arbitrary method of using the sacred Scriptures for the purpose of manufacturing orthodoxy to order. Almost every denomination has made the Bible a nose of wax through which to blow its own peculiar doctrines into self-justification. Too often have orthodox systems been constructed by the church or some branch thereof and thrust into the Bible. In this way, for example, Catholic orthodoxy ruled the religious thinking, or thoughtlessness of the church and the world, until it helped to mature the crisis of the Reformation, in which

the great Evangelical heresy (?) and Schism (?) of the 16th century were started as new factors in the onflow of history. Thus Catholic orthodoxy as advocated by the Roman church and Protestant orthodoxy as advanced by the Reformers began to confront and antagonize each other. "In both cases," says Dr. Schaff, "the doctrines were settled beforehand by the Fathers or Reformers, and confirmed by proof texts, arbitrarily selected from any part of the Bible with little or no regard to its historic character and the difference between the Old and New Testament." It follows, therefore, that there is no advantage in having an acknowledged standard of truth for the purpose of distinguishing between orthodoxy and hetrodoxy, unless there be also an agreement as to some general principle and method of interpreting such standard.

The twentieth century of the Christian era must therefore witness a great change in theology. Orthodoxy must be tested by a more Christocentric principle. Sound doctrine and the form of sound words will still be insisted upon as of great importance for the preservation of the faith once delivered to the saints; but doctrine will no longer be the principal battle cry and battle-axe of God's embannered hosts. The church is even now fast coming to a consciousness of the threefold truth that Christianity in its most essential element is life, that that life is a real substance, and that that substance is found fontally in neither the Bible, creed, faith, reason nor experience, but in the person of the Christ. When that point is reached there will be a clearer distinction, without separation, between reason and faith, between creed and canon, between the record of revelation and revelation in record, between the Bible with its human elements and the Word of God which, in its divine essence, is forever settled in heaven. Ps. 119, 89.

The orthodoxy of the future will, therefore, be different from that of the past. It will not differ radically, and yet it will be more rational and more biblical because more Christological. It will be more true because more in conformity with the Archetype and Fountain of all revealed truth. It will be more Catholic because less denominational, and more general in its adaptation to the wants of Christendom. It will be more Evangelical because of a less arbitrary interpretation of the Bible. It will be more positive because it will have for its contents the very substance of things hoped for and realized in the person and work of Christ.

We are in agreement with some things said by Prof. C. A. Briggs, in his article on *Church and Creed*, as published in the June *Forum*. He truly says: "The tendency of thought in the present century has been toward the person and work of Jesus Christ. His life has been studied as never before. The doctrine of the incarnation has again become prominent." We, however, differ from that learned professor in his statement that "this tendency is especially in the Anglican Church." Our eyes have not so read the pages of modern church history. In our limited reading we have been led to the conclusion that this tendency has been started and fostered rather by the more Germanic type of Christian thought. But whether here or there it is a grand Christocentric movement, and one that is bringing a blessing to all the denominations of the church and all the nations of the earth.

Standing, then, upon the threshold of an advanced and improved order of things, the church should begin to prepare new bottles for the new wine. The new wine will be better than the old. It will be less of a polemical intoxicant for the brain and more of a tonic for the heart. Truth will not give way to make room for error, but some very popular systems of thought hitherto held as strictly orthodox will be pruned of nonessential and heretical limbs to make room for an ingrafting of some of the sappy scions of organic truth hitherto measurably despised and rejected by orthodox schools of thought.

What is true in the above in its application to theological theories is equally true when applied to the secular sciences. Take, for example, the science of astronomy in the radical changes through which it has passed. Just as ancient astronomy was moving out of existence upon the back of an imaginary mud-turtle, the heresy of Galileo and Copernicus began to wheel into line with God's everlasting truth as revealed in his works. This change took place as soon and as fast as the sun was recognized as the center of the solar system. So will it be when Jesus Christ is recognized in all the fullness of his Messianic person and the organic centrality of his relation to all things that belong essentially to God's revelation to man, and man's restoration to God. The Bible will then be authenticated and understood in the light of the sun of righteousness; its inerrancy will be made manifest to all believers; orthodoxy will consist in agreement with "the law of the spirit of life in Christ;" and only those who array themselves in avowed opposition to the incarnate Lord will be branded as heretics.

Corresponding with and complemental to this Christocentric tendency in the realm of religious thought and activity is the new and modern method of reasoning known as Substantialism. The movements of the two are upon parallel lines. The direction of their common course is from mere motion to substance, from the material to the immaterial in being, from the visible to the invisible, from the outward letter that killeth to the inward spirit that maketh alive, from the traditions and theories of men to the facts of God. The future will not bring in a new Bible, but a new discovery of truths in God's old book. There will be no new faith, but a more biblical, because a more Christological, apprehension of the old faith. There will be neither demand for nor toleration of a strictly new creed, but a willing subordination of everything to the superlative majesty and glory of Immanuel. In this grand movement the Substantial Philosophy is and will be the vestal virgin of Heaven's queen. Substantialism will give philosophy a greater potency wherewith to understand the facts, and forces, and laws of nature. Such more correct apprehension of the truths of God's outer temple will assist the Christian man in his searches after the proper contents and meaning of His inner sanctuary—the kingdom of heaven. That knowledge may be measurably gained before we are called to pass the pearly portals. And when the church reaches on earth that attainable position of Christocentric excellency, the work of hatching heresy and hunting after heretics will go into the shades of the past, and a new song of praise will be sung by all the disciples of the Lord:

"Let names and sects and parties fall,
And Jesus Christ be all, in all."

Fremont, Ohio.

IMPORTANT SUGGESTIONS TO POLITICAL ECONOMISTS.

BY THE EDITOR.

Some years ago we printed an editorial in this journal upon the problem of our rapidly increasing population, and what was to be the outcome within a few generations in view of the natural limitations of our productive soil. That editorial was widely copied into other journals and extensively commented upon by far-seeing political economists.

Since giving that paper to the public we have thought much upon the near future of our rapidly increasing people, including the constantly augmenting influx from the over-crowded populations of other lands. Whatever view may be taken of our statistical figures in the article referred to—and we admit they were sufficiently startling to appall the coolest headed economist—no one disputes the fact that very soon not an acre of available soil for cultivation will remain unclaimed and unoccupied—a fact abundantly proved by the crowds of homeless toilers, who waited almost to the verge of starvation a few months ago to claim a small strip of the comparatively unproductive land of the newly added territory of Oklahoma.

It is surely natural enough for a thoughtful mind to inquire as to what must become of the succeeding millions of our people when no more arable soil remains to be taken up. A single hope as a ray of comfort remains; though it must be apparent to the statistician who calculates only a couple of centuries into the future, that even the prospective resource here referred to, even if it can be made available at its best, is but a very temporary relief to the dread foreboding that casts a very dark shadow over the future of our population.

We refer, of course, to the vast millions of acres of what is at present known as our "arid region," much of which, except for the want of water, contains as productive a soil as any now under cultivation in this or any other country.

This now desert portion of our country embraces more than two-fifths or nearly one-half of all the dry land of the United States, and only awaits some system of successful supply of moisture either from the sky or from the ground to blossom like a garden of roses. With such a system of water supply at a reasonable cost not less than 750,000,000 acres of land, now entirely unproductive and at present beyond the reach of irrigation, could at once be reclaimed to successful agricultural and horticultural pursuits, and could easily furnish subsistence, if suitably cultivated, for two or three times the present industrial population of the United States.

No wonder, with these statistical facts staring us in the face, that economic philosophers are earnestly discussing the possibility of some means being devised for supplying water to this desert portion of our country. It is entirely appropos that the Governor of Utah should have called a convention of delegates to be sent by the governors of all the Western States, and to be held at Salt Lake City on the 15th, 16th and 17th of this month, to take into consideration the best means for organizing a general and practical system of irrigation.

It was entirely appropriate that Utah should take the lead in this great land-reclaiming movement as she is, without doubt, the best irrigated of any of the rainless states, a point at least very creditable to the Mormon inhabitants in the midst of all the prejudice felt against them.

The questions to be discussed at this Salt Lake convention are of vastly more importance to mankind than can be any merely political questions that are likely to come before the American people in the next fifty years, and should receive paramount consideration at the hand of every far-seeing statesman in our national legislature.

What comparison is there between the discussion of tariff or free-trade, or of the silver question, about which politicians are making so much ado, and this humanitarian project of devising some plan for reclaiming nearly a thousand million acres of land now lying waste and absolutely useless, on which a hundred million homes for our coming industrious workers would in time be established?

In the Middle, Eastern and even in most portions of the Southern States, the subject of irrigation has never come up, nature having as a rule abundantly supplied them with the early and the latter rains. The more important question to them, especially for the eastern and some of the southern agricultural territory, undoubtedly is that of *fertilization*,—millions of acres of at one time the most productive soil of this country having been totally worn out and lost to the community for the want of a proper fertilizing system of cultivation.

At present, in the New England States alone, more than four thousand farms, which fifty years ago yielded handsome returns to the frugal Yankee farmers, are now practically abandoned by their owners as uninhabitable, being no longer worth tillage. These farms can now be had by any one who might be disposed to "jump" them and pay the back taxes.

Would not a *fertilization* convention now be in order for the east in imitation of the *irrigation* example so opportunely set by the governor of Utah?

Should the experiments now making in the neighborhood of Midland, Texas, by Gen. Dyrenforth, for producing rain artificially, prove successful, it would then be a question of cost merely between the burning of dynamite continually and the sinking of artesian wells once for all. From recent reports of the experiments in Texas, it is quite confidently believed by the scientists engaged in that novel enterprise that the explosion of large quantities of powder, dynamite, etc., in the upper regions of our atmosphere, sent up in balloons and ignited by electricity, may tend to condense and precipitate the vapor into clouds and rain. We will wait and see, though we strongly suspect that it would be much better economy for the government to make liberal appropriations for sinking artesian wells where they would permanently supply water to large regions of country, since we are sure that water exists in the bowels of the earth in inexhaustible supply and can be had if we can only sink wells deep enough to reach it.

With quite successful experiments already made by private enterprise in our oil regions for sinking wells to a depth of two or three thousand feet, there would seem but little doubt that by proper encouragement from the government newly invented apparatus would soon be brought out that would more than double the depth of the deepest wells yet pro-

duced, causing perpetual flows of water that would irrigate vast surrounding districts.

No matter what the quality of the water thus obtained,—whether fresh, salt, sulphurous or mixed with oil,—its value for agricultural and horticultural purposes would not thereby be lessened, but might be greatly enhanced.

Government is already doing well in its encouragement to forestry; but it might do a thousand times better by judicious appropriations for tree-planting in all our prairie states, and thereby add immensely to the wealth of the nation without in the least impoverishing the national treasury.

The effects of forests upon climatic conditions, especially upon the fall of rain, has been too well demonstrated in Germany and other European countries to admit of question or of any hesitation on the part of our National and State legislatures, so far as offering encouragement of the most liberal character for tree-planting is concerned.

But aside from the general climatic advantages of the proximity of extended regions of forests, we have not only the commercial importance of the increasing growth of the most valuable timber, now rapidly approaching extinction throughout the civilized world, but we have the paramount benefits of oxygenous exhalations from the foliage of countless forests to invigorate the health and promote the longevity of both man and beast.

And as a branch of forestry hitherto scarcely discussed, what hinders the land-owner from planting in vast quantities nut-trees, which yield the most nutritious and wholesome food, without any further care or cultivation, for both men and animals?

A whole volume could be written upon this subject alone, unfolding the various characteristics, peculiarities, and advantages of the some thirty odd nut-producing trees known to commerce, some of which, such as the pecan, almond, cocoa, chestnut, etc., are already sources of immense profit to those who, in suitable latitudes, have been shrewd enough to take advantage of such commercial opportunities.

All these are questions legitimately connected with the great theme of irrigation, and the possible reclaimation of the arid lands of this continent, which are sure to come up before the Utah convention, and as such we earnestly commend them to the serious attention of that honorable body of investigators.

THE WILFORD HALL SANITARIUM.

At last we are able to announce that this long talked of and much needed institution is now ready to receive applications from persons who may desire the comforts of a home in connection with the only absolutely safe and reliable treatment for disease known to therapeutical science. Since our Health-Pamphlet has been before the public we have become acquainted with and have made a constant study of disease in its thousands of forms as indicated by our enormous correspondence, and have often longed for the establishment of an institution where sufferers from such chronic complaints as consumption or tuberculosis, kidney disease in its varied forms, rheumatism, gout, stomach and liver troubles, and the numerous other difficulties which ordinary medical treatment will not reach, might come at reasonable rates and receive the benefits of the vast amount of experience we have attained in the treatment and cure of such diseases.

As a first step towards supplying this need we have opened our sanitarium in the most healthful part of New York City away from the crowded district, and yet within the city limits so as to be easily reached without fatigue from any part of the United States or Canada. The institution is entirely private and is conducted under the superintendence of O. S. Phelps, M. D., an able and well known medical practitioner who is in full sympathy with our Hygienic ideas, and who at the same time brings from his own vast experience and study, a fund of physiological and pathological information which makes the potency of the proposed sanitarium in the cure of disease in the shortest possible time, second to that of no similar institution in existence.

In addition to a scientific application of Dr. Hall's Hygienic methods with which our readers are acquainted, and which have produced such marvelous results in the eradication of disease during the past two years, it is proposed to combine the celebrated Drs. Salisbury and Cutter systems of diet treatment so universally recognized and commended by the medical profession, and which created such extended and favorable discussion at the late Berlin Medical Congress. This system is based upon a daily microscopical examination and analysis of the blood and excretions, and the diet adapted to the peculiar conditions of the disease under investigation.

Such in brief are the facilities which will be afforded patients in the Wilford Hall Sanitarium, which will be conducted under the business management of the president and superintendent, who will constantly have in addition the aid and counsel of Dr. Hall himself.

Persons desiring rooms, board and treatment in this institution will receive full information, terms, etc., by addressing Dr. Robert Rogers, President and Treasurer, MICROCOSM Office, 23 Park Row, New York.

IMPORTANT NOTICE.

If you have a friend anywhere whom you think would be interested in any subject discussed in the MICROCOSM, send us the name and address and we shall take pleasure in forwarding a sample copy free. Fifty cents a year is a low price for the information given by this journal from month to month.

PROF. A. B. WOOD'S ARTICLES.

Prof. Wood complains in private letter because our replies are so much longer than his articles. In reply to this we say that we are not making our rejoinders merely to oblige Prof. Wood, but to put on record in the only Organ of Substantialism full scientific instruction upon the subjects discussed for the benefit of coming generations. We merely take Prof. Wood's short article—for example, on the possibility of sending off an air-pulse by the slow motion of a tuning-fork's prong—as a text for the utter and perpetual refutation of what we regard as a scientific fallacy. That kind of work is the office and purpose of the MICROCOSM, and not merely to gratify Prof.

Wood or any other writer by indulging him in wordy replications which can be continued without end even on the wrong side of any question.

SUICIDES—HOW TO PREVENT THEM.

BY THE EDITOR.

The prevalence of suicides in this country and Europe is becoming a subject of alarming and widespread interest among social reformers. There seems to be no present means within the knowledge of moral and social philosophers that can have any avail in checking this mania for ending one's troubles by ending one's life.

Legislatures have enacted laws with penalties attached against attempts at suicide, feeling that it is useless to enact laws against the completion of the suicidal act, supposing naturally that the man who fears not to die will fear no penalty which human authority can inflict after he is dead.

But this is a mistake, as we will now attempt to show. Indeed, we believe that by the proper legislation, with suitable penalties vigorously and inexorably to be enforced upon a man's body after he is dead, there would be an abrupt end put to more than nine-tenths of all the suicides in the civilized world.

For example, let our State legislature pass an act to be confirmed by the municipal council of every incorporated city in this commonwealth, decreeing that the body of any person who shall be declared a suicide by the verdict of a coroner's jury, shall unreservedly be handed over to the duly constituted authorities of any medical college as a subject for dissection by the professors and students, in order to improve their knowedge of anatomy and physiology, and its effects upon this mania will immediately be apparent.

Nothing strikes a sensitive mind with greater horror than the thought that his body, after the breath shall have left it, will be stretched out naked upon the marble slab of a dissecting-room for the knives and saws and scalpels of the curious and unsympathetic medical students of a college or hospital!

Let the certainty of this final act in the drama of a would-be suicide's career be placed constantly and vividly before his mind, and it will prove the most powerful possible incentive to prevent suicidal thoughts from ever finding a lodgment in a brain however unfortunately constituted. Let him be constantly reminded by newspaper reports and otherwise, that the glittering steel dissecting instruments will be cutting and carving his body under the unfeeling scrutiny of a class of medical students as soon as he is dead, and he will prefer to bear and try to overcome the ills he has than to be thus cut into steaks and chops, like a beef in the shambles, as soon as he has by his own foolish act made himself the legal prey of such desecration.

To make this legislation effective as a preventive of suicidal acts, or even of the contemplation of such acts, the penalty should be imperative, inexorable, and absolutely irrevocable whatever the respectability or public reputation of the suicide or whatever the social standing of his relatives, unless, of course, there shall be a reasonable doubt of suicidal intent in the minds of the coroner's jury. This certainty of such a terrible *post mortem* fate to the body of the suicide well grounded in the minds of families, will cause them to exert the proper influence on any member who shall show a morbid tendency in that direction. Besides, the very discussion of such a horrible fate will be an educator in all families to nip in the bud any such morbid proclivity, and thus strengthen the mind against its contemplation.

The only apparent objection to this extreme legislation, or making the penalty absolutely irrevocable in every case, is the possibility that the suicide might have been insane at the time of the fatal act. But this, so far from an objection, is a strong argument in its favor, as it is one of the best educational features to grow out of such an unconditional penalty. Insanity, in ninety-nine cases in a hundred, is an inexcusable, self-inflicted abnormality, the result of mental trifling with its own environment, which in turn is largely the result of social and educational surroundings partly of one's own choosing. But let the average man who inclines to become a lunatic by first becoming a conspicuous crank, be spurred and goaded by the proper mental incentives acting on his rational hopes and fears, and it will greatly tend to keep his mind from losing its equipoise. If there shall be nothing in the shape of terrorizing consequences to startle and horrify one of weak intellectual stamina, in the possible event of his not bracing up his thoughts to a standard of cool, intellectual manhood, and if to this be superadded the environment of indifference to such morbidity on the part of relatives and friends, such a man may subside, as is too often the case, into a genuine case of insanity that will end in suicide.

But let the act of suicide from insanity, even, be no shield from the inexorable penalty of this law, and its educational effect can only be salutary upon a mind that might otherwise yield to whimsical hallucinations and gradually drift into a state of aberration solely from a lack of the right kind of moral incentives.

We sincerely trust that some progressive member of the next legislature of this State, instead of considering the propriety of affixing

worthless penalties, in the form of imprisonment, to the crime of attempting suicide, will spring upon that body the advisability of a law attaching the fearful penalty of the actual dissection by medical students of the body of every man or woman who shall for any cause whatever take his or her own life.

This, in our judgment, will do more to deter cranks and self-constituted lunatics from self-destruction than all the moral suasion within the power of man.

"THE PROBLEM OF HUMAN LIFE."

BY THE ASSOCIATE EDITOR.

Very few of our readers are aware of the great value of THE PROBLEM OF HUMAN LIFE. It is regarded by those who have read it as the only scientific refutation that has ever been made of the Darwinian theories of the evolution of man from the lower orders of creation and of modern atheism and materialism as taught by Tyndall, Huxley, Spencer, Hæckel and Ingersoll.

There are hundreds of clergymen who have written Dr. Hall that they regard his work only second in rank to the Bible, while thousands of papers of the religious, scientific and secular press have given it such endorsements as we venture to say have never before been awarded to any book written.

For the purpose of giving to those of our readers who may not have purchased the book an insight into its character and merits, we intend giving extracts from it each month.

The book ought to be circulated among all Christian men and women in order that they may have the material ready at hand to crush the arguments and objections of sneering and cynical infidels.

We regard it as particularly valuable to clergymen of all denominational opinions in furnishing seed-thoughts for sermons of power and interest, which will be a revelation to all who have been accustomed to preach and from their infancy to hear the same old doctrinal and theological disquisitions which are very valuable if people did not already thoroughly understand them.

We quote here three testimonials concerning the *Problem* which will act as a sample of thousands which have been received:

[From the *Methodist Protestant*, Baltimore, Md.]

"This is the book of the age, and its unknown author need aspire to no greater literary immortality than the production of this work will give him; and thousands of the best educated minds, that have been appalled by the philosophical teachings of modern scientists will 'rise up and call him blessed.' Hitherto it has been the boast of atheistic scientists that the opponents of their doctrines have never ventured to deny or to solve the scientific facts upon which their theories are based. But our author, accepting these very facts, unfolds another gospel; and Tyndall, Darwin, Hæckel, *et al.*, are mere pigmies in his giant grasp."

[From the *Watchtower*, Newberne, N. C.]

"The problem of human life is at last solved, the Bible is saved, and the Christian faith is redeemed; and the broad space of eternity is too short for evolutionists to think of recovering from the deathblow of 'The Problem of Human Life.' Without doubt it is the most startling book of the century. We would rather have the honor of writing such a book than to be President of the United States."

[From *The Dominion Churchman*, Toronto.]

"We most cordially concede to the 'Problem of Human Life' the well-earned title, the book of the age. Doubtless, the God of Providence has raised up the author to meet the wants of the church in this time of need."

"THE ABSURDITY OF SPONTANEOUS GENERATION."

Extract from Reply to Prof. Earnst Hæckel.

(Problem of Human Life, pages 358-360.)

But there are also general philosophical objections to the hypothesis of spontaneous generation which render it wholly inadmissible, aside from the self-contradictory statements of its chief exponents, and in addition to the acknowledged absence of any experimental tests going to favor its possibility. The very idea of life originating out of not-living matter, independently of supernatural intervention, and that, too, without any such thing as pre-existing life or mental powers in the universe from which vitality and mentality could come, is a self-evident absurdity on its face. Such hypothesis would be even more difficult to accept than the unnecessary and unscriptural dogma that God created the world out of nothing. No man would be more ready, than Prof. Hæckel, to detect and point out such a philosophical impossibility as the idea of something having been created out of nothing, and he would be justified in so doing on the general axiomatic ground that "from nothing nothing comes." Yet he labors through a large portion of the "History of Creation," to prove that the *life* and *mental powers* of the first living organism—powers so wonderful as to constitute it "the primeval parent of all other organisms"—came into existence out of absolutely *nothing*, since no life or mentality existed in the universe prior to the spontaneous rise of this marvelous little animal. Hence, "poetic imagination," to which he ascribes all religious belief in the supernatural, and on account of which there is no end to his ridicule of Christians, exists in his own brain to a degree unparalleled even in that of an insane religious fanatic. It is impossible to conceive of a more superstitious and inflamed poetic fancy than the one which enables its possessor to believe in the *creation* of the most important thing about an animal—its life and mental powers—out of nothing, and that, too, without a *creator!* Those who believe in the creation of the world out of nothing, do not make themselves ridiculous by adding to it the absurdity of such *creation* without an almighty power for its accomplishment. But Hæckel's inflamed poetic fancy pictures his own soul as originating out of nothing, in the person of his "primeval parent," the moneron, without the aid, even, of any originating power whatever. This modern Democritus is so surcharged with poetic imagination, that he sees not the least difficulty in believing, "with full assurance," as he expresses it, that the most important *something* connected with man or the lower animals, could not only come into existence out of nothing, but that there can easily be a *building* without a *builder*, a *generation* without a *generator*, *laws* without a *lawgiver*, and a *creation* without a *creator!* I solemnly aver that if all the religious faith in the supernatural, of all the theological seminaries, colleges, and universities in Christendom, were boiled down and concentrated into one chair, it would not constitute a tithe of the poetic imagination which now falls to the lot of the single chair of natural history in the university of Jena. Yet this evolutionary prodigy of the nineteenth century, with an arrogant claim to about all the "philosophical culture" of the age, ridicules a religious belief in God and His

works of creation and providence, as but a superstitious poetic fancy, too weak and childish for a scientific thinker to entertain for a moment, and only suited to the brains of sentimental women and precociously developed children! A scientific investigator who is possessed of such "philosophical culture" that he can not conceive of a single grain of sand, coming into existence out of nothing, even with the aid of almighty power, renders himself supremely ridiculous in the eyes of the thinking world by teaching for science, as does Prof. Hæckel, that the great soul and intellect of Sir Isaac Newton, for example, actually came into existence out of nothing by spontaneous generation; because the mental powers of Newton all came from those of the *moneron*, "the primeval parent of all other organisms," there being no other source of mentality in the universe from which he could derive intellect, save that of his animal ancestors, which, of course, had obtained their supply from the same spontaneously generated "primeval parent!"

To assume that the spontaneous generation of the first living organism was the result of the *laws of Nature*, acting upon inorganic material, and so combining its lifeless particles as to generate life and mental power, and that these laws were eternal in their nature and operation, is simply admitting the existence of God, to all intents and purposes, under another name. For *laws* of Nature, which could so manipulate lifeless matter, and so shape it, as to create a living, volitional, moving, growing, propagating animal, must possess life and mentality to be imparted to such material structure, since nothing can impart to an object that which it does not itself possess. These laws of Nature, which possessed this power to change inorganic dust to organic protoplasm, albumen, bioplasm, or whatever we may please to term it, and then were capable of transfusing into such lifeless mass the elements of vitality and mentality, or volitional instinct, must have possessed the capability of first designing an organic structure, with its complex parts adapted to the exercise of such vital and instinctive functions. And after having planned such an organism—requiring the very highest conceivable order of intellectuality—these "eternal laws of Nature" must have possessed the power of transferring to such lifeless mass a fraction of their own life and mentality in order to animate the organism thus designed and shaped. Such assumed laws of Nature, therefore, clearly involve the very idea which we understand by the personal attributes of an omnipotent, omniscient, and omnipresent God; and their assumed work, in thus producing a single organic being out of inorganic matter, would be the equivalent, in every sense of the word, of the direct personal act of an intelligent creative Will. Prof. Hæckel's attempt, therefore, to attribute the origin of life and mental power, in the moneron, to the operation of the "eternal laws of Nature," in order to eliminate the intelligence and hand of God from His works of creation, is but an unintentional conversion of his lifeless, designless, mindless and will-less materialistic philosophy into a sort of improved form of pantheism, by changing Nature into a Personal God, having every quality and attribute ascribed to Him by Christian or Jew, thus affording another self-contradictory exhibition of his singularly inconsistent philosophy.

We do not doubt the reign of law as inseparable from every work of God in creation and providence. We hold that God could no more act, in the construction of a living form, without the use of the laws of Nature, which He had ordained for the purpose, than He could deny himself or cease to exist—or than He could create a world out of nothing; for such creation out of nothing, and such alone, would be without law and in defiance of it. The laws of Nature are God's mode of operation in the physical universe, or His method of manifesting Himself to His creatures, and may, to this extent, be considered a part of Himself, just as man's voluntary acts, through the instrumentality of his hands and fingers, are a part of himself.

But as the reigning Monarch and Lawgiver of the universe, it is but rational to believe that special laws may also be enacted for special purposes, which, after having served their ends, as in miraculous interpositions, may be abrogated and set aside by the same power that enacted them; just as statutes in human legislation are annulled when no longer needed. But that anything is done without law by God, by man, or by the operations of the elements of Nature, I deny equally with Prof. Hæckel, or any other evolutionist.

There is no such thing as *chance* or *accident* in Nature, and no such a word as *happen*, scientifically speaking, though, by unscientific usage, we may speak of a thing as having happened by chance or accident, when the cause is not apparent or not foreseen and provided against. Every act, however trifling, in the complex realms of motion, is as certainly determined by inflexible enactment, and by laws as fixed and settled as are those which control the movements of a planet. Not a down or thistle-pappus, whirled and drifted by the cyclone, but at last will end its journey in some definite location determined by law; and this would be again repeated, and a thousand times repeated, with the nicest precision, the down falling in the same position without one hair's variation, should the same wind act upon it and the same force be exerted under similar conditions. Thus, through laws ordained by Heaven not a single sparrow falleth without His all-searching notice, while our very hairs are numbered.

We often fail to recognize the presence of law in the operations of Nature, owing to the complex intermingling of laws and causes of phenomena, proximate and remote. There is no effect, however, produced in the universe but it depends upon a cause involved in a law of Nature. The direct or immediate cause of one operation may be the secondary cause of another so remote that we can scarcely trace or detect their relation one to another; and could we trace or untangle all the causes of an event, immediate or secondary, efficient, proximate, or remote, we would find them but links, connecting other causes, correlated in one grand concatination, back to God the primal fountain—the ultimate causation of all proximate or secondary conditions.

Thus the thistle-down was anchored, after being whirled through the heavens for days, perhaps, carried by ærial currents in various directions, till at last entangled in the meshes of some grassy fiber, not by chance or accident, but by law. For the pappus was pulled down toward the earth by the law of gravity, while it was carried upward and onward by the coun-

teracting force of the wind. But the wind had its cause in heat, rarefying air in strata. Heat was caused by the rays of the sun, but modified by other causes such as those of rain-clouds, which again acted as causes in modifying the direction or force of the wind. Again, these rain-clouds were caused by heat coming from the sun and falling upon the surface of some body of water, changing it into vapor, thus causing it to rise high into the air where a cold stratum of the atmosphere caused it to condense into rain and fall upon the meadow, thus causing that particular spire of grass to shoot forth as the immediate cause of arresting and anchoring the pappus. And in this way do causes, and laws, and forces, intermingle and ramify through each other, interlaced beyond all comprehension of the most cultivated human intellect, while the sum of all conditions, proximate, secondary and remote, is embodied in the great ultimate cause of all causation—God himself—as much surpassing Nature, and her complicated laws and forces, as the sun in the heavens outweighs the down of the thistle.

But notwithstanding we are thus forced to recognize the operation of law in every event that occurs, there is and must be something above law in Nature, as there is something even above Nature in the universe, by which her laws have not only to be enacted, but intelligently directed, in order to the accomplishment of the very things which Prof. Hæckel claims as the result of forces that act without intelligence and without a purpose.

INVISIBLE AND IMMATERIAL FORMS AND FORCES.

BY ISAAC HOFFER.

The life beyond the reach of unassisted vision, which the microscope has revealed, constitutes a considerable portion of the vegetable and animal kingdom. In number and variety the visible portion does probably not exceed the invisible. It is claimed by some microscopists that the ordinary house-fly represents approximately the average in size of the animal creation. The microscope and the telescope have demonstrated that the unaided senses can not be relied on for determining the limit of existence or non-existence even of tangible and material things; that the visible is only a part of the existent; and that beyond the reach of the senses there exists not only a miniature world of life, and various states of material substances, but numberless worlds and systems of worlds, not unlike this earth and the solar system to which it belongs.

When we have demonstrated to our entire satisfaction that the limit and imperfection of our senses are such, that but a small portion of the material worlds, and the world of life, can be apprehended, we have no reason to expect that our senses can apprehend all the energies and agencies of activity in the immaterial or spiritual world. The material organs of our senses do not perceive the immaterial; and the logic of reason must be invoked to establish the verity, the form, and the characteristics of immaterial energies and agencies.

In crystallization, and in vegetable and animal life, we can see the effect and result of systematic formative action, but our senses can not apprehend the energy or agency that produces this action, and develops special forms out of homogeneous matter. The imperceptible gathering of material substances into definite forms that become perceptibly developed—the growing into form of material substances—is the only evidence of vital action which the senses can apprehend; but experience has demonstrated, even to the senses, that material substances, without a vital germ from previous life, will under no conditions develop a plant or animal; while such germ under proper conditions will cause action in material substances that produces plants and animals.

Here is the negative evidence that matter has no vital formative power, and the positive evidence that life-force has; and that it is an energy capable of exerting action in matter, and forming material substances into definite forms, and endowing them with living characteristics. It is therefore clearly evident that the form, as well as the formative power, is in the invisible immaterial vital energy in the seed. The form and characteristics of a bird are in the homogeneous matter in the egg, or else the bird could not be developed, and is in the invisible vital energy, or else the matter in the egg would develop a bird without the vitality, if it could develop at all. This is such a self-evident truth that attention is called to it only for the purpose of showing, that the senses unaided by the intellect, can not take cognizance of immaterial agencies, and can only apprehend them in their effects and results, produced in material substances.

Creation is not limited by the scope of our sensible apprehensions, and our intellectual energy is not confined to a mere reception of impressions from the senses. Sensual perception and intellectual digestion must work together, for both are equally necessary to a full understanding of any subject. In visible, tangible and material things the senses are the apprehending power, and furnish the intellect with all the data for a rational understanding; but in invisible, intangible, and immaterial things intellectual energy is the searching and detecting power.

Some scientists and philosophers hold the theory that material substances in their various states and combinations account for all the activities in nature. The difficulty with this theory is, that it fails to notice that material substances by themselves can not change their states, nor form any combinations; that in changing the states and forming combinations of material substances there must be an active power as well as something to act on, or else there can be no action. A force by itself can produce no effect and no result, any more than matter can act upon itself. An active substantial principle and a passive substance are absolute necessary to an effective action. That the two are always associated, and as far as man can ascertain inseparably, is no evidence that they are one and the same thing.

The line of distinction between formative action and the thing formed is too broad to make the formative power the formed result; or the formed result the formative power.

Gravity, attraction, repulsion, magnetism, electricity, light, heat and sound, although closely associated with material substances, have none of the distinguishing properties of matter, and can therefore not be classed as material substances. They are, however, substantial energies, with exerting or exertable powers capable of producing various kinds of action in matter, and of effecting great changes

in the states and combinations of material substances.

The difference between the material and immaterial seems to be, that the material is a tangible *inactive* substance, while the immaterial consists of invisible intangible *active* energies. The immaterial is the direct or indirect causative agency of all the activities in the material. Whether in evolution or dissolution, the moving changing power is an active substantial energy, and the thing moved and changed is a yielding submissive substance; otherwise there could be no changing action, cause and effect would be one and the same thing, for unobstructed or unresisted motion produces no action and no effect.

That electricity is a substantial something has been so fully demonstrated, that its existence as an entity should no longer be questioned. It can be stored and carried from one place to another; and it can be conveyed by wires and produced as a motive power, or as an agency of illumination. It can be used as a medium for the conveyance of signs, of sound, and, as Edison now claims, of perfect representations of objects and their movements.

In telegraphing, the exact motion of the operator's fingers is taken up by the electro-magnetism, and instantly conveyed to every part of the wire and produced wherever arrangements are made for their production.

In telephoning, sound in all its various forms is taken up, conveyed, and produced the same as the forms of motion in telegraphing.

In phonographing, the forms of sound are durably impressed upon sheets of suitable substances, and may be reproduced from these impressions at any time.

By Mr. Edison's late invention, perfect representations of objects, movements, and sounds, are taken up and conveyed to different places, and under proper arrangements accurately produced, so that the objects and movements can be plainly seen and the sounds distinctly heard.

In photographing, light conveys a representation of an object and imparts a perfect picture of the same upon suitably prepared plates or paper.

If we could see the currents of electro-magnetism when in the act of conveying representations of objects, movements and sounds, we would see everywhere in these currents the pictures of these objects and movements, and if our vision had the needed power, we could see the forms of the sounds, for these representations could not be accurately produced if they had not been accurately copied, and the copies safely conveyed to the place of production.

In vision we know that there must be some connection between the object we can see and the eye, or else we could not see the object. But before the discovery of photography the nature of this connection could not be tangibly demonstrated, although it had been correctly discerned through the logic of reason. It was the mental perception that the image of an object must be brought to the eye to be seen, which led to the discovery of photography; and it was the same perception of reason that enabled Edison and other electricians to perceive the hidden wonders of electricity, and that induced them to venture upon discoveries for a tangible representation and utilization of these wonders.

These discoveries clearly demonstrate the reliability of intellectual perceptions reached through the logic of reason, if grounded upon rational and correct premises; and these demonstrations should aid us in overcoming the difficulty of forming a clear concept—a realizing idea of that which is not perceptible by the senses, and yet is known to be rationally and logically a reality.

The important lesson which the action of vital energy, and these late discoveries, clearly teaches, is, that the formative power, and the model of the form, are not in the formed material, but in the formative energy. This fact establishes another point: namely, that the formative energy, and the formed material, are not one and the same thing, not cause and effect at the same time, but two distinct things; the one an active power and the other a passive substance. The further lesson clearly taught, is, that the immaterial—the imperceptible by the senses, is just as much a substantial reality as the perceptible; that the imperceptible is the operating power and the perceptible the passive substance; that the mystery of formative action is due to the fact that this imperceptible operating power works from the interior outward, and with imperceptibly minute particles of matter; that these immaterial energies are mediums of conveyance, that can receive, convey and transfer, not objects, but images of objects, and forms of sound, which, contrary to all laws in material activity, are invisibly and inaudibly conveyed to distant places, and there visibly and audibly produced; that the picture of an object which can be received, conveyed and transferred on paper must either be of a substantial nature itself, or the medium that received and transferred it must have been of a substantial character, and must have taken a substantial impression of the object pictured; and that sound has form, and form of a substantial nature that can be impressed upon material substances, and can be taken up by electro-magnetism, conveyed to different places, and there audibly produced. We can not conceive of the existence of a form without substance, and especially not of a form that can make an accurate impression upon some material substances, or can be transferred to distant places as sound can, and there produced in the exact form it was received. Hence it is a rational conclusion that sound must be a substance of some kind, but the senses not being able to detect tangibility in sound are reluctant in giving their assent to the conclusions of reason. It is, however, admitted on all sides that sound moves through the atmosphere, and through some solid substances such as iron and wood, and moves in unison with electric currents, and moves in forms which the sense of hearing perceives and distinguishes, just as clearly as the sense of sight perceives and distinguishes material objects.

If sound is a mode of motion, it is a mode of motion in which something moves, or is moved; for there can be no mode of motion without something moving or being moved. It is a delusive conception to conceive of a mode of motion without the concept of something moving. And when this something has form and distinguishing characteristics, such as sound has, it must have substance of some kind, that has form, or receives the impression of form.

If sound moves 1,142 feet per second in the atmosphere, 4,900 feet in water, from 12,000 to 16,000 feet in wood, and 17,500 feet in iron, it

shows a mode or law of motion directly the opposite of moving material bodies. Iron, a substance almost impenetrable to the hardest material, "propagates" sound through itself more than fifteen times faster than air.

In electro-magnetism, itself an intangible and immaterial substance, sound is instantly imparted to, or taken up by, all parts of the current ready everywhere to be produced at any distance.

Why sound travels so much faster through iron than through the atmosphere, and how the "wave" motion can be maintained in its passage through the iron, are questions which I must leave to others to answer, if they can be answered at all.

How sound is taken up by electricity, instantly and inaudibly conveyed or transferred to great distances, and there produced as it was received with all the distinguishing characteristics unchanged, are facts which open up a promising field for investigation into the mysteries of the immaterial agencies of activity, that manifest themselves everywhere around us and within us in this material world.

When a hundred cameras can pick up a hundred perfect representations of an object, at a hundred different places, at the same time, there is a law of conveyance and impression, which is contrary to all material laws. When the spoken words of a person in New York can be conveyed almost instantaneously to the ear of a person in Philadelphia, the law of conveyance of material agencies fails to account for the performance. When an impression of words, spoken or sung in a particular voice or tune, can be made upon tinfoil or wax that may be reproduced from these impressions, it shows a perfection and substantiality in the forms of sound, and a method of reproduction, wholly at variance with the laws of material perfection and reproduction of forms. Invisible and imponderable agencies have become mediums of conveyance and transmissions; distance and time are no longer causes of delay; immaterial energies furnish motive power and light, and are rapidly revolutionizing the old order of things; venerated philosophical theories have fallen hopelessly in the rear in this great march of progressive development; and a new substantial philosophy, embodying the principles underlying these new developments, and standing abreast with the advancing age, must take the place of the old motion theories of science, as immaterial energies are taking the place of material forms.

Lebanon, Pa.

DR. SWANDER'S NEW BOOK.

BY THE ASSOCIATE EDITOR.

Last month a short notice was given in the MICROCOSM by the editor of this latest work by our valued friend and contributor. Since then we have given the *Invisible World* a careful reading and have experienced a feast of genuine æsthetic and intellectual enjoyment.

The author of *The Invisible World* needs no introduction nor letter of commendation to our readers who have followed from month to month in the MICROCOSM for the past seven or eight years the intellectual scintillations from his brilliant pen, nor do we need to speak for him, to those who have read his book *The Substantial Philosophy;* but in this his latest effort he has really surpassed himself and has produced a book which has no superior nor do we believe an equal in that brilliant, illustrative and masterly literary style in which Dr. Swander is such an adept.

The Invisible World is brought forth as a complete *resumé* of all the arguments and discoveries advanced by the editor of the MICROCOSM and his numerous co-laborers in support of the *Substantial Philosophy* and the reality of immaterial entities in the universe of God. These arguments and facts are all taken by Dr. Swander and made to lead up to and dovetail into one another in such a way as to make this new presentation of the *Substantial Philosophy* irresistible in the force of its logic to any fair-minded and unpredjudiced investigator.

The book contains twelve chapters and may be divided into two parts, one devoted to the purely scientific and philosophical, while the latter half is devoted to theological subjects to which Dr. Swander has given much careful thought and on which he has advanced many original ideas, which may meet with criticism from some orthodox centers, but which we venture to say the author is well prepared to defend.

The book is very apropriately dedicated to Dr. Wilford Hall and the Rev. Dr. Moses Kieffer, the former being his scientific mentor, the latter having been the teacher under whose guidance the author's theological education was prefected.

The literary honor and magnaminity of Dr. Swander is shown throughout his whole book by the credit given to Dr. Hall, whom he loses no opportunity to justly praise and defend and whom he regards as the founder, promoter and defender of the *Substantial Philosophy*, all others being at best merely ardent students and disciples, catching their inspirations from the work he has already done in his *Problem of Human Life* and is doing in the successive volumes of the MICROCOSM.

We have heard from the author that the success of the new book thus far has surpassed his most sanguine expectations. Through the notices given in this journal the orders for it are rolling in so rapidly that the first edition must soon be exhausted. Dr. Swander writes that orders have been received from every state in the Union, from Europe and even from the antipodean regions of Australasia.

We earnestly commend every reader of the MICROCOSM who is at all interested in a consecutive history of the principles, discoveries and conquests of the *Substantial Philosophy*, to send the price $1.50 to A. Wilford Hall, 23 Park Row, N. Y., and receive a copy by mail.

It is unnecessary for us to say anything further in expression of our satisfaction with this book, but will make an extract from the first chapter which will give the reader an opportunity to judge for himself of its merits:

This great work which Wilford Hall has undertaken, will succeed. The assurance of such success is found, not so much in his remarkable powers of intellect, as in his happy combination of *distinct and inseparable elements of strength.*

His position is central.—For this reason it is impossible for him to fall into fundamental error, except through illogical reasoning. He holds that mind and matter have the same origin in the very substantial fullness of the Infinite God; that they are distinct in their essential elements and properties; that man, as

the microcosm of nature, consists of a dual structure; and that the human soul, though invisible in the hemisphere of materiality, is nevertheless, a substantial organic entity. Starting from this central point, he can sail up the main channel of truth, between bold materialism on the one hand, and bald idealism on the other, without necessarily nearing the dangers to which the philosophical mariner is usually exposed. True, he has been charged with materialistic tendencies. The third chapter of the *Problem* cites a few specimens of an attempted side-push. Certain parties, whose cosmogony is predicated of "nothing," undertook to drive him into the meshes of materialism, and, in return, received such a counter-push from the Gibraltral center of truth as to send them reeling back to—"nothing"—the proper landing point of men who claim that they were made out of nothing.

Having failed to convict Dr. Hall of materialism, a new count was thrust into the indictment. "Pantheism" was the grave charge laid at the door of 23 Park Row, New York City. The founder of Substantialism a pantheist? Indeed! Let us look a little at the ground of this serious accusation. While he teaches that the personal and infinite God is the creative source of all things, he also insists that God's transcendancy is in perfect agreement with His immanency; and that His immanent presence in the finite or created universe is the motor power thereof, and yet in such sense as to be distinct therefrom.

In anthropology he holds that a recognition of the dual structure of man, as the microcosmic culmination of nature, is the only royal road of escape from that old heresy of dualism in philosophy which was hatched from the false conception of two primordial principles, and, consequently, two different forms of substance—mind and matter—in eternal conflict. Spinoza sought to destroy this false dualism, but failing to distinguish clearly between the corporeal and incorporeal entities of the universe, he fell, with all his masterly powers, into the vortex of pantheism. His God was consubstantially one with the world. This is just what Wilford Hall does *not* teach. He consistently and constantly holds and proclaims that God was before creation, is above creation, and ever shall remain distinct therefrom. If Dr. Hall is a pantheist, the American woods are full of them, and the Christian church is steeped with the very essence of this most biblical heresy; and those who are trying to kindle their censorial fires to burn such heretics, had better save their fuel to thaw the frigidity out of their own iceberg orthodoxy.—pp. 77–79.

A VALUABLE PREMIUM.

Any person who will send us eight subscribers to the present volume of the MICROCOSM with $4, will receive as premium a copy of "*The Problem of Human Life.*"—527 pages, handsomely and substantially bound in cloth.

This is Dr. Hall's greatest book, and includes the arguments refuting the Darwinian theory of evolution and proving from a scientific standpoint the existence of God and the absurd fallacies of atheism and infidelity.

It also explains and elaborates the *Substantial Philosophy* which is creating such a furor in religious and scientific circles.

We make an extract from this book on another page that the reader may have a sample of the wonderful literary and argumentative ability with which the book is composed. A little effort on the part of each subscriber will be sufficient to induce eight friends to subscribe fifty cents for a year of the MICROCOSM. One number is easily worth that amount to any person who thinks. The regular price of the "Problem" is $2 per copy.—ASSOC. EDITOR.

OUR PREMIUM OFFERS.

20 Subscribers to MICROCOSM secures Dr. Hall's celebrated Health-Pamphlet.

8 Subscribers secures Dr. Hall's "Problem of Human Life."

6 Subscribers secures either "Universalism Against Itself" (a death-blow to the doctrine of universal salvation), or "The Walks and Words of Jesus"—a harmony of the four gospels.

5 Subscribers secures the "Text-Book on Sound."

40 Subscribers secures the complete scientific library of Substantialism, embracing the 7 bound volumes of the MICROCOSM, "Problem of Human Life," "Text-Book on Sound." (The *retail price* of this library is $14.)

These books ought to be in every household. No library can be considered complete without them, as they are filled from cover to cover with thousands of new thoughts and discoveries.

DOCTORS AND THEIR MEDICINES.

We call the attention of our readers to the exposure of the hypocrisy and ignorance of the medical profession and the poisonous, destructive and disease-creating nature of their drugs, as admitted by the most celebrated and renowned members of that profession.

It is indeed sad to hear such a confession coming voluntarily from the mouths of the ablest medical practitioners, who have the health and lives of the people at their disposal.

The truth of this terrible admission is realized by every person who has taken a cathartic; the intended work of elimination from the bowels is accomplished, but almost invariably at the expense of a diseased liver, kidneys or stomach, which organs are contaminated by the drugs taken.

The only method by which diseased conditions can be successfully combated is by some harmless method of driving from the body the impurities and disease-bearing germs, through the three organs which were ordained by God for that purpose, *i. e.*, the skin, the kidneys, the bowels. If activity in any one of these organs is obtained by the use of drugs, it is simply increasing the difficulties by injury to the heart, lungs or other portions of the body and is simply robbing Peter to pay Paul.

These facts were realized by Dr. Hall, the editor of this paper, in his own experience with doctors when a young man, the result being that his death was expected by his physicians and would certainly have occurred had he continued under their treatment. But in the extremity of his despair he made the hygienic discovery, which has preserved him from a consumptive's grave at thirty years of age to a man of strong and robust physical health and unquestioned intellectual vigor at the age of seventy-two. His discovery repudiates the use of medicines and drugs of every description, depending entirely upon the killing of disease-bearing germs by a simple and rational process, thus allowing *nature* to heal and build up disordered parts. The success attained by its use during the past two years by over 300,000 families has stamped it as the greatest boon ever offered to humanity. To the sick from almost any cause (not organic) it offers a certain cure by putting the system in a condition to receive the aid of nature, and to the well it affords a preventive of disease by causing the elimination of the very substances upon which germs of disease feed.

We direct attention to the last page of this number for the damaging testimony from the before-mentioned celebrated physicians against their own practises and medicines.—[ASSOCIATE ED.]

DR. AUDSLEY ON ACOUSTICS.

By a crush of articles this month, Dr. Audsley's series of discussions on the Sound question was crowded out. It will again be resumed next month.

DOCTORS AND MEDICINE.

On page 159 of this paper we promised our readers the testimony of the most prominent physicians in both this country and Europe concerning the efficacy of their medicine in the cure of disease. The disclosure is startling and speaks for itself:

PROFESSOR N. CHAPMAN, late of the University of Pennsylvania, formerly President of the Philadelphia Medical Society, and declared a few years ago to be at the head of the medical profession in America, says, in "Materia Medica," vol. 1, page 3: "Medical conclusions differ very widely from every other species of evidence. We cheat ourselves with a thousand illusions. It is not necessary that I shall enforce this remark by the enumeration of any examples. No one who is conversant with the practice need be told how often his own deductions have proved erroneous, and *how little confidence* is to be reposed in those pompous recommendations with which medicines are promulgated."

On page 33 the same author says: "To trace the multiplied relations of medicine to disease, we at once introduce the spirit of speculation."

And again he says, page 32: "This, indeed, is emphatically true, that we can hardly ever pronounce with certainty what will be the exact results from the dose administered. It might gratify our vanity, were it not more than counterbalanced by the humiliating view of so much absurdity, contradiction and falsehood."

SIR ASTLEY COOPER, physician to Queen Victoria, has declared: "The science of medicine is founded upon conjecture and improved by murder." What a shocking statement from a man so eminent as to have the royal family in his professional care.

PROFESSOR ARMOR, of the Long Island College Hospital, declares, in the New York *Medical Journal* for January, 1883, that "drugs are administered, patients sometimes recover, and we suppose we have cured them, whereas our remedies have had little or nothing to do with their recovery. Very likely it took place in spite of our drugs."

SIR JAMES JOHNSON, formerly editor of the *Medical Chirurgical Review*, London, says: "I declare, as my conscientious conviction, founded upon long observation and experiment, that if there were not a single physician, surgeon, chemist, druggist or drug on the face of the earth, there would be less sickness and less mortality than now prevail."

DR. OLIVER WENDELL HOLMES has declared before the Massachusetts Medical Society: "I fairly believe that if the whole materia medica could be sunk to the bottom of the sea, it would be all the better for mankind and all the worse for the fishes."

PROF. MAGENDIE, the great French physician, whose experiments and teachings are recorded and scattered over the whole globe, addressed the students at the Paris Medical College in the following language: "Gentlemen, medicine is a great humbug. It is nothing like science. Doctors are mere empirics when they are not charlatans. We are ignorant as men can be. I must tell you frankly that I know nothing about medicines. I repeat to you, there is no such thing as medical science. I grant you people are cured, but how? Nature does a great deal but *doctors do devilish little.*" Think of it; a man so high in the medical profession, as Dr. Magendie is acknowledged to be, lecturing in such style to a class!

DR. JAMES MASON GOOD, the noted author, says: "The science of medicine is a barbarous jargon, and the effects of our medicines in the highest degree unsatisfactory, except, indeed, that *they have destroyed more lives than war, pestilence and famine combined.*" How does this sound to the people who have a mania for swallowing medicine?

DR. MARTIN PAINE, in his great work, "Institutes of Medicine," page 541, declares: "The most violent poisons are among our best remedies. We do but substitute one morbid action for another." Dr. Paine is authority. He was Professor of Institutes of Medicine and Materia Medica in the University of the City of New York, and member of any number of learned societies in Europe and America.

DR. HALL, of *Hall's Journal of Health*, says: "Medicine, even the *mildest*, is a poison, and effects a result in proportion to its poisonous qualities. It cures by *setting up a disease greater than the original which it seeks to cure.*" Hence the reader can easily see how it is that medicine *seems* to "cure" the simpler forms of disease, by establishing the more serious ailments, such as heart disease, liver troubles, consumption, kidney disease, dyspepsia, paralysis, spinal trouble, female disorders and the host of other chronic ailments which are acknowledged incurable by any drugs.

It is the duty of a doctor to ease a man's pains, and quietly slip him out of this life into the Great Beyond.

HEALTH WITHOUT MEDICINE.

The quotations just made from the highest authorities and representatives of the medical profession show the dangerous and experimental nature of filling the system with their poisonous medicines. Believing implicitly in the truth of the facts set forth by these testimonies, we append a few counter testimonials from thousands which we have on hand from those who have been restored to health by Dr. Hall's Health treatment, which reveals a method of curing disease **without Drugs or Medicines** of any description:

L. F. Churchill, Esq., a lawyer, of Rutherfordtown, N. C., writes, Aug. 24th:

"Dr. Hall,—Several months ago I commenced your treatment for chronic dyspepsia, from which I have been a sufferer for a long time. It has had a wonderful effect in the right direction. I send you enclosed $4 for a pamphlet for a friend. Respectfully yours,

"L. F. Churchill."

Wm. J. Hall, Marion Station, Md., writes:

"Dr. A. Wilford Hall,—I bought your Health-Pamphlet eight months ago and am so well pleased that I want to act as agent for you in this county. When I began your treatment I was in a precarious condition. Suffering from consumption of the bowels or chronic dysentery. This terrible disease gradually grew worse. Notwithstanding the fact that I received all the medical attention that any man could receive. My weight decreased from 165 pounds to 125 pounds, and my doctor and friends gave up all hope of my recovery. I was at this crisis informed by Dr. J. C. Hummer that there was only one thing to cure me and that was Dr. Hall's Health-Treatment. In twenty-four hours after using the treatment I felt a radical change, and in ten days I was able to attend to business, and in two months I was as healthy a man as lived in the community.

"Sincerely and gratefully, Wm. J. Hall."

Mr. F. Gorton, of Fenton, Michigan, writes:

"Dear Dr. Hall,—Simple justice to you demands that I make known my experience with your valuable discovery; I was severely attacked with 'La Grippe' and for three weeks was *very* sick. Your treatment brought me out all right. I took no medicine and when I recovered, I at once felt all right, strong and well, while all others complained of feeling weak and half sick for many days. I am seventy-five years old; I intend to die without making an apothecary shop of my stomach. Many thanks for your valuable and wonderful assistance to nature.

"Yours gratefully and fraternally, F. Gorton."

C. H. Harmon, of Athena, Oregon, writes:

"Dr. Hall,—About eighteen months ago—upon the recommendation of my neighbor, Isaac Blum, in whose family your health method had been satisfactorily tested—I purchased one of your pamphlets. The treatment has proven a godsend to my family, and especially to my wife, who, marvelous as it seems, recently gave birth to a large and healthy boy without having suffered a moment's pain, whereas on all previous similar occasions (two) she underwent long and severe labor agony. I take great pleasure in making known this fact.

"Yours very truly, C. H. Harmon."

Our Health-Pamphlet, revealing fully this drugless remedy, is $4.00, which we agree to refund if treatment is not satisfactory after a month's trial. This shows our faith in results. Write to any of those giving testimonials concerning our reliability and the genuineness of their indorsement, inclosing stamp for reply.

CONTENTS FOR SEPTEMBER NUMBER.

Our "Extra" MICROCOSM of 16 pages, giving further information and endorsements from prominent persons concerning the Health-Pamphlet, sent FREE upon application.

Press of H. B. ELKINS, 13 and 15 Vandewater Street, New York.

The Microcosm

A MONTHLY JOURNAL OF SUBSTANTIALISM AND COLLATERAL DISCUSSIONS.
THE ORGAN OF THE SUBSTANTIAL PHILOSOPHY.
A. WILFORD HALL, Ph. D., LL. D., Editor and Proprietor.
(Author of the "Problem of Human Life," Editor of the *Scientific Arena*, &c., &c.)
ROBERT ROGERS, Ph. D., Associate Editor.
Address all communications to A. WILFORD HALL, 23 Park Row, New York.

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DR. HALL IN GREAT BRITAIN.

The editor of this journal has just received notice from London of his unanimous election as a fellow of the *Victoria Institute* or *Philosophical Society of Great Britain*, accompanied with an invitation to prepare a special paper on Darwinism or "Direct Creation *versus* Spontaneous Generation and Natural Selection," to be read before that society. The doctor has accordingly prepared and sent to the Secretary of the Society the following paper to be read for him by his friend Dr. Audsley.

ASSOCIATE EDITOR.

DIRECT CREATION *versus* SPONTANEOUS GENERATION AND NATURAL SELECTION.

BY A. WILFORD HALL, Ph. D., LL. D.

From our first examination of the "Origin of Species" by the late distinguished Charles Darwin, we have not only doubted but repudiated the logic that would begin organic life on this earth by special acts of creation, and then complete it by "natural selection" and "survival of the fittest."

Mr. Darwin distinctly resorts to direct supernatural interposition on the part of the Deity for the origin of the "first few simple forms" of life as a foundation for "natural selection" to begin work upon, well knowing that there can be no *selection* unless there are two or more things among which or from which to select.

To assume that "natural selection" could produce the first simple forms of life thereby to make choice of the fittest to survive, was such a logical absurdity as to force its repudiation and compel the great naturalist to accept the "unscientific" basis of several special acts of creation on the part of an intelligent creator, or else abandon at its very threshold the entire great scheme of the origin of species by "natural selection."

There is not a scientific investigator living who has approached this discussion, from the first appearance of the "Origin of Species" to the present time, who is not forced to accept the logic of Mr. Darwin, namely, that at least a few original organisms must necessarily have been created by some supernatual means and placed in the struggle and competition for life on this earth before selection of any kind, natural or artificial, could commence its work as a preparatory step to structural improvement and the survival of the fittest.

Evolutionists as a rule, in their lectures and published arguments in favor of Darwinism, either purposely slur over this essential phase of their master's system of commencing the work of selection, or else they superficially ignore it entirely as too difficult and dangerous a ground upon which to risk their scientific feet. They surely ought to know, should they incautiously adopt the logical conclusion into which their great leader was forced as his only alternative after a life long mental agitation upon that very point, that they at once nullify all their sneers at the "unscientific" doctrine of miraculous or supernatural acts on the part of a personal and intelligent creator for the production of all species as believed and taught by religionists of every school.

Darwin was too careful and too logical a student of nature and science to precipitate himself into the doctrine of "spontaneous generation" as a means for securing the "first few simple forms" upon which his law of natural selection could afterward go to work for the development of the higher orders of animate being. Whatever want of logic was displayed by this eminent naturalist in beginning his system of populating the earth by intelligently directed miracles, and ending it by the action of blind and designless laws of selection, he could not be cajoled by the emergencies of his dilemma to choose such an irrational and indefensible basis for his future reputation as that of the origin of sentient beings possessing mental powers, without preexistent life and mind as their cause.

He did not dare to risk the future of his masterly book based upon any such defenceless hypothesis as "spontaneous generation out of inorganic matter" for the production even of one living and intelligent animal, possessing all the necessary parts, organs and voluntary faculties fitting it for the struggle for existence and endowed with the capabilities of development into myriad other species of a still higher order. The reason why he did not dare to risk the assumption of such a means of securing the necessary "few simple forms" for natural selection to begin upon, however tempting the idea, was, that the same intelligent laws of nature which possessed sufficient designing and constructing power to convert inorganic matter into his primeval *ascidian*, for example, and confer upon it the mental faculties required by its environment to enable it to subsist, propagate its kind, and evolve into still higher forms of organic life could, without a logical doubt, so act on similar or other organic matter as to produce a fish, a bird, a quadruped, or a man.

Darwin had the sagacity to see that the creation of a perfect horse, for example, with all his mental powers, was only the reasonable extension of the same intelligent processes which were necessary in the natural laws and forces to construct a *moneron* with its invisible parts and organs by which it could thrust out its *pseudopodæ* or false feet, seek for and devour its food, and finally divide its body into two living procreating parts, possessing the same mental powers of the original. But while Darwin saw this consistent method of reasoning and the logical absurdity of adopting the hypothesis of spontaneous generation to give a start to natural selection, he totally failed to see the same inconsistency in his own hypothesis of calling in a personal intelligent Creator to produce his first few simple forms, including the "ascidian," which he definitely specifies, and not then permitting that same creative power to go on and finish the work he had been absolutely obliged to commence!

Darwin's disciples are therefore the last men on earth to inveigh against the "unscientific" character of the doctrine of the miraculous creation of the species. A "*scientific* fact" is any fact the assumption of which becomes unavoidable under the logical analysis of existing conditions and circumstances, or in other words which makes such assumed fact an absolute necessity. Darwin was driven to such a logical necessity by finding his newly discovered law of "natural selection" without materials upon which to begin work until he had first called to its aid the absolutely unavoidable scientific fact of the direct miraculous production of a few simple organisms by the intervention of a personal, intelligent Creator. This being a scientific necessity for the very commencement of evolution, hence miracles in this case became scientific facts. Let no evolutionist henceforth fling a sneer of contempt at miracles as "unscientific" when no other solution of a problem presents itself.

Prof. Hæckel, of the University of Jena and the greatest living apostle of Darwin, in his "History of Creation," and "Evolution of Man," resorts to the spontaneous generation of the first living form out of inorganic matter as a strictly "scientific process" every way in harmony with that of natural selection and the survival of the fittest, while he mildly ridicules the position of his master, as a weak concession to the church, that anything had ever been created miraculously by an intelligent Deity.

Little, however, did the Jena professor realize that in giving to nature the intelligent designing power to produce a living, thinking "*moneron*," which he declares to be the "primeval parent of all other organisms," he had simply made nature itself the very intelligent and personal "Creator" he was ridiculing in Darwin. And while Darwin logically recognized the necessity of the supernatural creation of a "*few* simple forms" in order that anything like *selection* could begin, Hæckel entirely and inconsistently overlooked the self-evident necessity of a plurality of diversified organisms in order to put the law of natural selection into operation, but limited the creative work of his spontaneous god to a single "simple form"—the *moneron*.

He repeats over and over, in his different works, that but one single effective act of spontaneous generation ever took place on this earth, and that but one single organic being was ever thus created capable of organic reproduction. He thus absolutely stops the entire process of natural selection at the very threshold of creation, which his master, Darwin, consistently saw could only be started by having at least a "*few* simple forms" to select among and from in order that any survival of the fittest could take place. Hæckel, however, in his desperate anxiety to improve upon Darwin's special-creation hypothesis and thus ignominiously rule a God out of the universe, assumed but one single effective spontaneously created organism, and then set his little albuminous "primeval parent" at the incomprehensible task of *selecting among itself*, to carry on the struggle for existence and survival of the fittest in competition with itself!

If there is any naturalist now extant so deficient in logical powers as to prefer Hæckel's method of beginning natural selection, the struggle for existence and survival of the fittest by having but a single spontaneously generated organism to start with, to that of Darwin's "few simple forms" specially prepared by an intelligent "Creator," we confess we should like to meet him. If there is any man who can conceive of the generation of a sentient, intelligent being without at least an equally intelligent and sentient *generator*, we should also like to meet such an intellectual curiosity. Yet Prof. Hæckel, according to his "History of Creation" and his "Evolution of Man," does actually believe in an intelligent generation without a generator, an ingenious invention without an inventor, an intelligent and sentient creation without a creator, a work of art without an artist, and in intelligent self-executing laws without an intelligent law-giver.

Accepting Darwin's view of the origin of living forms upon this earth, as having taken place by special acts of supernatural creation, as the only scientific basis of evolution by natural selection, we therefore accept the decision of this high authority that a *miracle*, in every case where it is the only rational explanation of phenomena, must also be regarded as a *scientific* and *demonstrated fact*. That a miracle, and even a number of miracles were absolute scientific facts at the commencement of natural selection, and in order to start it into operation is, therefore, conceded by this highest authority on the subject.

Another thought must not be overlooked, bearing directly upon this point. Keeping in mind that it was absolutely necessary, according to Darwin's forced admission, in order to start natural selection, that a few simple organisms should be specially created in order that this law might have something upon which to operate, is it reasonable or consistent to assume that the all-wise Creator changed a plan that had proved entirely successful at the start, and adopted one to be left to the mere chance of circumstances and environments for completing the great scheme of creation? For an infinite Creator to adopt two plans entirely different for the production of new species which were to populate this earth, when the simpler of the two plans had proved entirely practicable, is a puerility of which, in ordinary mechanics, no intelligent man could be guilty.

No inventor, for example, constructs an ingenious machine and then expects that machine to evolve other inventions even still more complex than itself. He would consider the same ingenuity necessary to produce a new invention that conceived and designed the first, though he might cause an ingeniously

constructed machine to turn out a given uniform product *ad libitum*. Such are the workings of the complex physical laws within an organic species which go on reproducing its individual members, just as a given invention will produce millions of *pins* exactly alike. But no man ever produced a pin-machine with a capacity to produce other machines capable of turning out needles, screws, tacks, buttons, etc. The reader can make the application.

Besides it is just as easy, so far as the human intellect can conceive, for an *infinite* creator to produce an elephant as an earthworm by direct creative energy. It is only a difference in the number of material or visible parts and their manner of arrangement, since the life and mental powers of the worm are as much an essential emanation from the life and mentality of the Deity as in the higher degree of mentality and vitality exhibited in the elephant.

Although the great Hoe printing-press shows more ingenuity than the invention of a simple folding-chair, yet the inventor of the folding-chair could as easily have made the printing-press by a still higher cultivation of his intellect. Infinite capacity or genius can not be cultivated; therefore the creation of any form of organic life would be alike easy to the mind of a creator capable of producing Darwin's primordial ascidian.

Is it not therefore a bald specimen of logical inconsistency to admit the construction of the first animal species by direct creative acts on the part of an intelligent and personal Deity, and then seek to finish the work by the operation of the unintelligent forces of nature through the so-called law of natural selection?

Darwin's carefully repeated limit of the creator to a "few *simple* forms" is disingenuous, as he himself teaches that the simplest conceivable organism is incomprehensibly "complex." Here is a specimen of his own real conception of what he calls "*simple* forms" as the mere preparatory ingredients upon which the marvelous and superior law of natural selection was to be set to work.

"In *every living creature* we may feel assured that a *host of lost characters lie ready to be evolved under proper conditions*." * * * "We can not fathom the *marvelous complexity of an organic being;* but on the hypothesis here advanced *this complexity is much increased. Each living creature* must be looked upon as a *microcosm—a little universe—formed of a host of self-propagating organisms, inconceivably minute and as numerous as the stars of heaven.*" "Animals and Plants," vol. 11, pp. 478 488.

How frivolous then for Darwin to reiterate the "few *simple* forms" when according to his own showing, there is no such being as a *simple* form, but that "every living creature" is of "marvelous complexity," a "microcosm," a "little universe" with parts "as numerous as the stars of heaven!" What more could be said of an elephant or of a human being?

Plainly, Darwin's originally created "ascidian" proves too much and shows that this wonder-working law of natural selection was entirely unnecessary for the development of the very highest orders, since the admitted creative acts which produced the simplest conceivable organisms with their inconceivable powers, did all for them in the way of "complexity" and "heterogeneity" that natural selection and survival of the fittest have ever done, only we haven't the eyes to see it.

It follows from the foregoing that all the way through the claimed achievements of the law of natural selection, if it shall transpire that certain facts in the production of species are totally irreconcilable with the operations of that law and can only be made to harmonize with the teleological doctrine of direct acts of intelligent creation, then in every such case we have a conclusive scientific proof of a miracle having been wrought.

This is the course of reasoning we have been obliged to adopt throughout our entire argument against evolution in the "Problem of Human Life,"—that if a single miracle were ever wrought, on the part of the Creator, as demonstrated by science, then a miracle becomes a scientific fact and must be received as scientific evidence in every case where ordinary or natural processes fail to explain the phenomena.

In the course of that discussion we found scores of phenomena in the origin of species, many of which were conceded by Darwin to be entirely inexplicable on the principles of natural selection, the only possible explanation of which being that of direct miraculous intervention.

We have no space here to give a list of these cases where by the assent of Darwin himself a miraculous interposition is the only solution of the problem. For a full discussion of that phase of Darwinism, so important to the religious philosopher, we refer all parties interested to the Seventh, Eighth, Ninth, Tenth and Eleventh Chapters of the "Problem of Human Life."

But not to leave this part of our subject entirely without an illustration in this paper, we here add a couple of extracts from the last chapter of the work named, which will show the trend of that entire controversy with evolution and natural selection:

(Extracts from the "Problem of Human Life.")

The object in this closing chapter will be to point out some of the more prominent and manifest difficulties in the way of evolution as a reasonable or scientific hypothesis, and to indicate such contradictions and inconsistencies as can not possibly be found in a theory based on truth, whether claiming to be scientific or not.

The evident impossibility of the origin of *wings*, for example, in flying animals, such as birds, bats, insects, and some reptiles and fishes, by natural selection, is alone sufficient to overthrow evolution if there was not another objection to the hypothesis. It is a difficulty which has not only never been answered, but has remained a distinct rebuttal of the evolution hypothesis ever since the first publication of Mr. Darwin's *Origin of Species*. In his later editions of that work, he has had the candor to refer to this objection and state it, but has lacked the candor to admit its unanswerable character,—while, at the same time, he does not even make an attempt to meet it. No better proof need be asked to show that the origin of wings must have been the result of special miraculous creation than this failure on the part of all evolutionists, from Mr. Darwin down, to point out even a supposable solution on the basis of natural selection. If any imaginable explanation had been possible it would surely some time or other have been attempted. How such great naturalists as Darwin, Huxley, and Haeckel, can feel satisfied still to believe in evolution while quietly ignoring this crushing difficulty, seen in its millions of forms all around them,—while each bird, bat, or insect, constitutes a perpetual refutation of their theory of natural selection,—is more than I can comprehend. The reason why they can not even attempt an explanation of this problem will now clearly be shown.

Natural selection, Mr. Darwin repeatedly and particularly reminds his readers, can not, in the first place,

produce an organ of any kind, since it can not even cause the smallest *variation*, thousands of which it takes to constitute an organ, if carefully preserved. It can only cultivate organs *after they exist and are useful*, by saving in one direction such variations as "arise" by unknown laws, and tend to add to their usefulness:

"Several writers have misapprehended or objected to the term *natural selection*. Some have even imagined that natural selection induces variability, whereas it implies only the preservation of *such variations as arise* and are *beneficial* to the being under its conditions of life."—"Unless *favorable variations* be inherited by some at least of the offspring, *nothing can be effected by natural selection*."—DARWIN, *Origin of Species*, pp. 63, 80.

Mr. Darwin and other evolutionists can easily tell how natural selection might cultivate a bird's wings by making them more and more effective after such wings exist, and are so far useful as to answer the functional purpose of *flying*. But until the wings of birds are so far developed as actually to serve the purpose of flight they are utterly useless (with a very few exceptions, as in the case of the ostrich,) and Mr. Darwin is well aware of it. Hence, natural selection could not have touched the first bird's wings during all their incipient stages of development, since such stumps or rudiments of wings could have been of no service to the bird. The common intelligence of every reader must assure him that a stump of a wing in any animal would not only be useless but would be a clumsy and awkward appendage, burthensome for transportation and requiring extra nutrition for its growth and waste of substance. Hence, during all the incipiency of the wing-bones in starting the organ, or until the wings became at least of sufficient size to aid in running, as with the wings of the ostrich referred to, they would be not only useless but harmful, for the reasons given. No answer can possibly be made to this state of facts; and therefore no answer has ever been attempted.

There is a distinct intelligent design in the wing of a bird, bat, or insect, and it defies the ingenuity and reason of any man to conceive of such adaptation of the most wonderful mechanical principles and parts to uses and results, without admitting an intelligent purpose in the very incipiency of the mechanism. Atheism, materialism, pantheism, evolution, and every other theory or philosophical hypothesis which denies the absolute and intelligent existence and intervention of a personal Creator must forever stand dumb and confounded in the presence of a humming-bird. The whole question of evolution, with its truth or falsity, is thus narrowed right down to this one class of facts—the wings of birds. If they could not, by any possibility, have originally been produced by natural selection, as I will now demonstrate, then the intervention of an intelligent Creative Will is an unavoidable necessity. No candid evolutionist can or will dispute this.

The idea of the possible development of a wing by natural selection saving up slight favorable variations is a very different thing from the development of a leg in a snake, for instance, or any animal which is legless, and which moves on the ground. Evolutionists might, with some show of plausibility, claim that the nascent leg of a reptile, even in its most incipient rudiment or before it showed through the skin, might be of some use in causing a sensible protuberance of the surface at that portion of the body which might act upon the ground in helping to move the body of the snake. But not so with the wing of a bird. All its earlier stages of development would not only have been useless but actually harmful, as shown, consuming nutrition and strength for transportation; and therefore natural selection, so far from assisting its development, would—aided by the economy of growth—have suppressed it; since Mr. Darwin in a score of places reiterates the law that natural selection "acts only," "acts exclusively," "acts solely," in saving variations which are "beneficial," while he repeatedly tells us that

"This preservation of *favorable* individual differences and variations, and the *destruction of those which are injurious* [such as partly developed wings, which could be of no service,] I have called natural selection or survival of the fittest."—(*Origin of Species*, p. 63.)

The movement of any body through the air which is many times its specific gravity is utterly *unnatural*, and opposed to every law or principle of evolution as expounded by Mr. Darwin above. Such a mode of locomotion as the movement of a body through the atmosphere having a thousand times its weight, *being absolutely opposed to Nature, is, therefore, in its original design and construction, supernatural!* Being supernatural, and depending for its accomplishment on the combination of numerous mechanical devices and principles, in opposition to the laws of Nature, and embracing the highest elements and faculties of reason, it amounts to an absolute demonstration that the first wings were constructed and adapted to their use by an intelligent Creative Will!

Evolutionists often ask their opponents to produce a miracle. I assert that birds, bats, and insects, are perpetual and unmistakable miracles, at least in their primal origin, according to the intrinsic definition of the word. Our dictionaries define a miracle to be *a supernatural event—an occurrence contrary to the established laws of Nature*. The flying of a bird, a thousand times heavier than the air, is a purely mechanical process,—an operation of the very highest order of intelligent skill,—and is accomplished in violation of the central law of Nature—*gravitation*. There is no part of the process of flying but what is or must have been in its primordial commencement a miraculous operation, since all its mechanical results come from the intelligent use of one law of Nature by which to overcome another, and are therefore supernatural events.

Thus, evolutionists have the indisputable proof of *bona fide* miracles all around them all the time; while the inventor who shall in the future construct an apparatus by which a man may fly through the air by the mechanical aid of wings alone, operated by his own individual strength, will have wrought a new miracle in mechanics, and one of the greatest since the world began. Such a supernatural event I believe not only possible but probable, and in strict accord with the rapidly advancing triumphs of human skill in employing one set of Nature's laws to overcome and render subservient another set.

While the assumption here maintained (that the incipient structure or unuseful stage of a bird's wing, if developed at all, could not have been produced by natural selection), would seem an almost self-evident proposition, I will add a few remarks and quotations which will prevent the most casual reader from losing the annihilating force of this single argument.

I have already shown from Mr. Darwin, as just quoted, that natural selection can not *induce* a single variation, much less a whole organ,—that it can "*only*" save by survival of the fittest those slight variations which happen to "*arise*" and are "*beneficial*" to the creature. As shown in the preceding chapter, Mr. Darwin lays it down as a law of evolution, that natural selection can not advance by *sudden leaps*, but must proceed by means of *short and slow steps*. I will add here a citation or two:

"Natural selection *acts only* by taking advantage of *slight successive variations;* she can never take a *great and sudden leap* [such as producing an efficient *wing*], but must advance by *short and sure though slow steps*."

"Natural selection is a *slow process*, and the same favorable conditions must long endure in order that any marked effect should thus be produced."

"As natural selection *acts solely* by accumulating *slight successive favorable variations*, it can produce no *great sudden modifications* [such as a useful wing]; it can *act only by short and slow steps*."

"Natural selection *acts exclusively* by the preservation and accumulation of variations which are *beneficial*."—DARWIN, *Origin of Species*, pp. 97, 156, 180, 413.

The reader can not misunderstand this language. A wing of a bird has a score or more of distinct, ingenious,

but co-ordinated parts and devices, each of which is essential to make it useful, the whole showing unmistakably the work of the highest order of intellectual skill and designing capability. Such a complex and perfect organ could not have come by chance as a monstrosity or a single spontaneous variation. It could not have been produced by evolution, for natural selection makes no "sudden leaps" nor saves any such monstrosities should they occur, since it "acts solely by accumulating *slight* successive favorable variations," and "can act *only* by *short* and *slow steps*." As if to impress it on the reader's mind, Mr. Darwin takes pains to show that monstrosities, should they occur in a species, can not be saved by natural selection, but will soon be lost and obliterated by intercrossing with the normal individuals. (See pages 212, 213, of this book.) He also adds:

"We have abundant evidence of the constant occurrence under Nature of *slight individual differences* of the most diversified kinds; and thus we are led to conclude that species have generally originated by the natural selection, *not of abrupt modifications*, but of *extremely slight differences*."—*Animals and Plants*, vol. ii., p. 495.

Here, then, we have the demonstration, so completely established by Mr. Darwin himself that there is no evading or misunderstanding it, as follows: The wing of the first bird in its incipient stages, if it came by "short and slow steps" at all, would have been wholly useless, and not only useless but absolutely injurious during numberless generations of incipiency, for reasons given. As "natural selection acts *exclusively* by the preservation and accumulation of variations which are *beneficial*" and "the *destruction* of those which are injurious," it could have done nothing toward developing the first pair of perfect wings, since it could not *touch* them till they were already sufficiently developed to be *useful*, except to destroy them as "injurious" appendages! Hence, here is one complex organ, in tens of thousands of forms, which is outside of the operations of evolution, and must therefore inevitably be relegated to the intelligent workings of the Creative Will. Can anything more clearly be demonstrated?

How completely, then, does Mr. Darwin's theory again "break down" by his own definite stipulation, already quoted. Here it is reproduced, that the reader may not lose the benefit of the edifying lesson which it inculcates:

"If it could be demonstrated that any *complex organ* [such as the wing of a bird] existed, which could not possibly have been formed by numerous successive slight modifications, *my theory would absolutely break down*."—DARWIN, *Origin of Species*, p. 146.

The *demonstration* is "absolutely" complete, since it is in Mr. Darwin's own very concise and unmistakable language. Not only have we "demonstrated" a single "complex organ"—all he stipulates—which could not "possibly" have been produced by "numerous successive slight modifications," but we have pointed out countless millions of them all around us in the wings of the myriad birds, bats and insects, not one of which could have been so produced, since they would have been utterly useless during all their "numerous successive slight modifications," or until they had attained functional capacity! I ask the reader, therefore, does not his theory "absolutely break down?"

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I am compelled to admire the extravagantly liberal propositions of Mr. Darwin, if I am obliged to disagree with his logic. He not only stipulates that his "theory would absolutely *break down*" if a single organ could be found which natural selection could not have developed, but he frankly declares:

"If it could be proved that *any part* of the structure of *any species* had been formed for the exclusive good of another species *it would annihilate my theory*, for such could not have been produced by natural selection."—*Origin of Species*, p. 162.

Why did Mr. Darwin carefully use the word "species" in the above stipulation instead of the word *being*? Evidently it was a matter of shrewd precaution; for, had he stipulated "any part of the structure of any *being*" "for the exclusive good of another *being*" he would have just annihilated his own theory by proving, as he did, that the *mammary glands* of every mother throughout the class of mammals are developed "exclusively," not for her own good but for the good of other beings! But as carefully as this precaution aims to guard the difficulty, it falls fatally short, for the mammary glands of the *first mammal mother* were developed (if developed at all) for the benefit of all the mammal "species" on earth, *since they all came from her by transmutation!* How much does Mr. Darwin's theory lack of being *annihilated*, then, according to his own agreement?

But there are numerous species which have parts (or *qualities*, which are the same thing), exclusively for the benefit of other species. The flavor and odor of the *ants*, which adapt them to the taste and smell of the ant-bear, can be of no service to these insects. For countless generations natural selection has kept right on cultivating the emmet, keeping up its peculiar flavor which adapted it to the peculiar appetite of the ant-eater, when, by survival of the fittest, it might have completely changed both its flavor and odor to a quality which would have disgusted its devourer.

The same is true of the peculiar flavor of the hive-bee, which adapts it to the special benefit of the *mid-wald*, a bird which feeds on nothing else. Mr. Darwin urges with all his ingenuity that the marvelous instinct of the hive-bee, as well as its remarkable structure, is the result of "numerous successive slight variations" saved up from age to age "by natural selection" for the good of this insect. Yet this "scrutinizing" law keeps right on cultivating the flavor of this insect, which it has otherwise so vastly improved, and which fits it so exactly and "exclusively" for the appetite of the midwald, since it is fair to infer, as the bees do not eat one another, their peculiar flavor must be for the special benefit of this other species, and therefore must inevitably "annihilate" his theory.

The odor of the fox's feet "is for the exclusive good of another species," the wolf or the dog, since by it the latter is enabled to run down and destroy the former on account of greater endurance. The odor of the fox is clearly, then, of no good to it, since it is the most efficient means of its destruction. That this proverbially cunning animal knows instinctively that its odor is its deadly enemy, and would, no doubt, be glad to have it abolished, if possible, is proved by its habit of "doubling" on its own track to misdirect the hounds. Yet Mr. Darwin's "scrutinizing" law of natural selection, after weeding out the foxes for ages which gave forth the strongest odor, on the principle of *survival of the fittest* or the less odorous, still continues right on cultivating this destructive quality, which can only be for the "exclusive good" of Renard's enemies! Hence by the unanimous judgment of all the foxes in Christendom and heathendom, Mr. Darwin's theory is hopelessly annihilated, according to his own stipulation!

But, then, Mr. Darwin would say, while natural selection was substituting a new *flavor* for the ant it would also have been at work on the ant-bear, changing its taste, so that in the end the ant would not have gained anything by the modification! This, however, does not quite correspond with the work of natural selection, which Mr. Darwin and Mr. Wallace so elaborately discuss, where worms and insects of various kinds are made to imitate the bark of trees, dead and green leaves, etc., all to protect them from the devouring insectiverous birds. It is remarkably strange that natural selection should have thus devoted all its attention to the form and color of worms, while neglecting the *eyes* of the birds! Had the birds' eyes been as assiduously cultivated as the color and form of these insects, their imitation of the leaves and bark of trees would have

done them no manner of good, and the mimicry would have consequently been abandoned in its incipiency.

This stupid performance of nature is also illustrated by the *mane of the lion*, which, Mr. Darwin gives it as his learned opinion, was developed by selection to protect his neck from the teeth of other lions and the teeth and claws of tigers! But it seems singular that the teeth of the tiger were completely neglected by natural selection, while taking the particular pains to produce such an enormous growth of hair as a protection for the lion! If natural selection devotes such careful attention to worms and insects, it might show a little regard for the tiger's teeth, and at least cause them to keep pace with the hair on a lion's neck.

But is not Mr. Darwin slightly mistaken? The tiger finds the lion's matted mane an excellent foundation into which it fastens its teeth and fore-claws while using its hind-claws in fearful lancination upon the loins and hips of the lion, where natural selection has wholly neglected to provide a suitable protection! I think the lion can justly enter his stentorian protest against Mr. Darwin's "scrutinizing" law, as a great scientific humbug in furnishing him with a matted mane for the particular advantage of the tiger to cling to while unmercifully raking his hinder parts, where there is no protecting hair! And while protesting, he should petition natural selection to show a little discrimination and remove the useless bunch of hair from the end of his *tail* (the same as that of his *mane*, precisely,) and distribute it over his hips!

Elephants in some parts of India, Mr. Darwin says, were gradually destroyed by insects which bored into their backs. Now this is attributable wholly to the inexcusable neglect of natural selection in not covering the backs of those princely beasts with a protection like the lion's mane! That Mr. Darwin's great and "scrutinizing" law could have done this, and thus have saved these pachydermatous proboscidians of the jungle from such contemptible enemies as gadflies is clearly evident, after having stretched the same animal's nose five feet long for the primitive purpose, as supposed, of smelling at a distance!

If there is the least truth in natural selection having elongated the neck of the giraffe just to enable it to browse off the limbs of the acacia, as Mr. Darwin insists, rather than to change its mode of living, and cultivate in it a taste and habit like those of its sensible neighbor the eland, there would have been surely no trouble in evolving a carapace for the back of the elephant as impenetrable as that of the tortoise, or else in extending its trunk till it would reach clear around it! Pshaw! This whole business of natural selection, judging it by its bungling operations, is an unmitigated fraud on the brute creation. While it can industriously build up a mane on the lion's neck, it leaves its loins at the mercy of the tiger and protects the end of its tail! While it allows certain insects to bore into the elephant's back for the want of a coat of hair half as dense as that of the lion's mane, it changes other insects into forms and colors to protect them from the hungry birds, at the same time totally neglecting the birds' eyesight. It stretches the complicated neck of the giraffe, with all its important vital organs, such as vertebra, thyroid cartilage, larynx, trachea, tongue, œsophagus, with the numerous arteries, ligaments, and muscles involved, to enable it to reach the branches of trees, when by simply stretching its nose as it did in the case of the elephant, it could have reached much higher branches and stood square on its feet! Inconsistency, thy name is evolution!

The hive-bee is another example of the infamous unfairness of natural selection. While this most valuable and intelligent of all insects has its defensive weapon so awkwardly constructed by Darwin's "scrutinizing" law that it is compelled to commit suicide by pulling out its barbed sting whenever it defends itself from an enemy, all other bees, such as wasps, hornets, bumble-bees, etc., worthless and uncivilized in habit, can sting *ad libitum* without doing the least damage to their own mechanically constructed weapon. And, further, while the bumble-bee has a proboscis sufficiently long to suck red clover and extract its precious stores of delicious nectar which hive-bees so dearly love (as proved by their sucking at broken corollas), the proboscides of the latter have been neglected for ages by natural selection, when the sixteenth of an inch added would have opened up to these deserving little geometricians untold wealth of honey. Yet a worthless moth, Mr. Darwin assures us, has had its proboscis extended by natural selection *four inches in length*, simply to adapt it to sucking the nectar from a single bell-shaped flower! Just a hundredth part of this development added to the hive-bee's proboscis would have enabled it to suck the red clover, and thus compete with its big, awkward cousin, etc., etc., etc.

A TWO-FOLD QUESTION ANSWERED.

BY J. I. SWANDER, D. D., PH.D.

The following letter is evidence that its author is not afflicted with mental indolence. It testifies to his desire and determination to seek the truth wherever found. If there be any gospel in babbling brooks, any homilies in trees, or any sermons in rocks, he is laudably disposed to secure all the benefit they afford, even though he should be obliged to hew his way into the pyramids, or climb those "mystic obelisks" from whose heights "forty centuries look down" upon him:

WINNIPEG, Canada, June 30, 1891.

REV. J. I. SWANDER, Fremont, Ohio.

Dear Sir,—I am sorry I can not have "The Invisible World" before August. Its arrival will, however, be patiently waited for. May I intrude upon your time to secure your ideas and conclusions regarding the "Great Egyptian Pyramid?" Was it built under Divine direction and so constructed as to reveal in due time the mysteries and solve the problem of the future existence of mankind? If this is not explained in your book, I would be pleased to have your opinion, even in a condensed form.

Yours respectfully,

C. H. FLEMING.

It is assumed that Mr. Fleming's question concerning the "Great Egyptian Pyramid," has reference to "Cheops," visible from the city of Cairo. This pyramid, it is thought, was begun about 2,700 years B. C., under the reign of Chufu or Cheops. It covers an area of not less than twelve acres. Its masonry consists of stones cemented with lime. The height is about 450 feet. Like the other pyramids of Egypt, its four sides are directly toward the cardinal points. Much is conjectured and little is known of its contents. Exploring parties have found sepulchral chambers, and it is supposed that there are many undiscovered apartments nearer the center, some of which, it is thought, will in the course of time be compelled to yield important information concerning the early history of the human race and possibly some hitherto unrevealed purpose of God respecting "the problem of the future existence of mankind."

We have no hesitancy in giving an affirmative answer to the first part of Mr. Fleming's question. The pyramids were all built under Divine direction. Distinction must, however, be made between the general orderings of Providence whereby He upholds and governs

all things, and those more special acts of Divine direction in the sphere of grace and redemption in which He makes known his ways unto Moses, declares His purposes to those who allow themselves to be brought within His covenant, and reveals His secrets to them that fear him.—Psa. xxv. 14. In other words, God's providence of divine direction is co-extensive with creation, while His revelation of His grand purpose concerning man is measured by man's capacity to receive and his need for the bestowment of such benefit in order to the recovery of his lost dignity and the attainment of his true destiny.

Mr. Fleming also asks whether the Great Egyptian Pyramid was "so constructed as to reveal in due time the mysteries, and solve the problem of the future existence of mankind?" Our answer is that any discovery of record in stone can never be more than confirmatory of revelation proper. He is correct in his tacit assumption that man will yet come to a full knowledge of God's revelation, which revelation must include the key to a proper knowledge of man's "future existence;" but in our view he is mistaken in supposing that God will ever make an important revelation to man outside of man. He has not done so in the past. The knowledge which man most needs of God and of himself can never come through "scarped cliff and quarried stone." Moses undertook to bring it on stone from the "scarped cliff of Sinai," but the tablets were soon dashed to pieces by the righteous indignation which human idolatry had provoked. Even when the revelation was recorded on stone by the finger of God, it "could not make the comers thereunto perfect" in a clear knowledge of their "future existence." And if "mankind" had never been furnished with knowledge of its future existence until it could have been supplied from the charnel-house of desiccated royalty, supposed to be stored away in the "Great Egyptian Pyramid," it would have been doomed to continue as ignorant of the past, present and future as the Arabs that still grope their way through moral darkness in the land of Ham.

Manifestly it was a part of God's great plan of the universe from the beginning to reveal Himself to man *in* man; and it was in the very nature of both God and man and their relation to each other that such revelation could and should complete itself in man's completeness. Indeed, it is not possible for man to conceive how God could have made such revelation complete in any other way. And any revelation from heaven in strictly some other form, even if it were possible, would be of no benefit to man because he could not receive it. It would prove a complete failure as regards its only conceivable object. Man's constitution requires that God's law should be written upon the tablets of his heart—that is, organically interwoven with the very fibers of his moral nature—before it could have for him any beneficial force as "the law of the spirit of life." What effect could a mere outward declaration of purpose or proclamation of abstract truth have in the way of enabling man to "solve the problem of his future existence?" If all the pyramids of Egypt and all the "scarped cliffs and quarried stone" in the everlasting hills were literally covered with precepts and promises from the skies, they would, as such mere outward manifestation, contain no beneficial information for man. The information that benefits an ethical being must be *in*formed. God's movement manward not only always assumes the possibility of man's responsive movement Godward, but also enables that possibility to actualize itself in such Godward and heavenward movement. In this way, in the realm of the spiritual, *information* becomes inspiration. Just as the Eternal Word (Logos) by His entrance into the substance and under the law of humanity opened up a source and channel of life to the race, so does the word revealing itself through the inspiring power of the Divine Spirit and under "Divine direction" accomplish that whereto it is sent (Isaiah lv. 11) by entering into and quickening the receptivity and apprehension of the human spirit. This organic contact of the Divine with the human produces inspiration and gives inerrancy to the fruit of such holy wedlock.

Moreover, revelation can have no reality and force for man except as it has its absoluteness of character in the person of the Christ. He is the embodiment of Divine manifestation and the fountain of all inspiration, the unity of which are essential to the completeness of revelation. The Bible is better than the "Great Pyramid" because "in the volume of the book it is written of Him;" and men are benefited in the reading of the Bible only as they are thus led to exclaim: "We have found the Messias!" In Him are *all* the treasures of wisdom and knowledge hidden.—Col. ii. 2. See Chapter I of our "Invisible World." Man is not the mere audience *to* whom, but also the organ *through* whom, God manifests himself: and such manifestation of God to and through man can never be correctly considered, except as something inseparably connected with *the manifestation of man to himself.* The light of this last mentioned fact seems not to have shined above the horizon of Canadian theology when brother Fleming inquired at the base of the Great Pyramid for a solution of "the problem of the future existence of mankind."

The mission of the pyramids is to demonstrate through all the ages that mere matter can not be inspired, and that that which is not inspirable can never serve the purpose of a living oracle to creatures who hold their proper being in their Maker's image. The Bible is the Word of God because it contains more than material, paper and printer's ink—more than the human factors that enter into its constitution. Its essential contents are in the realm of the invisible world; and the Scriptures are "profitable for instruction" because, thereby, the invisible is united with the visible in the intellectual and ethical nature of man. Thus holy men wrote as they were moved by the Holy Ghost, yet in such way as seemed good both to the Holy Ghost and to them. Thus, too, the Scriptures were given to man through man, and even they contain no saving revelation to individual men who, in the reading thereof, do not become so inspired as to be able to look behind the letter and the material to see the invisible, spiritual and immaterial contents which alone can make the soul alive to that whole world of sublime realities, of which man can have no true knowledge through the monuments of benighted antiquity and the mummy-pits of the Orient.

Fremont, Ohio.

☞ See the last page of this number for valuable testimonials concerning the treatment unfolded in Dr. Hall's Health Pamphlet.

THEOSOPHY UNDER A CLOUD.

BY THE EDITOR.

The recent death of Madame Blavatsky has cast a very dense and sombrous cloud over the hopes and pretensions of theosophs both in this country and Europe. She had been regarded for many years as not only the priestess *par excellence* of that strange order of mystics, but as having so thoroughly drank at the fountain of perpetual youth as practically to have escaped the power of death.

Indeed, many theosophists, some of whom have personally so informed us, regarded her as already several hundred years old though appearing to be only forty or fifty. To such extent had this sentiment prevailed that on the announcement of her death a few months ago, her followers here and in England denounced the story as a false and malicious slander, and as only one of the many methods by which the uninitiated have sought to obstruct the onward march of that revolutionary philosophy.

Her obsequies, however, in which the leading theosophists of both hemispheres took solemn and sorrowful part, soon dispelled the hope that she was only in one of her trances, while her astral body was in secret communion with the fathers of that mystic lore amid the fastnesses of the mountains of Thibet, or taking new draughts of the sacred elixir of life from the invisible fountain which pours down at one of the gates of Lassa.

Still, so deeply grounded are its disciples in the truth of this mysterious system of belief, that the death even of the high priestess was easily construed as a taking off essential to the spread of the cause by necessitating the selection and consecration of her successor against whom less prejudice would be found to exist.

It has been published and proved by the most startling evidence that the pretended communications which Madame Blavatsky claimed to have received in India, from the sacred Mahatmas, and which were given to the world as veritable revelations from pure astral realms, came alone from the trickery of prestidigitation, conveyed in strangely constructed envelopes, and dropped through a hole in the roof of the rude temple after being suspended on nothing, as it were, by means of a silk fiber so small as to be invisible in the tenebrous shadows of that occult lodge where the theosophic god was supposed to work his wonders.

These proven facts, of course denied by her followers, made another high priestess necessary by which to give a new impetus to the cause which had come into such bad repute by the legerdemain so unfortunately thus exposed. The new honors seem to have fallen by common consent to the lot of Madame Annie Besant of London, the famous associate of Charles Bradlaugh, and who recently gave a series of very thoughtful and interesting lectures in New York and Brooklyn on "Darkest England" and other highly practical subjects.

It is now announced that the mantle of Madame Blavatsky has authoritatively and miraculously fallen upon the shoulders of Mrs. Besant, who had not only become a recent convert to theosophy from the actual teaching of the departed priestess, but had also become her loyal co-worker and fast personal friend.

From reliable reports of interviews printed in the London papers, Mrs. Besant unhesitatingly declares in her outspoken and level-headed manner, that she has received direct communication by astral message from the secret chambers where theosophic sages meet in the mystic caves of Thibet and India. She denies, of course, any collusion or deception on her part, and insists in the most positive manner that these communications from the Mahatmas are dictated by pure and occult heirophantic inspiration.

She modestly but firmly repudiates the idea that this mission is of her own seeking, and asserts that she only accepts the responsibility of the sacred office ultimately to vindicate the character and memory of her teacher—Madame Blavatsky. She intends to show when the time comes, as she now proclaims to the world, that her great mentor was an honest but greatly reviled woman; and that exactly similar messages to those she published to the world have reached her own hands from Thibet in care of astral messengers traveling at the rate of more than a thousand miles a second.

Why should not this system of psychical rapid transit be all that it is represented to be by the newly consecrated priestess, if the central tenet of the philosophy of occultism be true, that a full-fledged and rounded-out theosophist is able to project his or her entire astral body from here to Madras in the tick of a quarter-second stop-watch? A sealed letter from the chief *Mahatma*, inclosing a drop of the oil of gladness that confers perpetual juvenility, surely ought to travel with the same facility as that of a woman's better half of herself—her whole astral body.

The truth is, those who personally know Mrs. Besant and are aware of her sterling honesty, are amazed at the positive manner in which she affirms her actually having received these communications, and her reiterated averment that they are actually authentic documents from the theosophic junta of Thibet. In fact, all England is just now excitedly discussing the case and awaiting her departure for India with no little anxiety when, after receiving her formal annointing with the immortal elixir, she promises at once to return to the appointed custodians of theosophic wisdom in this country and England verified copies of the messages she has just received from the Mahatmas by hierophantic telegraph.

That Mrs. Besant is sincere in her strange and sudden departure for India and Thibet, none who know her can entertain a doubt, as it seems to involve the total abandonment of her great scheme of circulating her *Malthusian* work which must soon have yielded her a fortune, and which no one else can push as could its author. Let us wait patiently for her arrival in India and the return of the astral messages which shall reveal the secret of her very singular change of base.

A NEW TELEPHONE.

We have just had our attention called to a new electric telephone which, for the first time, steers clear of Prof. Bell's patent. For years—nearly ever since the Bell Company has been organized—numerous parties have started telephone companies hoping not to encroach upon Bell's rights, but invariably the Courts have stopped them. Bell's invention, as finally decided by the United States Supreme Court, consists of an undulatory current over a closed or unbroken circuit. But the new telephone, to our certain knowledge, permits conversation over a wire cut in a dozen places! "There are millions in it," and what is better, the MICROCOSM hopes to have a slice of this wonderfully fat discovery.

A PHYSIOLOGICAL AND ANATOMICAL PROBLEM.

Valuable Premiums Offered.

BY THE EDITOR.

It is well known that the red-blood corpuscles are essential to the vitality of the human organism, and that they are visible under the microscope in the blood taken from any part of the body,—whether that blood be arterial or venal.

It is further known that the blood passes from the heart through the arterial system to the uttermost extremities of the organism, where the arteries become so small, according to Dunglison, as to be absolutely invisible under the most powerful microscope, and where they connect, notwithstanding, with the veins alike invisible for returning the blood to the heart.

Now the problem, which has hitherto defied all explanation, is: how is it possible for these corpuscles, always visible in blood under a powerful microscope, so to diminish as absolutely to disappear at the termination of the arteries and then reappear shortly after passing to the veins, while in passing the hiatus which separates the arterial and venal systems neither the corpuscles nor the vessels which convey them are visible under the most powerful glasses?

We solicit attempts at solving this problem from the medical profession and others throughout the world, to be presented in short and concisely written explanations, the best of which we propose to print in the MICROCOSM, after which we shall probably submit an original explanation of our own for what it is worth.

Remember that the blood, the corpuscles and the vascular system which carries them absolutely disappear from view at the termination of the arteries and reappear at the beginning of the veins, with no visible connection or even apparent existence between the two systems. What becomes of the corpuscles, the blood, or even the vessels which convey it across this separating chasm?

We now offer as a premium for the best ten explanations of this mystery—embracing not more than 200 words each—ten copies of *The Problem of Human Life* (by the Editor), handsomely and substantially bound in cloth. In addition to this we will give a cash prize of $20 to the writer whose explanation is deemed most satisfactory by the judges.

The merits of the various articles will be determined by a committee of three physicians of this city. No one is barred from this competition. (See extract from the *Problem of Human Life* in our first article.)

ISAAC HOFFER ON SOCIALISM.

Of all the quiet annihilations of a doctrine, claiming to be based on reason, we have ever seen or read, the article of Isaac Hoffer, crushing the very life out of modern socialism takes the lead. We beg of every reader of the MICROCOSM to study this article, and if he knows of a socialistic or anarchistic man or woman, ask him or her to read the article.

THOS. MUNNELL.

The undulatory theory of light is the eldest daughter of the wave-theory of sound, and was invented by Huygens to explain light on the same principle universally accepted in the case of sound. The arguments against the wave-theory of sound are almost innumerable, as this journal will show, but here comes Dr. Munnell with an argument, entirely new, against the wave-theory of light, based on the spectroscope. No reader should fail to study this argument.

THEORETICAL AND NATURAL SOCIALISM.

BY ISAAC HOFFER.

The foundation of theoretical socialism is that all property should be held in common, under government control, for the common use and benefit of the whole people.

This state of society would necessitate an equitable enforcement of labor and an equitable distribution of its products. It needs no argument to show how utterly impossible it would be to enforce labor so that each person would do his or her fair proportion, or to divide the products equitably and to the satisfaction of all. But even if an equitable enforcement of labor would be possible, the very idea of being *forced* to work contains the thought of slavery, and is repugnant to the God-like and irrepressible sense of freedom inherent in man, and in conflict with the inalienable right of life, liberty and the pursuit of happiness. Equally humiliating and degrading is the idea of having doled out to you your allowance out of the common stock.

The worst and most intolerable feature of this theoretical socialism would be the army of officials required to carry it out. In every field and workshop officers would have to be stationed to see that all performed their fair share of labor, and to bring to punishment those who would fail to come up to the standard required; and there would have to be a system of distribution, and officers to see that the distributions were fairly made. These officers would have to be paid, they would be an additional expense, they would not likely be all faultless—some might be insolent, partial, unfair or dishonest, and instead of this system bringing heaven down to the earth, it would bring something else up from a lower region.

As long as human nature is the same as it is now and always has been, pure co-operation—holding every thing in common and living out of a common fund—is impossible. It has often been tried by small communities where all believed in it and entered into it voluntarily, often under the belief that it was the best, if

not the only, way of living a truly Christian life; and almost invariably these communities have sooner or later come to inglorious ends. In some cases a few sharper than the rest got hold or control of the bulk of the property and the mass were frozen out, or contentions broke up the colony. In other cases they remained a close and exclusive community until the majority had died, and the few remaining had all the property. Ruin to all or wealth for the few has been the general, if not the universal, outcome of all these communistic settlements.

The socialism that yearns for a paternal government which would take the position of father and treat the people as its children, worships a social picture which has no existence in adult life outside of the parents of helpless children; and even there undisputed control and helpless obedience are the essentials of social peace and order. Among adult people with equal rights and equal duties a parental form of control is entirely out of place, and a childish submission a most improbable condition. A parental government, whether autocratic, monarchial, or republican, if administered by angels and for angels would be all right; but administered by men and for men with human nature uppermost in nearly all, and being necessarily constituted of rulers and of ruled requiring parental control and childlike obedience, it needs no prophet to see that the government would not be any better than it is now, for a change in the form of government does not change human nature; and there would be many more causes of discontent among the governed, because then the people would be dependent upon the government instead of themselves as they are now, and it is but natural that a man would not quarrel with himself so readily, as he would with others, in the control of his own affairs.

The fancied army of laborers all striving to outdo each other in working for the good of the common brotherhood of man; and the vision of a fatherly government liberally distributing among all the good things of this world from an abundant supply, which this army of labor has produced, is so very nice that it is a pity to permit the truth of actual experience to destroy the illusion. But we all know from experience that human nature is averse to doing more work for the public good than is necessary, and that what is everybody's business is left by each for the others to do.

The disposition to look upon public property by each individual as partly his own, and to make sure of getting his full share, and to get the most for the least labor, would be just as strong under this fancied Utobia as it is now, and there would be just as many worthless and wicked people as there are now, because the field for mal-administration would be greatly enlarged, and for "dead-beating," thieving, deception and fraud it would not be diminished.

Human nature is fundamentally selfish. Its first law is the law of self-preservation, and this world is a world of growth and improvement; and the hope of a universal change of that nature in *this* world is doomed to certain disappointment, for if man could be changed to an angel in this life there would be no use for this world of experimental struggling, where man must learn justice by suffering injustice, must learn right by meeting wrong, must learn what is good by feeling and seeing the effects of evil, and must acquire knowledge and wisdom in lessons of ignorance and folly.

The fatal mistake of the socialism of the present day is, that it holds public demands above individual rights, and accepts the old law "that the welfare of the people is the supreme law of the land" without limitation, or without properly defined and fixed construction. This law is the power by which the people of many nations have been sorely oppressed and cruelly robbed. By giving it a construction that the government is the conservator of the public welfare and must enforce this law for the public good, men in the control of the government have made the interests of the governing classes the public good, and oppressed and robbed the people for the benefit of the ruling classes, or for the glory of a great nation and a powerful government; and it is in this trap that modern socialism is trying to put its foot.

The people of this country have learned during Colonial times the wrongs that were committed under the sanction of this law, and, therefore, limited it to a just construction by a provision in the constitution of the United States, "that private property shall not be taken for public use without just compensation." This law—that "the welfare of the people is the supreme law of the land"—properly construed and carried out, is just and right, but like every other good thing, when perverted, misapplied, or improperly used, becomes a wrong and an evil.

The individuals of a country are the people of that country, and the public is constituted of individuals; and the rights and welfare of the individual are the rights and welfare of the people and of the public, and any wrong committed against an individual is a wrong which affects the public, for if wrongs can be committed against individuals a part of the public can be wronged and no part of the public is protected.

Natural socialism accepts the fact that individuals constitute the public and are the foundation and material of the social fabric, and that the first and all important object of social organization is to preserve and protect the individual rights of life, liberty and property. Men can not be merged into a mass where the conscious self loses sight of its individual wants and desires, or of its sense of right and wrong, and, therefore, no social organization, that ignores these facts and neglects to protect the rights of the individual, can stand.

Natural socialism, therefore, makes the protection of the individual rights of life, liberty and property the basis of all social organizations, and embodies the same in all its laws for the regulation of the affairs between man and man. All civil, social and industrial relations must be regulated by rules and laws which apply to the individual. Unfortunately human laws to be protective of what is right and good must be repressive of what is wrong and evil, and therefore necessarily lead to conflicts under any social system, and create discontent and dissatisfaction, no matter how just and perfect the laws may be. But where the rights of each individual are protected, where the earnings of his labor are his own, and where he knows that his welfare is in his own hands, secured to him by the fundamental law of the land, he feels that he is a free agent and a man as the God of Nature has made him, and not a part of an aggregation where his rights and interests are mixed up with others' rights and in-

terest, their value averaged with that of others, and their identity destroyed.

Conscious of an irrepressible instinct of self-preservation, and an inherent right to live and to act for himself, and with a natural disposition to be a free man and have exclusive control of what his needs and desires demand, his whole nature rebels against a power that would take the place of his individuality, that would undertake to direct his actions and control the supply of his wants and desires. The man must be an utterly helpless case who would not trust himself with his own good better than he would the conclusions drawn from the conflicting views and interests of an association or a legislature.

A government that guarantees the greatest liberty to the individual, social, civil and industrial, consistent with social order and equity, and interferes the least with private affairs, is a government of the people and for the people, and is undoubtedly the best form of government, and the only form in accord with the natural laws of human life. It is based on the individual consent of the governed, is a government representative of the people, and is good or bad, in its laws, and in its administration, just in proportion as the people are good or bad and intelligent or ignorant. It should not be forgotten that the people make the government and not the government the people.

If every person would always do unto others as he would like others to do unto him, then every individual would be a law unto himself, and there would be no necessity for any other laws nor for a government to protect right and punish wrong. Then the destructive competition in business, the oppression of the weak by the strong, the poor by the rich, and the conflicts between all classes and conditions of people would cease, and a heavenly condition of life would be made possible on earth.

There is the great field for reform and for *universal* effort, here is the place to commence the formation of a heavenly utopia by educating the individual to understand *himself* and his true relation to his fellow-man; by simplifying the laws of equity and illustrating their inestimable beauty and value through their faithful observance; by showing the advantage of social organization and united effort in kindly assistance and forbearance, and of a fair distribution of the benefits and burdens which such organization and effort offers and imposes; and by a ceaseless effort of each individual to change and reform his own selfish nature into an unselfish one instead of wasting his efforts in working out a regeneration in others. Association and legislation can not change the selfishness of human nature. Among the twelve select Apostles there was one a Judas and one a coward that denied his membership; and so long as this selfishness is not cut off in each individual and unselfishness—heavenly righteousness—engrafted in its place, will the evils which afflict society remain in some form, no matter what kind of government or what kind of social system may prevail. The best kind of cultivation, and the most careful pruning, can not make a crab-apple tree produce baldwins, unless the crab is cut off and the baldwin grafted on.

Lebanon, Pa.

☞The next number (Nov.) closes this volume. No subscriber need wait till the volume closes to send on his renewal, but can remit at once.

(Continued from page 141.)

THE WAVE THEORY OF ACOUSTICS.*

BY GEORGE ASHDOWN AUDSLEY, F.R.I.B.A.

Gentlemen, I am afraid I weary you with this long dissertation on the Locust Argument, but I have still a few remarks to make on the subject before I enter on the concluding portion of my paper.

Now, by way of introduction to the next amusing matter I am going to treat of, let me quote a passage from "Sound," the work by Professor Alfred Mayer, America's greatest wave-theorist. He says: "Sound is the sensation peculiar to the ear. This sensation is caused by rapidly succeeding to-and-fro motions of the air which touches the outside surface of the drum-skin of the ear. These to-and-fro motions may be given to the air by a distant body, like the string of a violin. * * * These tremors of the air, however, are not sound, but the cause of sound. Sound, as we have said, is a *sensation*, but, as the cause of this sensation is always vibration, we call those vibrations which give this sensation sonorous *vibrations*. Thus, if we examine attentively the vibrating string of the violin, we shall see that it looks like a shadowy spindle, showing that the string swings quickly to and fro; but on closing the ears, the sensation of sound disappears, and there remains to us only the sight of the quick-to-and-fro motion which, the moment before, caused the sound."

I might occupy you for a whole evening in discussing and showing you the absolute absurdity of this sapient teaching that sound is merely a *sensation*, but that was not the aim I had in view in making the quotation. It was merely to clearly put before you the teaching of the wave-theorists on the mechanical action of the sound-waves on the drum-skin of the ear.

Turning to the pages of "Sound," by our own great wave-theorist, Professor Tyndall, we find this exposition. "Applying a flame to a small collodion balloon which contains a mixture of oxygen and hydrogen, the gases explode, and every ear in this room is conscious of a shock, which we name a sound. How was this shock transmitted from the balloon to our organs of hearing? * * * The process was this:—When the flame touched the mixed gases they combined chemically, and their union was accompanied by the development of intense heat. The heated air expanded suddenly, facing the surrounding air violently away on all sides. This motion of the air close to the balloon was rapidly imparted to that a little further off, the air first set in motion coming at the same time to rest. The air, at a little distance, passed its motion on to the air at a greater distance, and came also in its turn to rest. Thus each shell of air, if I may use the term, surrounding the balloon took up the motion of the shell next preceding, and transmitted it to the next succeeding shell, the motion being thus propagated as a *pulse* or *wave* through the air." * * * Thus "is sound conveyed from layer to layer through the air. The air which fills the external cavity of the ear is finally driven against *the tympanic membrane*, which is stretched across the passage leading from the external air towards the brain. The *vibrations of this membrane*, which

*A Paper read before the Members of the South Eastern Section November 8th, 1890.

closes outwardly the 'drum' of the ear, are transmitted through a series of bones to another membrane, which closes the drum inwardly, thence through water to the ends of the auditory nerve, and afterwards along that nerve to the brain. Here the physical becomes psychical, mechanical vibrations giving birth to the consciousness of sound."

Now, gentlemen, nothing can be clearer than this teaching on both sides of the Atlantic; and so let us see what its true result according to the locust argument is.

Let us do a little quiet calculation and arrive at some results. As it is certain that the sound of the locust can be heard more than a mile distance, and that in any directon, by any single ear, it is equally certain that it could be heard by any number of ears placed close together at that distance. Now, allowing that a human head, with an ear turned towards the source of the sound, occupied every half square foot of the outer surface of the four cubic miles (not including the four square miles along the ground of course), we should have no fewer than *six hundred and sixty-nine millions, eighty-one thousand, six hundred* of tympanic membranes to shake, with all their systems of bones, etc., in and out 900 times in a second by the sound-waves sent off from the locust a mile away. The weight of a drum-skin has been found to be about half-a-grain; so the stridulating locust has simply to shake "to and fro" 25 tons, 18 cwt., and 64 lbs. of solid tendinous matter 900 times a second for about a minute at a time. But this is a mild calculation to some which have been advanced on this subject. Here is what a writer on the new Theory of Sound says:—"The shaking of *twenty million tons* of suspended air particles by this insect, and alternately squeezing them into 'condensations and rarefactions' 440 [900] times a second, is but a bagatelle compared to what the locust has to do, if the wave-theory be correct. According to that theory we can only hear sound by our tympanic membrane bending 'once in and once out as each sound-wave strikes it,' as Prof. Tyndall and all authorities on the subject teach. This membrane is constituted of *solid tendinous matter*, each membrane weighing in air half a grain by actual test. Now, as the sound of the insect could be heard, if an ear were present, at every point of air throughout the four cubic miles large enough to contain such a membrane, it demonstrates, if the wave-theory be true, that every such point of air is actually condensed and shaken by the strength of the insect, in addition to its displacement, with a mechanical force sufficient to 'bend in and out' a solid membrane weighing half-a-grain [to say nothing of the resistance it offers by its stated stretched condition], *whether or not such membrane be present.* Hence, as a cubic quarter inch of air gives sufficient room for such a membrane to vibrate in freely, we fairly estimate each such block of air as the exact equivalent of the mechanical displacing force of *one-half grain of solid matter*, or thirty-two grains to the cubic inch of air. No mathematical reasoner will doubt the fairness and correctness of this estimate, for plainly, if we only hear sound by our 'drum-skin' shaking, then every point of air filled with the sound, large enough for such a drum-skin to vibrate in, *must be estimated as the exact equivalent of the shaking of such a drum-skin whether present or not.* Then by simply multiplying the easily ascertained number of cubic inches in the four cubic miles of air (in round numbers *one thousand million million*), by thirty-two grains of solid matter, we have in round numbers *two thousand million tons* of such drum-skins that the locust has to 'bend in and out,' overcoming their inertia 440 [900] times a second, or in other words, it has to exert that equivalent of mechanical force if the wave-theory be true. This is *solid* scientific and mathematical truth, and no man can get over it but by denying tympanic vibration as the mode of hearing sound, which is to deny the wave-theory altogether as that is the very basis of the received doctrine of acoustics. Is it possible for a theory to be true which involves such a monstrous impossibility as this? —such an almost infinite task for a trifling insect to perform? Yet that theory with this absurdity loading it down, is taught in all our schools and colleges as true science."

The same scientist puts the matter in a milder and perhaps more intelligible form. Alluding to Professor Mayer's remarks on the action of the violin, where he says:—"The air touching the violin is set trembling with 500 tremors a second, and these tremors speed with a velocity of 1,100 feet in a second in all directions through the surrounding air. They soon reach the drum-skin of the ear. The latter, being elastic, moves in and out with the air which touches it. Then this membrane in its turn pushes and pulls the three little ear-bones 500 times a second. The last bone, the little stirrup, finally receives the vibrations sent from the violin-string, and sends them into the fluid of the inner ear, where they shake the fibers of the auditory nerve 500 times." Mr. Munnell says:—"A marvelous animal this locust? Put only one ear-drum a mile away, and let the locust have a tube through which to pour all his little strength upon this single ear-drum, and let there be no 'condensations' to make on the way, outside of that tube, and let him 'shake that single ear-drum 440 times, in and out, every second,' and then 'shake' the three 'ear-bones' 440 times a second in and out, and after that 'shake' the auditory nerve fibers 440 times in a second, and the poor little fellow will soon get the shakes himself, or be converted into a regular shaker.

"But now remove the tube and let him kick at every ear-drum that could occupy its quarter of a square inch in that whole semi-orbicular shell with its radius of a mile, and you will have the most remarkable animal on earth. Jumbo would be nothing to him. Five hundred mules could not do half the kicking the wave-theorist demands of our little locust. To overcome the inertia of all this solid matter, and to move it 'to and fro' at such a rate requires 'force,' 'urging,' 'pushes and pulls' that reduce the entire wave-theory to the quintessence of absurdity."

Gentlemen, I have not half exhausted the locust argument and its fatal teaching against the wave or motion theory of sound; for instance, I have not touched the phase of the argument bearing upon the heat hypothesis advanced by Laplace to save Newton's calculations from ridicule: nor have I touched on the phase which treats of Mayer's ratio of increased density in the condensations of the sound-waves. To exhaust these two phases of the locust argument would occupy me for an hour; and so you will thank me for leaving them for some future occasion.

I shall now direct your attention to a basic law of the wave-theory, which you will agree with me is not supported by any experiment yet made, or by our every-day-experience in matters of sound. This law is commonly known as the "Law of Inverse Squares," and directly lays down, as a fact, that the intensity of any sound decreases as the *inverse square of the distance*. But do not take my word for it whilst I can give you the highest and best authority on the subject.

Professor Tyndall says:—"In the case of our exploding balloon the wave of sound expands on all sides, the motion produced by the explosion being thus diffused over a continually augmenting mass of air. It is perfectly manifest that this can not occur without an enfeeblement of the motion. Take the case of a thin shell of air with a radius of one foot, reckoned from the center of explosion. A shell of the same thickness, but of two feet radius, will contain four times the quantity of matter; if its radius be three feet, it will contain nine times the quantity of matter; if four feet, it will contain sixteen times the quantity of matter, and so on. Thus the quantity of matter set in motion *augments* as the square of the distance from the center of explosion. The intensity or loudness of sound *diminishes* in the same proportion. We express this law," continues Professor Tyndall, "by saying that the *intensity of the sound varies inversely as the square of the distance.*"

I am not aware that a mathematician or acoustician in England has ever dreamt of questioning this law as regards sound; and until the present year it has passed current in all the motion theories. It has the high-flavored scientific smack about it, and that goes a great way with people who will not calmly think for themselves, and who will not open their eyes and ears to the teaching of daily experience.

Recently, however, Prof. Silvanus Thompson let a brick fall upon the devoted head of this pet mathematical law, by stating boldly in his Contor Lectures on the Electromagnet, that it is a "fallacy" that "the attraction of an electromagnet for its armature varies inversely, as the square of its distance from the poles."

I said *devoted head*, for a whole cart-load of unmistakable bricks has been pitched on it already by Dr. Hall and other supporters of the Substantial Theory of Sound. I shall have to throw a locust at its head in a few minutes.

I do not question for a moment the fact that sound decreases in strength or loudness as the distance from its source is increased; but I dispute that under any possible conditions it decreases in accordance with the law of inverse squares. Daily experience refutes such absurd teaching; and I unhesitatingly say that no properly conducted and observed experiment ever proved the law to be correct. To the listener at a popular lecture, or to the superficial reader of text-books on sound, it may appear a reasonable law—so reasonable, indeed, that there seems no necessity to test its accuracy even with a little observation and common-sense. Have not the great scientists, who ought to know, stated the *law* to be *truth*, and is not that enough for the ordinary student and the musician? I say, a thousand times, no!

If the law is true it will, of course, stand any test. Let us try. The law says—bear in mind, gentlemen, we are discussing a basic law of the Wave-Theory of Acoustics—the law says clearly and simply that *the intensity or loudness of sound, as heard by the normal and perfectly healthy ear, diminishes as the inverse square of the distance from its center of origin.*

Professor Tyndall and other wave-theorists who profess to be profound mathematicians, assert that a shell of four feet radius contains sixteen times the quantity of matter contained in a shell of one foot radius—I admit they are correct if *surface* measurement alone is taken—and then, in application of the law, they unhesitatingly affirm that the loudness of a sound four feet from the center of origin is only one-sixteenth of the loudness it is at one foot from the center. The mind is not impressed by such small figures; and the absurdity of the whole reasoning hardly appears whilst *sixteen* bounds the calculation. Let us carry the law to something like a logical conclusion. Let us "right here," as our American cousins say, see what our little singing or screaming friend, the locust, has to tell us on the subject. You see I am not quite done with that insect yet.

The sound produced by the locust is a loud one; indeed, it would require to be so, under any law, to travel the great distance it does; but its sound is not sufficiently loud to injure the auditory nerves when the ear is held close to its source. Its pitch, about that of 900 vibrations, is not painfully acute, as you all can realize; but you may use any expression with respect to its effect on the human ear, held, say, one inch from the insect, you think proper; call it almost deafening, or even deafening, in the usual acceptance of the word, if you like; for my argument will be very little affected, if any, by the most forcible expression you can use to describe the strength of the sound at the stated distance of one inch from the locust's sound producing organ.

Now, suppose the locust to be stridulating in the center of a large, level, and perfectly unobstructed plain; in which, beyond the ground, there is absolutely nothing either to deflect or reflect its sound. In such a position the sound of the insect can be distinctly heard for more than a mile in all directions. Can you form a mental idea, from your own experience, of how much the deafening sound we have been considering could be and would be likely to be reduced in strength to be simply audible and no more? Suppose we reduce it to one-half. So reduced it would be no longer deafening or even unpleasant to the ear (bear in mind, we are speaking of the natural stridulations of a small insect weighing less than a quarter of a pennyweight). Let it be reduced to one-quarter, and surely the sound will be quite an ordinary one. Now let it be reduced to one-sixteenth of its original strength at one inch away, and you will agree with me that we are getting well on towards the *pianissimo* effect to the ear. Your own musical experience will assure you that I am correct. Now, gentlemen, how far do you think the ear has had to be removed from the locust to accomplish this reduction to one-sixteenth? According to the great mathematical law just given, the ear has only had to move to the distance of four inches from the locust. Well, this seems absurd, so we start for a brisk walk of a mile across the plain; and as we go we hear the sound of the locust getting perceptibly and very gradually weaker, but always quite distinct and audible. At the one mile limit we stand and listen, and still we hear the sound perfectly clear, but of

course greatly reduced in strength by the distance. Taking a pencil and note-book, we work the sum of the decrease of strength in strict accordance with the law of inverse squares; and find, to our absolute mental confusion, that we are hearing the sound of the distant locust reduced to the *one four thousand and fourteen million, four hundred and eighty-nine thousand and six hundredth* part of its strength at one inch distance. Was there ever anything, outside the dream of a mathematical mind, so absolutely absurd and preposterous? Just fancy any earthly sound being reduced to the *four thousand and fourteenth millionth* part of its *loudness*, and then realized as an *audible sound* by the *unaided ear* in the open air. I should hardly like to publish my opinion of the man who believed in such an insult to common sense.

Objectors, on the Wave-Theory side of the house, will say that the position of the locust on the ground, in the neighborhood of a level reflecting plain, is against the true operation of the law, and, accordingly, great allowance must be made. Gentlemen, I am willing to make *great allowance* both for the *objections* and the *objectors*, and shall strike off *four thousand millions* from the fraction arrived at by the law. I am quite content with the one *fourteen millionth* part of the locust sound—but where am I to find an ear to hear it?

(To be continued.)

A NEW FRIEND—THE SPECTROSCOPE.

BY THOMAS MUNNELL, A. M.

The spectroscope is the most wonderful invention of modern times. In connection with photography it has become a conqueror in astronomy that surpasses all the achievements of only a few decades ago, by the number of its new and valuable discoveries.

Dr. Huygens announces among other recent advances, "the improved measurements, by means of the spectroscope, of the motion of the stars and nebulæ, and the discovery of double stars and stellar systems." The number of fixed stars cognizable by the best telescopes is about 50,000,000 while the spectroscope discovers about as many more. Some of these last are so distant that it requires light flying at the rate of 192,000 miles per second, more than a hundred years to reach us. The telescope has measured the distance of about fifteen stars but the spectroscope has reached about fifty of them. Among these last is Arcturus, a star of the first magnitude, whose distance from us is such that it takes its light 200 years to reach us. Now let some one who has leisure find the number of seconds in 200 years and multiply that by 192,000 and he will have the number of miles Arcturus and the earth are apart, so that if the former had been destroyed 199 years ago, it would still be shining on us every night. Admitting all this, how does it prove light to be an entity? What has it to do with Substantialism?

"*Much in every way.*"

1. No Substantialist, not even Dr. Hall, fifteen years ago, knew that the spectroscope was to develop into the mightiest advocate of the new philosophy. The scientific world has been surprised to find that according to wave-theorists the cricket must shake four cubic miles of air whenever it choses to put its little machinery into operation for that purpose. This simple fact is an unconquerable Gibraltar whenever the question of sound-waves is before us. But as the wave-theory holds that light also does not generate but *consists* of wavelets, and as said theory asks us to believe that Arcturus must be keeping up this trembling motion for the space of *two hundred years* before its light reaches us, the assumption becomes too absurd to be seriously discussed, especially when we consider that the supposed waves are of course sent out in all directions—east, west, north, south, up, down, right, left, and at every infinitesimal angle, till every possible point on the outermost shell of Arcturus' light is reached. For were we disposed to strain their theory unmercifully, we could remind them that the light of said star goes far beyond our planet so that said outermost shell may be trillions of leagues in diameter greater than the one that only embraces us, but for the present purpose we will confine it to present dimensions. Besides the groundless working hypothesis of ether filling all space, invented in order to have something to make waves out of, the assumption becomes still more grave when they suppose that the Creator had no more economical way of sending light across the universe than to create a universe of ether for that purpose. It would require no more power to create light as an entity than to create ether as an entity. And that is just what was done for "God said, Let there be Light and there was Light"—not "Let there be Waves." Everything that God made he called a "Thing," and light was among the "Things" he said were "very good." Gen. i. 31.

It may be said in reply to this that an Almighty Creator would find no difficulty in endowing Arcturus or any other world with power to send its wavelets throughout a whole universe and to keep up such tremors in all the media through which it was to pass. Of course almighty power could do so, but He never wastes His power in doing what is useless. Besides this, the following, among many facts derived from the revelations of our new friend, clearly proves that light does not flow in wavelets. Although the burden of proof lies with the affirmative we do not hesitate to prove a negative.

It is well known that the spectroscope can not of itself gather light enough from Sirius or any other star to perform its wonders in spectral analysis. It is compelled to use the telescope to collect sufficient light for this purpose. To do this it must place the object glass of its collimator exactly in the focus of a telescope whose broad eye concentrates the needed amount of light upon said glass. Now the light that falls from Arcturus first upon the object glass of the telescope where its rays are refracted from nearly parallel to converging lines, till they reach the object glass of said collimator, thence in divergent lines till they pass two other lenses and an intermediate prism and thence convergent again to the eye glass of the spectroscope. Here are at least five crystalline lenses as hard and as inflexible as any flint in the Rocky Mountains, all of which are expected to be frightened into tremors by the approach of an inoffensive little bean of light through a window slat that left Arcturus 200 years ago and has travelled more than a quadrillion of miles or more than four trillions of leagues, causing all the ether between as well as these lenses to shudder at its gentle presence. But this is only the radius of the shell, the whole interior of which is kept in

perpetual agitation to send out this nonentity they call light. And when we think of the 100,000,000 of fixed stars each of which has such a shell of light the waves of which, like water waves they say, are crossing each other at every infinitesimal point in reach, at every possible angle and with all the supposed condensations and rarefactions in infinite multitude and "confusion worse confounded," how can there be a wave of light at all in any part of the universe? Cut up into innumerable squares, triangles, diamonds, parallelograms, rhomboids and geometrical figures of all possible forms by decillions of rays from every star in the heavens, how can there be any continuous wavelet anywhere while thus broken into vigintillions of fragments everywhere.

But to return to the argument from our new ally, the spectroscope, aided by the telescope in its spectral analyses, which can not be effected with less than five lenses. Now can any sane physicist believe that this gentle little ray from Arcturus, after completing its four trillion leagues in two hundred years, can assault even the first of said lenses with such blows as to throw it into tremors, and keep up the agitation of the flinty crystal during one or one thousand observations at the will of the astronomer? These same wave-theorists teach that the number of waves of light range from five to seven billions per second, and as it is the medium through which light passes that is made to vibrate, whether it be ether, air, or crystal, it follows that our little streak of light not only forced the said object glass to bend in and out as the drum of the ear is supposed to do some six hundred billion times per second, but that said glass communicated the same number of strokes per second to the air inside of the tube of the telescope, till they reached the first lense in the collimator, and with force unchecked bombarded it into its six hundred billion quivers, and so on through the other three crystals and their respective spaces, till it reaches the eye of the observer and there pelts its retina with the usual 600,000,000,000 per second. Was there ever a plainer *reductio ad absurdum?* And yet a purely sectarian philosophy that can believe that a tack hammer or even a pin scratch can send waves through an iron log fifty feet long, can easily arrange to swallow any other camel that comes in its way.

Welcome then, thrice welcome Substantialism whose light and heat, though not material, are as veritable "things" as God ever made, and being immaterial they need no ether for their transmission, have no collisions in the clouds, nor battles anywhere; it has successfully and triumphantly spanned the chasm that so long has yawned between the material and the immaterial, and has furnished the best assurance on philosophic and scientific grounds of the immortality of man ever offered to the troubled soul.

OUR HEALTH-PAMPHLET.

Still continues the sale of the pamphlet revealing fully the discovery made by Dr. Hall for the cure of disease of all kinds, without medicine; and still the testimonials continue to arrive. We give a sample on last page of this number.

We will take pleasure in forwarding to any address, free, a copy of our EXTRA MICROCOSM giving full information concerning this drugless remedy, and any person who may wish copies to distribute among his friends will be abundantly supplied by us, free of charge, and will have our sincere thanks at the same time.

"THE INVISIBLE WORLD."
BY REV. J. I. SWANDER, D. D., Ph. D.

Last month the MICROCOSM gave a notice of this masterpiece of elegant writing as well as logical reasoning. Orders, we are glad to say, are coming in encouragingly for this book so important to the library of every man or woman who wishes to keep up with the times.

Dr. Swander struck a most felicitous idea when he hit upon the name "*Invisible World.*" A man who has a promising young horse which omens great speed, oftentimes cudgels his brains for months in deciding upon a name for his coming racer, one which will carry with it the prestige and portent of good fortune, with a kind of occult superstition that the genius which presides over the race-course is partial to pretty and appropriate names. Dr. Swander no doubt felt the same toward the invincible racer to which his own brain had given birth. Of one thing we are certain, that no other name could have been constructed out of all the 30,000 leading words of Webster and Worcester which would so appropiately have symboled the drift of thought embodied and unfolded in the book so happily christened. It is a gem.

This book must be read to be appreciated. Send for a copy to the MICROCOSM office and receive it by return mail. Price, beautifully bound in cloth, $1.50. It contains between three and four hundred pages. EDITOR.

THE "PROBLEM OF HUMAN LIFE."

This book was the first scientific work written by Dr. Hall, the editor of this paper. It has achieved a sale greater than any similar work ever printed, even under the prestige of the largest publishing houses with all their enormous advertising advantages, having already passed its seventy-eighth thousand, and without one dollar's expense in advertising. While other books have their maximum run at the announcement of their publication, the "Problem of Human Life" was entirely unknown at the start, as its author, without money and never before heard of, had to be his own publisher. But at once it sprang into the very lead of all scientific works previously printed, simply by one person telling another, and it is even now selling faster than at any time during the fourteen years of its existence. This, judging from its previous history, will no doubt be the natural rate of its increasing sales for the next 100 years to come. The great fundamental truths and principles which it unfolded were not only original and told in an original way, but they touched a sympathetic chord in the heart and intellect of every brainy man and woman who ever casually happened to open its pages. This is the reason why it sells with an increasing furor such as is unparalleled in the annals of literature.

We now announce that the book can not be sold for less than its regular retail price by mail—$2; and to agents at $9 per dozen by express, or at $12.16 per dozen by mail.

The book is handsomely and substantially bound in cloth and contains 524 pages.

To those who have not seen this wonderful book—this *chef d'œuvre* of the nineteenth century—should read the extracts copied from it at the close of Dr. Hall's masterly paper on Darwinism just read before the Victoria Institute of Great Britain and which forms the opening article in this number.

ASSOCIATE EDITOR.

CONTENTS FOR OCTOBER NUMBER.

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The Microcosm

A MONTHLY JOURNAL OF SUBSTANTIALISM AND COLLATERAL DISCUSSIONS.
THE ORGAN OF THE SUBSTANTIAL PHILOSOPHY.
A. WILFORD HALL, Ph. D., LL. D., Editor and Proprietor.
(Author of the "Problem of Human Life," Editor of the *Scientific Arena*, &c., &c.)
ROBERT ROGERS, Ph. D., Associate Editor.
Address all communications to A. WILFORD HALL, 23 Park Row, New York.

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THE WAVE-THEORY OF SOUND DEMOLISHED.—ARRAIGNMENT OF PROF. TYNDALL.

BY THE EDITOR.

At the request of the Secretary of the Society of Science, Letters and Arts, of London, England (which had conferred upon the writer the honor of electing him a Fellow), we sent for publication in their *Transactions* our reply to Sedley Taylor, the distinguished Professor of Acoustics, at Cambridge University. This reply appeared in the Society's Journal, June 16th of this year, and is the same as it appears in the MICROCOSM of last April, at page 73.

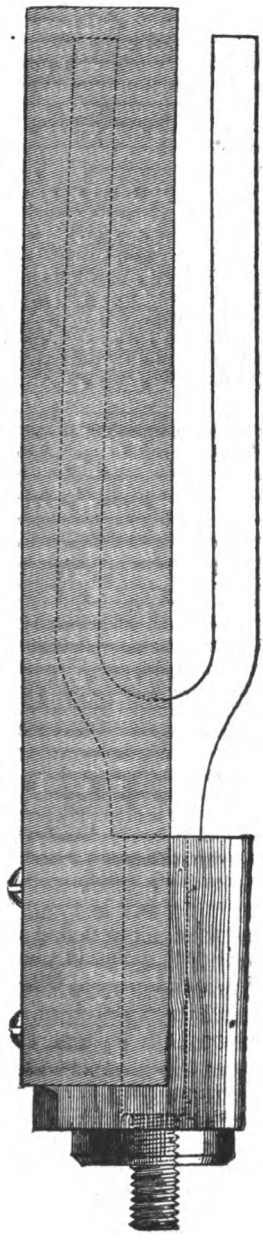
We have just received a letter from E. Albert Sturman, M. A., LL.D., General Secretary of the Association, inclosing a reply to our article from a Mr. Alfred H. Bowman, "Student of Natural Science," and requesting a reply from our pen. But for this request we should not have considered the remarks of Mr. Bowman as worthy of notice, for reasons which will appear further on. To show the reader that we are not unduly prejudiced against our English "Student of Natural Science," we quote the gist of his criticisms as follows:

DR. WILFORD HALL:

Dear Sir,—As concerns your attack on the Wave-Theory of Sound and also on Professor S. Taylor's opinion of the cause of diversity in the intensity of sound produced by wooden and iron sound boards (as published in the journal *Society of Science, Letters and Art*, June 16th), I have a word to say.

Wood being much more compressible than iron, it must be evident that when the area of each sound board is small the wood would give the greatest volume of sound, because it vibrates *deepest* and so disturbs the air most; and, on the other hand, when the sound boards are large the fact would be reversed, because of segmental vibration being extended over a larger area. Hence, the sound boards of small instruments, as the violin, are of wood; *and, of larger instruments, of iron and steel.* The more elastic the sound board is the less superficial area it requires.

The reason why the tuning-fork produces such a weak sound is because of the interference of waves generated from between the prongs with those generated from the outside surfaces of the forks, a fact of which Mr. Taylor does not seem to be informed. If the vibrating fork be turned slowly round before the ear, there will occur four positions in which no sound can be heard, where the condensations between and the rarefactions outside, and *vice versa*, exactly neutralize each other. If we construct a diaphragm with a slit in it, just suffi-



ciently large to admit the prong of the fork and allow it to vibrate without contact, we find the sound much increased in volume, and the only reason I can assign for it is that the diaphragm prevents the interference of the two sets of waves generated from between the forks and from the outside surface of the one fork-prong. Even Dr. Hall must admit that waves must first exist before they can interfere. * * * *

I am sir, yours, etc.,

ALFRED H. BOWMAN, F. S. Sc.
Student of Natural Science.

But for the seriousness of the subject the second paragraph in the foregoing extract would be positively laughable. That there was an adult man in all England, whether "student of natural science" or not, so badly informed as not to know that "iron" or "steel" was never used for a sound board of a musical instrument big or little, is a revelation that may well surprise both hemispheres. The truth is, this innocent "student of natural science" entirely misapprehended Sedley Taylor's criticism and our reply, by supposing that we were actually discussing the reasons why large sounding boards were made of iron or steel and small ones of wood! If this does not break the championship record for scientific ignorance in Great Britain we fail to imagine what could do it.

His second paragraph though equally erroneous, is better, simply because it is an almost verbatim copy of the stereotyped arguments in favor of the so-called law of "sound-interference" as elaborated in every text-book published. To prove this we here give the words of Prof. Tyndall which are almost exactly parallel:

"You must have remarked the *almost total absence of sound* on the part of vibrating tuning-forks when held free in the hand. The feebleness of the fork as a sounding body *rises in great part from interference.* The prongs always vibrate in opposite directions, one producing a *condensation* where the other produces a *rarefaction*, a *destruction of sound being the consequence.* By simply passing a *pasteboard tube* over one of the prongs of the fork [which he illustrates] its vibrations are in part intercepted, and an augumentation of the sound is the result. *The single prong is thus proved to be more effectual than the two prongs.* There are positions in which the destruction of the sound of one prong by that of the other is *total.* These positions are easily found by striking the fork and turning it round before the ear. When the back of the prong is parallel to the ear, the sound is heard; when the side surfaces of both prongs are parallel to the ear, the sound is also heard; but when the corner of a prong is carefully presented to the ear the sound is utterly destroyed. During one complete rotation of the fork we find four positions where the sound is thus obliterated."—("Tyndall on Sound," chap. VII., page 272.)

Sedley Taylor in his "Sound and Music," page 155, elaborates precisely the same argument on the "silence" observed at the fork-corners as being caused by the "interference" of the air-waves issuing from the two prongs, and from which both he and Tyndall draw their argument that "musical beats" also result from the same "interference of air-waves."

Thus, having stated this entire wave-theory side of the case fairly and explicitly, we now purpose annihilating the whole law of *interference* and with it taking the last breath of life out of the wave-theory itself. And we respectfully invite Prof. Tyndall, Prof. Helmholtz, Lord Rayleigh, Mr. Taylor, President Stokes of the Royal Society, Sir Wm. Thompson, our own Profs. Mayer, Stevens and Rood, and all other physicists here and in Great Britain either to attend the scientific funeral in person or to send a letter of condolence.

The *coffin* for this occasion is presented in the accompanying cut which exactly represents a tuning-fork (C of 512 vibrations to the second), one prong of which is *buried out of sight and hermetically sealed in a heavy square casket of brass,* and which touches the fork only at the base along the center line between the prongs so as not to interfere with both prongs' free vibration, one inside of the casket and the other out.

At this base of the fork, as will be seen, the brass overlaps and is bolted to a block of wood that fits tightly around the stem of the fork so that no vestige of sound can escape from the prong inclosed in the casket, thereby permitting the outside prong singly and alone, without any possible "interference" from its interred fellow, to bear its testimony and thus ring the death-knell of the theory which for so many hundreds of years has persisted in slandering this purest and worst-maligned of all musical instruments. The location of the buried prong can be seen faintly outlined by the dotted lines upon the side of the sealed casket.

Now, having prepared the reader for the solemn requiem we seize the wooden base of the fork in our hand and strike the unconfined prong a blow against its pad and listen. And behold! *we get exactly and only one-half as much sound from this single prong as we get from a similar fork with both prongs free to "interfere,"* thus demonstrating that the normal weakness of the tone of the tuning-fork in no way results from the supposed interference of its air-waves as all science has previously taught. This of course is precisely as it should be according to true science.

But now we toll this funeral bell again by striking the free prong as before, and then holding the fork upright in our fingers in front of the ear. By turning it around just as Prof. Tyndall so carefully directs, behold! *we have the same "silence" at the four corners of this one prong, but much more distinctly marked than when both prongs are heard,* simply because this "silence" at either corner is necessarily somewhat neutralized by the tone from the other prong when both are exposed; *whereas the silence is complete when one of the prongs is entirely shut off!*

Thus we demonstrate beyond the shadow of a doubt that this "corner silence" so vaunted by wave-theorists results alone from the fact that by an unknown law of acoustics *no sound issues from the corners of a vibrating prong;* or, in other words, that *sound only issues in two general directions—that of the vibrating prong back and forth and that at right-angles to such vibration,* though these two directions of sound-force by diffusing come together and blend a very short distance from the corners of the prongs. The same thing precisely occurs with a round-prong tuning-fork, as we have proved by having one made for the purpose of testing it.

But here remains in bold relief the annihilating fact for the wave-theory, that the "interference" of so-called air-waves from the two prongs is an absolute myth, having nothing whatever to do with these observed phenomena peculiar to the tuning-fork, and which

for centuries have been so egregiously misunderstood and misrepresented by physicists all over the world.

And now comes the question for the rising students of science both here and in Europe, namely, what are Profs. Tyndall, Helmholtz, Thompson, Stokes, Taylor, Mayer, Rood, Stevens & Co., going to do about it? Will they, or either one of them have the scientific candor and courage to acknowledge that this very foundation law of "interference" has been swept out from under the wave-theory, leaving it a chaotic heap of ruins?

We do not expect any such an honest and straightforward answer from any of them; but as Mr. Sedley Taylor has had the manly courage to show fight by attacking Substantialism, we now propose to him, and will so write him personally inclosing this paper, that we will send him by express, prepaid, this tuning-fork and case, as shown in our cut, *if he will agree to examine and test it in the presence of Dr. Audsley*, at the same time giving the doctor his candid opinion of the bearing and force of the experiment. Will he accept this offer? We shall see.

But at this point we purpose focusing our calcium-light for a moment upon the celebrated "pasteboard-tube" experiment of Prof. Tyndall, and try to analyze its probable honesty and consistency in the light of our own illustrated demonstration and for the benefit of future students of acoustics. With a full responsibility for what we are about to write, we assert that in placing that "pasteboard tube" over one prong of the fork with the mouth of that tube wide open, not only to let out the normal sound of that prong but to produce a loud resonance from its air chamber in addition, *that distinguished scientist evinced either a want of moral honesty or a lack of competency as a scientific experimenter.*

We admit that this seems like a harsh thing to say of as great a man as Prof. Tyndall, but the truth of history and our duty to coming generations of scientific students compel us to utter this merited denunciation. Let us critically look at this experiment with the "pasteboard tube" in the light of our unimpeachable engraving and in the light of what *Prof. Tyndall must have known, if worthy to be called a scientist.*

While he was thus publicly claiming to show the effects of "interference" between the air-waves sent off from the two prongs, and while he was *pretending* to stop off the sound of one prong in order to show the effect upon the other prong when freed from "interference," why did he deliberately place over that prong an open-mouthed air-chamber of such capacity as to augment the sound of that prong by resonance and then fallaciously claim this increase of sound as the result of prevented interference by having stopped off one of the prongs? Did he not know that the sound of that prong, so far from being stopped off, was actually *augmented by resonance?* Can such a self-evident mechanical trick of jugglery and deception be reconciled with scientific honesty? If it can, it can only be done at the expense of scientific intelligence that would amount to worse than a crime in a man of his pretentions.

Again; why did not this scientific lecturer, as a man who had any care for his reputation as an accurate experimenter in matters of physical science, adopt the plan here illustrated and thereby really stop off the sound of one of the prongs entirely by a hermetically sealed metal case, and thus let his anxious students know the truth on this subject? Is it not perfectly plain that Prof. Tyndall *knew*, if he should honestly do this, that he would show his audience that the single outside prong, when entirely isolated from the other, would sound only half as loud as both prongs combined, and did he not know that he would thus totally overturn the wave-theory and hopelessly demolish his lecture?

To suppose that he did not know the fact that with one prong entirely insulated the sound would be *reduced* instead of "*augmented*" (an experiment so easily tried), is to write him down a scientific ass. This, of course, nobody can believe of Prof. Tyndall; therefore it remains a painful fact that this greatest living exponent of the wave-theory of sound, in order to maintain the appearance of truth in that theory before his scientific audience, *dishonestly passed an open-mouthed air-chamber over one prong of his tuning-fork in order to augment its sound by resonance, thereby to deceive his audience and make them think there was some truth in the law of sound-interference!* We have written this sentence emphatically and as our deliberate conviction, being totally unable to come to any other conclusion.

It now remains to be seen, before Prof. Tyndall shall depart hence, if he will or will not place on record some sort of explanation of this almost resistless evidence of scientific dishonesty—an explanation that will in some measure relieve his posthumous reputation by showing in what possible manner, by what imaginable mental processes, and by what theoretic emergencies he was so palpably deceived into deceiving others by false pretences and fraudulent experiments to bolster up an absolutely false theory of science.

Prof. Tyndall owes it to himself a thousandfold more than to any one else to go to work at once and make a clean breast of it by laying before the world the mystery of his self-deception, since we can not consistently expect him to confess to his actual dishonesty. That he now knows positively that the wave-theory of sound is false from root to branch there can be no manner of doubt from what he has recently learned through these publications. But the probability is that he is living along toward the end of his career in a vague sort of hope that the new theory will blow over, or possibly, that it may cripple itself by mistakes of its advocates so that the final dissolution of the wave-theory and its abandonment by the colleges will occur a long time after the place which knows him now shall know him no more. We are sorry, however, to write him that he is probably mistaken—and that the final catastrophy of the wave-theory is much closer at hand than he vainly hopes. It may come in all its cyclonic devastation before he dies, old as he is, and it is in this confident expectation that we have penned this admonition and advice. Prof. Tyndall *knows* that the foundation of his theory has been swept away. Why not accept the situation and prepare for posthumous consequences?

Were it possible to conceive of such a circumstance as that this world-renowned physicist and painstaking experimenter in all other departments of science, could accidentally or ignorantly have taken up by chance an open-mouthed pasteboard tube of just the

right size to augment the tone of that prong by resonance, and that he really thought he was stopping off the sound of the prong instead of increasing it, there might still be a faint hope of palliating the crime of dishonesty by substituting the semi-crime of stupidity. But against this charitable view stands a cloud of witnesses, since every single experiment or illustration throughout his entire book on sound, where any reference is had directly or indirectly to the defense of the wave-theory of sound, this same reckless tergiversation, disregard of accuracy and manifest deception of his audience by false scientific representations of facts prevails, in many instances even more marked than in his "pasteboard tube" illustration.

Take for example a dozen of this same class of experiments, carefully designed and planned and doctored to meet the demands of the wave-theory—such as the "tin tube" experiment of blowing out a candle by clapping two books together; such as the resonant jars with bell-shaped mouths having a doctored depth of a "half-wave length;" such as the two unison forks producing "absolute silence" when bowed half a wave-length apart; such as the double-siren ficasco in which the natural octave, from double the number of orifices exposed, was represented as the promised "total silence" on account of interference, etc., etc., and we find the same inaccurate and unscientific character prevails, wherever focused under the analyzing lens of truth, as that just exposed of placing a resonant air-chamber over one prong of a tuning-fork thereby augmenting its volume of tone while publicly pretending to stop off its sound.

Was it not, for example, passing strange when Prof. Tyndall attributed the faintness of the sound of the tuning-fork held in the fingers to the "interference" of the air-waves from the two prongs, that he never thought of precisely the same weakness of tone in a stretched chord when not connected with a sounding board? Hear what he had just said in a previous lecture while exhibiting such a stretched string:

"The *sonorus waves* which at present *strike your ears* do not proceed *immediately from the string*. The *amount of motion* which *so thin a body imparts to the air is too small to be sensible at any distance.*"—"Lectures on Sound," page 87.

How amazingly absurd must all this appear to the intelligent and open-minded student of physical science! Not a word does Prof. Tyndall here utter in regard to the "interference" of the air-waves from one side of the stretched chord with those from the other side as the cause of this very faint sound, only that it is "so *thin* a body!" Not being able to lug in "interference" with a single string, he had to account for its observed weakness of tone and thus to silence the misgivings of his audience by the convenient plea that "*the amount of motion which so thin a body imparts to the air is too small to be sensible at any distance!*" (How about the "thin" little locust, Prof. Tyndall, which imparts enough "motion" to the air according to your theory to be heard a mile in all directions?) But Prof. Tyndall never thought, when he was making himself dizzy over his fraudulent "pasteboard tube," trying to manufacture proof of "interference" out of "resonance" that the fork with half the surface of the stretched chord was too "*thin* a body" to impart motion to the air or "to be heard at any distance." No; then it was all "interference!" What a prodigious short memory a false theory of science necessarily engenders! Look at what Prof. Tyndall had just said about the wonderful powers of a "thin" harp string upon the air in moulding it into condensations and rarefactions. We quote:

"Figure clearly to your minds a *harp-string* vigorously vibrating to and fro; it advances and causes the particles of air in front of it to crowd together, thus producing a *condensation of the air*. It retreats, and the air-particles behind it separate more widely, thus producing a rarefaction of the air. . . . *In this way the air through which the sound of the string is propagated is moulded into a regular sequence of condensations and rarefactions* which travel with a velocity of about 1,100 feet a second." (Page 79.)

This is represented as the work of the harp-string. But see what he says about this same harp-string a few pages further on:

"I now pluck the string. It *vibrates vigorously, but even those on the nearest benches do not hear any sound. The agitation which it imparts to the air is too inconsiderable to affect the auditory nerve at any distance.* . . . It is not the *chords of a harp*, or a *lute*, or a *piano*, or a *violin*, that *throw the air into sonorous vibrations*. It is the *large surface with which the strings are associated.*"—"Lectures on Sound," page 88.

Ah! the *large surface!* Where, Prof. Tyndall, is the "large surface" of the "thin" little locust that "imparts" motion to the air throughout four cubic miles if your wave-doctrine be true? Is not your theory the body that happens to be too "thin" to furnish any true explanation of the nature of sound? And were you not correct when you said further on:

"Assuredly *no question of science ever stood so much in need of revision as this of the transmission of sound through the atmosphere.* Slowly but surely we mastered the question: and the further we advanced the more plainly it appeared that *our reputed knowledge regarding it was wrong from beginning to end.*"—Third edition, page 82.

The great German acoustician, Prof. Helmholtz, from whom Prof. Tyndall derived most of his wave-theory inspirations, takes the same view of the total ineffectiveness of the vibrating instrument in imparting motion to the air. He says:

"As we have had already occasion to remark, *vibrating strings do not directly* communicate any *sensible portion of their motion to the air.*"—"Sensations of Tone," p. 137.

Then how does it happen, Prof. Helmholtz, that the little locust, exerting a hundred times less mechanical energy than a stretched chord vigorously plucked, sends four cubic miles of air into condensations and rarefactions and that, too, without the aid of a sounding board? By every principle of logical reasoning both Tyndall and Helmholtz have abandoned the wave-theory of sound without being conscious of the fact. Here it is: Since "so *thin* a body" as a string can not "*communicate any sensible portion of its motion to the air,*" and since a much *thinner body* (the insect) does communicate sensible *sound-pulses* to four cubic miles of air, *therefore, sound is not motion of the air!!!* Gentlemen, why not give it up, since, by the most ironclad syllogism known to logic, you, yourselves, have demolished the wave-theory of sound?

Thank providence, and thanks to true science, no such a hotch-potch of jumbled self-contradictions can be found in the principles of the Substantial Philosophy. Every phenomenon of sound referred to in Tyndall's entire book is simply and beautifully explained on the basis that sound is a substantial but immaterial form of force, somewhat analogous to

that of electricity, magnetism, gravity, light, heat, etc., their ultimate laws of origin and conduction alone being unknown to man.

How grateful must be the coming generations of the students of acoustics, with a complete illustrated text-book of the Substantial Philosophy before them, which book we hope in time to announce from the artistic and scientific pen of Dr. Audsley, with all the irrational jargon about self-contradictory air-waves, condensations, rarefactions, interference, superpositions, etc., etc., forever brushed away! That happy time is already foreshadowed in the few colleges where Substantialism is already being taught, even without a suitable text-book, both students and teachers, as they stand by the blackboard, exclaiming that sound is a hundred-fold easier taught and understood as a substantial force of nature than when involved in the incomprehensible nonsense of air-waves with their condensed and rarefied pulses which can not be shown to have any existence. May the time speedily come when the prejudices of the professors of physical science shall give way, and when the light of the Substantial Philosophy shall shine into the class-rooms of every college in the land.

GOD AND LAW.

BY PROF. H. A. MOTT, LL. D.

To the thinking man it must be self-evident that there can be no such thing as chance—for clearly chance can have no existence under the constant laws of nature or under any laws. What we see fit in common parlance to call chance is but the uncalculated result of some known or unknown law of nature.

Real chance would be motion of some kind from no cause at all, and antecedent to all the laws of nature, such being the case, the rational mind will dispose of chance and look for a cause for every effect. It may prove difficult to find the true cause and even when found to comprehend the same, still the fact remains *for every effect there must be an efficient cause.*

Science undeniably shows that a *cause* must have existed outside of the visible universe to have distributed the cosmic matter in space unequally before the world was formed, and also to give the first impulse to the matter so distributed which caused its rotation, for it is a well-established act that no motion can begin without a force acting, whereas rest requires none. Few scientists seem to be interested in explaining how even a single particle of matter commenced to move, also to combine and produce all sorts of complicated results, which are not only physical but psychical, or belonging to the mind. The reason is simple, they would have to admit a great First Cause which unfortunately in the educational process some minds have lost sight of or do not care to admit.

To the rational mind the great First Cause is God. It is true that the late atheist Para Haugh said "I know not what you mean by God; I am without idea of God; the word God is to me a sound conveying no clear or distinct affirmation. I do not deny God, because I can not deny that of which I have no conception, and the conception of which by its affirmer is so imperfect that he is unable to define it to me"—and that Thomas Cooper has said: "I do not say there is no God; but this I say—I know not," and that Holyoake was of the opinion that "the only way of proving the fallacy of atheism is by proving the existence of God" Still, greater intellects instead of being led to say "that up to this moment the world has remained without knowledge of a God" have become convinced from a careful study of cause and effect, that there was a great First Cause, and that an infinite God exists—the Ruler of the Universe.

We can not refuse to admit with Hobbes: "Where there is no reason for our belief, there is no reason we should believe." But careful study of nature and phenomena convinces the unprejudiced and normal mind that— "just as an image is sustained in a mirror by the constant succession of the rays of light, so nature is sustained by the constant forth-putting of the power of God, in whom we live and have our being, and which, if but for an instant withdrawn, the whole universe, in all its vastness, glory and beauty, would sink in a moment" into the simple condition from whence it arose.

It is a self-evident truth that the finite can not comprehend the infinite any more than a part can be made equal to a whole, and still some finite minds can not be made to reason this way. Solomon's words can justly be applied to such a man—"though you bray him" and his false logic in the mortar of reason, among the wheat of facts, with the pestle of argument, "yet will not his folly depart from him." The infinite God must include all. If he is not in the dust of the streets, in the bricks of our house, in the beat of our hearts, then he is not infinite. He would have boundaries—but that the beat of our heart, the bricks of our house, the dust of our streets is God, has no more logical status than to say that because, our hands, our legs, our stomach which are necessary to make us human beings wholly constitute the *ego*—the *I.*

In theorizing on the existence of a power constituting and sustaining the Universe, or in other words, the existence of God, we have to go about it in the same way as in the consideration of any other scientific theory, by showing that such a power as God accounts for all the phenomena which it ought to account for much better than any other theory, and especially where no more than one rival theory is possible: or in other words, one theory is enormously more probable than the other. And when we find that there is a world of information outside of our finite senses, which by inference we know exists, yet our finite senses are unable to detect, we must look for a rational cause for such phenomena.

The absence of experience can not raise even the smallest presumption against any theory which does not in the nature of things admit of experimental proof, which the theory of the Universe constituting and being sustained by the persistent exercise of the power of God certainly does. We have a right to believe and our reason dictates such belief—in an infinite God constituting and being superior to and sustaining the visible universe as probable, and much more probable than the opposite view, and so probable that our faculties can not distinguish between the probability and absolute certainty.

It is just as impossible for the finite mind to understand the infinite as it is impossible to understand anything which is entirely unlike all that has ever been seen or heard, for every idea in the world that man has, has come to him by nature. Therefore man can not conceive of

anything the hint of which has not been received from his surroundings. "He can imagine an animal with the hoof of a bison, with a pouch of a kangaroo, with the wings of an eagle, with the beak of a bird, and with a tail of a lion and yet every part of this monster he borrowed from nature. Everything he can think of, everything he can dream of, is borrowed from his surroundings, everything."

So if an angel should come and tell of the infinite God, his description would mean nothing, unless we could translate it in terms of our own experience. Our ignorance is not even then a probability against our belief.

Our observations teach us that nature acts in accordance with laws, or in other words we observe certain modes of action, or sequences of motion, and having learned by experience that these are uniform we call them "laws of nature," but *these laws of nature are but the transcript of the thoughts of God, immutable and unchangeable.*

God is the prime cause of everything. It is from ignorance some talk of the laws of nature being the cause of anything, they are simple statements of the course of nature or the uniform results of unknown physical causes ending in some prime cause or causes not merely physical, and it is absurd to talk of such results as being themselves *prime causes.* "The combustion of coal in the furnance of a locomotive, and the eruption of a volcano, the zephyr that fans the cheek on a summer's day, and the tornado that sends a fleet laden with humanity beneath the remorseless waves, the rounding of a tear, a pebble, and the formation of a world, the motion of a feather in the air, and the majestic march of a planet, the movements of a zoophyte and the thoughts of man, are all and equally subjected to invariable laws. These laws are never changed nor suspended either to promote the welfare or to increase the suffering of man. The thunderbolt strikes whatever is in its course, whether it be the cottage of an honest peasant or a den of vice and crime."

It becomes necessary then to study nature and phenomena and understand the laws laid down by the Ruler of the Universe, and by just such study man has made the laws of nature subservient to his wishes. Man feels that there is nothing in the earth which eventually he can not subdue, to his use. There is hardly a physical phenomenon which he does not feel he can or may perform. But all this wonderful, this boundless power over material laws is gained by the laws. As Prof. Boyd has said, "He subdues nature by understanding nature. He creates no property; he therefore performs no miracles, though he does marvels."

"Despite the laws of gravity man ascends to the sky in a balloon; he makes water spring up in fountains; he makes vessels, weighing thousands of tons, float on the seas. It is by knowing that gravity is more powerful in the case of air than in the case of hydrogen gas, that he makes the air sustain him as he floats beneath a bag of hydrogen above the earth. It is by knowing that gravity is more powerful in water than in air that he sails in iron ships.

"Despite cohesion, he grinds rocks to powder; despite chemical affinity, he transmutes into myriads of different forms the few elements of which all matter exists; despite the resistless power of the thunderbolt, he tames electricity to be his servant or his harmless toy. With water and fire he moulds into shape mighty masses of metal; he shoots, at a sustained speed beyond that of birds, across the valleys and through the mountain ranges; he unites seas which continents had separated. It is by knowing chemical affinity or repulsion that he makes the compounds or extracts the simple elements he desires; it is by knowing that affinity is force, and that force is transmutable into electricity, that he makes a messenger of the obedient lightning shock; it is by knowing that heat causes gases to expand, that he makes machines of senseless iron do the work of intelligent giants."

To the American people great credit is due for their acute comprehension of the laws of nature and the ability, they have shown by their inventive genuis to make them subservient to their wishes always, however, subduing or overpowering one law by the exercise of another. The proof is, that there is hardly an industry to the progress of which Americans have not largely contributed. As for example—the cotton-gin without which the machine-spinner and the power-loom would be helpless, is American. The power-shuttle, which permits an unlimited enlargement of the breadth of the web, is American. The planing machine is American. Navigation by steam is American. The mower and reaper are American. The rotary printing-presses are American. The hot-air engine is American. The sewing machine is American. The machine manufacture of wool-card is American. The whole India-rubber industry is American. The hand-saw originated in America. The machine manufacture of horse-shoes is American. The sand-blast is American. The guage-lathe is American. The first successful composing machine was American. The type-writer is American. The grain-elevator is American. The first process for the artificial manufacture of ice was discovered by Professor Twining an American. The telephone, which is of so much practical value, was discovered by an American. The phonograph, invented by Edison, is American. The tassimeter, which measures the heat of the stars, was discovered by Edison, an American. The electro-magnet was invented by Professor Henry, an American, and was first practically applied in transmitting telegraph signals by him. The telegraph instrument, invented a few years later and which has been universally adopted, was invented by Professor Morse, an American. The system of duplex and quadruplex telegraphy is American, and is a discovery which the history of mechanical progress knows no greater triumph.

All nature is governed by immutable law, and surely the Infinite God is not lowered by estimates through law instead of personality.

Immutability is an attribute of perfection, mutability of imperfection.

Isaac Hoffer on Col. Ingersol.

We are glad this clear and level-headed contributor has taken up his pen on Ingersolism. We have received a paper on the teachings of this notorious atheist that will make two articles for the first two numbers of the next volume. The readers of the MICROCOSM can look for some close and logical reasoning on this subject.

THE DEFECTS OF THE WAVE-THEORY ACKNOWLEDGED.

BY J. I. SWANDER, PH. D.

In this communication the reader's attention is called to a very significant fact. The writer has reference to the general confession throughout the learned world that the wave-theory of sound is defective. Recent representative writings in England and America upon the subject of acoustics are noted for their concessions that there is something about the undulatory Denmark in an advanced stage of decomposition. In fact there is a general accumulation of testimony that in science, as in religion, some old things are passing away to make room for things more in harmony with the facts of nature. In keeping with the truth of this assertion is the testimony educed in the recent discussions between English gentlemen and the editor of the MICROCOSM. Prominent among these discussions is the "domino" argument between Dr. Hall and Mr. Charles Lunn in the *Monthly Journal* of London, England. In that discussion Mr. Lunn acknowledges that "the wave-theory is imperfect and inadequate to explain all things in sound." So, too, with that great apostle and high priest of the undulatory profession, Mr. Tyndall. Even he admits that there are some things in the science of acoustics which according to the old theory "is in need of revision."

In view of the fact stated and proven in the quotations and citations given in the above paragraph, it is now a matter of interest to know just what the wave-theorists may, can, or must do in their future acoustical writings and teachings. It is quite possible that some of them will pose themselves in the gauze of a flattering delusion that the defects acknowledged are only such as belong to the minor details of the old theory. Should that be their chosen position, they will find themselves at great disadvantage in any further attempt that they may make in its defence. They would thus be obliged to concede that for hundreds of years the science of acoustics has made poor progress in patching up the theory to that perfection required to make it "adequate to explain" some things which have completely baffled the individual and combined efforts of its very chiefest apostles.

And it is right here assumed that no one will deny that those apostolic advocates of the wave-theory are ranked among the intellectual giants of the world. Tyndall, Helmholtz and Sedley Taylor are classed with the most scholarly scientists of the age. It is generally conceded that their natural abilities and scholastic attainments combine to qualify them for the performance of almost any task within the range of scientific possibilities.

Why, then, have the undulatory acousticians failed to remove those "defects" which they acknowledge, and which it is now generally conceded adhere to the wave-theory of sound? The answer is in the fact that the old-theory is *constitutionally* defective. Its basic principle is false. The superstructure is built upon a most monstrous misapprehension of nature's fundamental forces and laws. For these reasons its logical teachings are liable to be out of harmony with obvious facts, while, according to the confessions of its friends, many of its seemingly correct formulæ are at war with strictly scientific truth. No wonder that there is a running to and fro, and mounting in hot haste the fragments of the undulatory steed! No wonder that Mr. Lunn goes tumbling over a set of perpendicular dominoes into the vortex of self-stultification! No wonder that he finds himself forced to say that the "wave-theory is imperfect and inadequate to explain" some things that now challenge the attention of the world's scientific wisdom! No wonder that Prof. Tyndall feels like "blowing out the candle" while he confesses that some parts of the theory are "in need of revision."

In the name of true science, Christian honesty and common sense why do not these men commit scientific suicide and put an end to their own agony by a frank and full acknowledgment that their theory is *radically* wrong? If it were not thus defective to the very core, the "imperfections" and "inadequacies" could and would long since have been removed. Hence the foolishness of any surreptitious attempt to clout the old garment with patches of new cloth. And if such attempts are much longer persisted in, modest intelligence will soon begin to shut its eyes or look in the other direction before the rent is made worse.

But what is it that has thus developed among and in the wave-theorists such a consciousness of "defects" and "inadequacies?" Certainly there was nothing originally in its leading advocates that prompted them in the direction of such general knowledge and concession. These "defects" were never seen until in the light that flashed from the Substantial dynamo. It was "the morn's early dawn" of the new philosophy that made the old theory's darkness clearly visible. The *Problem of Human Life* first stimulated the inquiry which has led to the present state of general dissatisfaction throughout the acoustical world.

The new theory may not be entirely free from defects, but it contains within itself the balm for its own healing. It may be obliged to lay aside some weights which do not belong to its essential constitution, and some besetting errors transferred from the old theory or which ground themselves in the fallability of its founder, but in the end it will triumph gloriously because it is essentially in harmony with the fundamental facts of nature. Even if it should require years to perfect all the details of the new system, it has already flooded the world with scientific light enough to show all honest acousticians that the old theory stands impeached by the testimony of unanswerable facts, and that consequently its walls must sooner or later crumble entirely away before the irresistible catapults of the Substantial Philosophy.

Fremont, Ohio.

Dr. Audsley's New Lecture.

We have just received a copy of Dr. G. Ashdown Audsley's new lecture on sound—The "Substantial Theory *versus* the Wave-Theory of Acoustics"—which we shall commence printing in instalments in the next number of the MICROCOSM or the first number of Vol. IX. This, including the two volumes of the *Scientific Arena*, will make eleven volumes of this publication. This lecture will run well along through that volume, and must prove of the deepest interest to our readers new and old. Dr. Audsley wields a trenchant pen and his clear comprehension of the fundamental distinctions of the Substantial Philosophy makes his writings standard authority on the subject of Substantialism.

HOW TO PREVENT BANK ROBBERIES BY TRUSTED OFFICIALS.

BY THE EDITOR.

Within the past few years in the United States alone, more millions than a busy man could well take time to count on his fingers have been stolen ruthlessly from the savings of confiding depositors who had been induced to trust their hard earned money to the care of bank-officials, who at the very time were plotting and conspiring for a wholesale robbery.

No sooner is the news made public that one bank has been looted and the guilty officials have either absconded, committed suicide, or been temporarily imprisoned to protect them from the just vengeance of the desperate depositors made penniless by the horrible outrage, than the papers are filled with a similar startling disclosure from another quarter, which does not even constitute "a nine days' wonder" till another and another are announced in rapid succession—so rapid that the daily news-reader has no time even to mature his horror at this prevailing aspect of crime, or give it the weight of more than a passing consideration, unless he shall happen to be one of the unfortunate depositors with a loss that will embitter his whole life and that of his dependent family.

The latest outrage of the kind, at Kingston, N. Y., in which some $700,000 were systematically filched from the savings of poor men, women and children, the majority of whom were widows and orphans, has especially startled and aroused thoughtful business men all over the country and forced the inquiry, if it is not possible to invent some system of bank-protection to be inforced by legislation that will render such robberies impossible.

We have cogitated much upon the same question during years past, and we now venture to believe that we have hit upon a plan that is not only new, but that will absolutely prove effective in preventing any such degreé of robbery or defalcation in any regular bank as will impair either the capital or deposits of such institution.

A gentleman of large financial operations said to us the other day, when we had hinted to him the possibility of the invention of such a system of bank-protection as would make depositors perfectly safe, that if we "could suggest such a plan that would be practically feasible, we would not only earn the gratitude of untold millions of future depositors, but would deserve a patent as well as a monument more imperishable than that of granite or bronze." We accordingly unfolded to him our plan with the satisfaction of receiving in return his unqualified indorsement. The plan is about as follows:

Let a general addition to the banking laws be enacted by the next legislature in every state in the union, making it unlawful under forfeiture of charter or other severe penalty for any banking institution to receive deposits from any persons whomsoever, except the directors of such bank shall give evidence to the state inspectors that they are acting with reference to the employés of such institution according to the following system of regulations, namely:

That no person in said banking institution, whose official duty or privilege it shall be to receive, handle, invest, or disburse any of the funds that may be entrusted to it, shall ever be employed longer than *one year at a time*, without at least an interim of a year before being again employed. This forced rotation in office of constantly recurring new men, who will of course come well recommended with abundance of security for the honest handling of funds while they remain, will prevent both time and opportunity for the formation of plots and conspiracies to effect robberies or stealings among such new associates and acquaintances that will amount to anything important, or which their personal bonds will not amply cover.

It was clearly the twenty years of intimate association and co-operation on the part of the two officials in handling the funds of the Ulster County Savings Institution, at Kingston, which formed the temptation and the almost inviting opportunity for a gigantic conspiracy to rob on the part of the Treasurer Ostrander and the Assistant Treasurer Trumpbour.

Without some such lengthy and intimate association, it is perfectly plain that these two infamous scamps—probably honest at the start and possible during the first year of their work—would never have conceived the monstrous conspiracy of robbing the innocent widows and orphans, whose faces had become familiar to them for years as their bank-books had been handed to them over the counter, containing the very money on which many of their lives depended.

Plainly, had the directors of this Ulster County Savings Bank been compelled by law to rotate their cashier, teller, treasurer, assistant treasurer, or by whatever other names these handlers of the peoples' money may be designated in different banks, at least once every year, placing a new man and a stranger to the previous occupant as his critical successor, no one can for a moment suspect that any important robbery of that bank would have been possible. Manifestly, it would be the self-interest of the new official, on receiving his responsible commission, carefully to scrutinize the financial transactions of his predecessor, thus not to be held responsible even for any errors or slips he may unintentionally have fallen into.

To make such a rotation in office doubly effective, it might be the policy of the legislature, for the absolute safety of depositors, to provide that the rotation of the different officials, whose duty it would be to receive, handle and invest funds, might not all take place in a given bank at the same time, but that these changes shall occur at intervals three or six months apart. This might, therefore, require the first term of the cashier or treasurer, for example, after the law shall have taken effect, to extend over the single year, say, three or six months, and by which means the new system of annual rotation could be so mixed as fairly and safely to be inaugurated in a broken succession which would scarcely give time for one new official to become acquainted till another new one would be ushered in.

Let bank depositors everywhere, to whose attention this new scheme of safety-rotation shall be called, spare no opportunity or occasion for impressing the importance of some such system of legislation for bank management upon the would-be member of the legislature who may solicit their votes. Let it become distinctly understood that our banks are all made perfectly safe and trustworthy de-

positories of the savings of the people by thus throwing around their vaults and their systems of book-keeping the annual safeguard of the scrutiny which this official rotation will insure, and there can be no doubt but that double the amount of money would annually be entrusted to the care of such absolutely protected institutions, to what is at present risked by doubting and cautious depositors, with the news of bank defalcations and robberies continually ringing in their ears.

Limited as is our own acquaintance among moderate capitalists, we know of hundreds who have their savings hoarded up in some safe hiding place so as to be sure that they will not be stolen by some bank cashier, teller, or treasurer. These poor men and women reluctantly forego the loss of all interest on their hard earned money, rather than trust it in any bank having the unlimited latitude to steal and rob, which now attaches to every institution of the kind in the land. Nothing, in fact, but the moral honesty of the oftentimes over-tempted official handlers of the peoples' money now stands between the bank-vaults and the financial ruin of tens of thousands of hard working depositors; whereas the enforced system of rotation here outlined, while it will be far better for the banks by inspiring universal confidence will of necessity bring conspiracies to rob to an abrupt termination.

The only practical objection to the working of such a system of rotation among bank employés would seem to be the fact of a bank's not being able to provide skilled help for such a limited term as a single year at a time. This difficulty is only imaginary, since all banks would be under the same restrictions as to the rotation of their officials, and the very help required in one bank, at the end of one of these terms of service, could easily be taken from another bank of help equally skilled and experienced. This annual loss of a situation, say of a cashier or teller in one bank, being enforced by law would rather be a recommendation of his service to a neighboring bank than otherwise, for obvious reasons.

Indeed, as the success of the entire banking system of the country depends almost entirely upon the confidence with which the people can be inspired as to the trustworthiness of such institutions as depositories of their funds, it becomes the duty as well as the interest of every bank-director and bank-stock owner in the land to look favorably upon the new departure in bank-management here suggested, and the new legislation necessary to enforce it.

In this view, we propose sending this number of the MICROCOSM, marked, to every bank official in the country, as well as to the members of all our legislatures, and we only wish we were able to obtain the address of every bank depositor, male and female, in the whole country for like purpose.

PROF. J. I. SWANDER, D. D., PH. D.

We have learned from a friend at Tiffin Ohio, that the recent Synod of the Reformed Church for the State of Ohio has unanimously elected our able contributor, Dr. Swander, to a professorship in the Theological Seminary of Heidelberg University at Tiffin. No man in the Reformed Church is more popular or stands higher than Dr. Swander as a sound and reliable exponent of Christian theology on its broad catholic and scriptural basis. Much of this popularity among the clergy of his church as well as among those of sister denominations, we are proud to believe comes from the wide circulation of his two famous volumes, "The Substantial Philosophy" and the "Invisible World," whose inculcation of the principles of Substantialism has touched a responsive chord in tens of thousands of Christian hearts who earnestly yearn for confirmatory evidence of Christian truth from God's book of nature.

We certainly congratulate Dr. Swander on his unsolicited and unexpected election no less than we congratulate the synod and the university for the wisdom of their selection.

EDITOR.

Our Leading Article This Month.

Our only excuse for so long an article on the sound-controversy in the present number of the MICROCOSM, is that during the remaining short period of our life no time nor opportunity must be lost in placing imperishably upon record the final arguments against the motion-theories of science, by which rising investigators will have no difficulty in vanquishing their most ingenious champions should any such remain. These original discussions have already very nearly if not quite exhausted the subject, so that there now remains no excuse for any man's belief in the wave-theory or his refusal to accept Substantialism who will become a dispassionate student of the twelve bound volumes of our Scientific Library.

CLOSE OF VOLUME VIII.

BY THE EDITOR.

Another *Microcosmic* year has come and gone, and another chapter in the great history of modern scientific investigation has been written and now becomes a part of the record as one of the philosophical land marks for the coming students of physical science. In the investigations and discussions which constitute this volume are recorded some of the most far-reaching and conclusive arguments for the Substantial Philosophy yet presented. These arguments have been called forth as the result of the attacks of physicists upon the principles of Substantialism, or more correctly speaking, in consequence of the desperate necessity on the part of these scientists to make some sort of show of defense for the motion-theories of science in general and the wave-theory of sound in particular.

Among these attempts may especially be noted the efforts of the distinguished author and teacher Sedley Taylor, of Cambridge University, England, who was absolutely compelled in defense of his own text-book on acoustics to try in some way to meet the crushing facts brought out against the wave-theory by Dr. George Ashdown Audsley in the presence of the most intelligent London audiences. Fortunately for the cause of true science, that eminent authority was emboldened, by his being entirely unaware of the real arguments in store against the current

theory of acoustics, to hurl his scientific javelins across the Atlantic ocean in a most disastrous and pitiable attempt to storm the very headquarters of Substantialism at 23 Park Row, New York.

If the reader will turn back to the March and April numbers of this volume he will there see the most sorrowful exhibit of scientific weakness ever witnessed in a great and popular author, who was coerced by circumstances into the trap of publicly defending his own false teaching.

The collapse of that time-honored theory of acoustics under the pen of one of its most distinguished advocates and authorities now living, may well mark this volume as the culminating point in the substantial campaign, since it has been universally conceded on the part of physicists, that if the wave-theory of sound shall be forced to give way to the assaults now making against it, both here and in England, then the entire philosophy of Substantialism must be accepted with the complete break-down of every motion-theory of science. (If anything additional were needed to show the total fallacy of that theory we take pleasure in referring the reader to the leading article in the present number.)

It involves even matters of still greater importance to the world than this mere revolution and reconstruction of the theories of physical science. If the wave-theory of sound, as the chief motion-theory of science shall prove not correct, then every form of physical force throughout nature must of necessity be accepted as a substantial though immaterial entity —as really an objective thing as are the material bodies upon which such force may act. And it follows, if the physical forces, such as heat, light, sound, electricity, magnetism, gravitation and cohesion shall turn out to be real forms of *immaterial substances*, as the collapse of the wave-theory of sound must demonstrate, then by every analogy of nature and science the vital, mental, psychical and spiritual forces which actuate and control our bodies are also substantial entities, and as such are constitutionally endowed with the possibilities of an immortal existence.

No clergyman who accepts the motion-theories of science or any one of those theories, can present a single rational or logical argument against the atheistic materialist who extends this same motion-doctrine to the soul or mind, or life, making it but the vibratory tremor of the brain and nerve particles. Never was there given an answer to the doctrine of Haeckel, that the soul-force in man is but a mode of motion the same as are the forces of heat, light and sound, till it was given in the "Problem of Human Life," by first overturning the wave-theory of sound as the mother and foundation of all the motion-theories of physical science.

Up to that time the scientific and truly philosophical clergy throughout the world, though appalled by the overwhelming logic of this atheistic argument against human immortality, suppressed their fears and rising doubts, hoping that there was some possible way out of the apparently resistless conclusion that as death necessarily ends all material motion connected with the human organism, therefore death ends all conscious existence if the motion-doctrine be true. Not one single clergyman of the whole world for one moment could bring himself to the thought of questioning the correctness of the motion-theories of science as the central and only successful position of attacking this atheistic belief that the soul is but a mode of material motion that must necessarily cease to exist at death. The first intimation that ever appeared in print, as all now concede, was given to the world by the writer, and which as now turns out opened a clear highway out of the tangled wilderness of materialistic science in which Christian evidence, based on natural analogy, virtually had become lost. Every blow that has been struck in the MICROCOSM and *Scientific Arena* since that first assault in the "Problem of Human Life," has but leveled down more trees and cleared away more undergrowth in this tangled forest of infidel science, thereby making the highway of natural analogy in support of religion clearer and broader for the advocate of scientific and philosophical Christianity.

Do the clergy appreciate this timely assistance on the part of a tireless investigating layman? We answer yes, as our enormous correspondence from all parts of the English speaking world goes to prove. They begin to see in earnest, that without this natural and philosophical analogy based on the logical necessity of the substantial character of all force there can be no sure foundation in God's book of nature for a belief in the human soul as a substantial entity capable of immortality, or even of a moment's existence after the breath leaves the body and its material motions cease. They begin to see that in this crusade against the motion-theories of modern science we have not only founded the *philosophy* of Substantialism but the *theology* of Substantialism as well; for a theology or ecclesiasticism which can not point to a single direct passage in God's book of nature which goes to confirm the ecclesiasticism of verbal revelation, might as well close its pulpits and its churches so far as any impression to be made upon cultivated scientific minds is concerned.

It is not, then, at all strange that intelligent

clergymen, particularly those scientifically inclined, should hail the rise of the Substantial Philosophy as a new star of Bethlehem to guide the Christian traveler on his way through the wilderness of life. It is this aspect of Substantialism—bringing as it does natural analogy and natural philosophy to the aid of Christianity in its battle with materialistic science—which commends it to so many Christian clergymen in all parts of the world, and which fills our files with hundreds of letters in almost every mail breathing thanks to that Providence which ever permitted the "Problem of Human Life" to see the light of day.

Had this volume of the Organ of the Substantial Philosophy, now just completed, contained no other discussion than the class of articles referred to utterly annihilating the wave-theory of sound, thereby divorcing science and materialism while indissolubly wedding true religion and true science to walk hand in hand forevermore, the volume should have a priceless value to all who really hope for personal immortality in the great beyond. But this volume is replete with other matters of scientific importance which alone should make it worth many times its cost, and which should induce every subscriber to send at once for a bound copy for perpetual preservation in the family library, at the regular price $1.

To our large list of subscribers we beg to say that *Volume Nine* will begin at once, and that the first number will issue as usual in the first week of December proximo. We can safely promise and do hereby announce some startling disclosures in a scientific way during the progress of that volume—disclosures which will, no doubt, surpass anything announced since the issue of the "Problem of Human Life."

The field for substantial work has but just been scratched by the harrow-teeth of scientific investigation. The soil, though filled with numerous roots difficult to remove, and obstructed with some boulders, is, nevertheless, the finest and most substantial ground that has ever been plowed or that has ever yielded a crop. We intend to remove and burn every root and to use the boulders, like our Connecticut farmers, to build around Substantialism a fence that will endure forever. Will our readers aid us in this work of renovation and reconstruction?

We ask no gifts, loans or donations. We have gotten way past that stage of our journalistic career, thanks to the lucky star that has guided our little bark during the past three years. We propose that for every fifty cent subscription received at this office, we will return a full-weight silver dollar's worth of Microcosmic reading before the year shall expire. So let no reader procrastinate in making the investment, but send on for Vol. IX. with as many new names as possible. We are ready to open our new books for a new era in Substantialism.

With feelings of profound gratitude for the loyal manner in which our old subscribers have stood by us during the ten years of our journalistic efforts, and with renewed energy and resolution to prosecute the work as never before, we close the present volume with an affectionate but very brief adieu.

VELOCITY OF LIGHT—HOW SHOWN.

Editor MICROCOSM:

It has been demonstrated (?) that light travels at a velocity of about 186,000 miles per second, and that it consequently takes about eight minutes for a ray of light to pass from the sun to the earth; and about thirty times as long, or four hours, to pass from the sun to the planet Neptune.

But how can we prove this to be a fact?

It has been demonstrated in the case of electricity, which is closely allied to light, that the greater the frictional resistance the less its velocity; also, that all material substance interposes a certain amount of resistance to passage through or over it.

By inference then, if there be no matter all resistance will be removed and, consequently, the velocity will be augmented; though to what extent we may be unable to determine.

In all our investigations toward determining the velocity of light, we have two difficulties to contend with:

We have a line, at one end of which is a resistance offered by an unknown quantity—our earth's atmosphere; while the greater portion, and that most inaccessible to our investigation, contains a lack of resistance equally unknown and also unknowable. How then can we determine the velocity of light where we have two different conditions of the same question, and both phases, perhaps, equally insolvable?

Whichever theory, whether undulatory or corpuscular, we take, I think the difficulty remains the same. The resistance offered by the air must diminish the velocity of light in either case. WM. BECKLER.

Escondido, California.

REMARKS BY THE EDITOR.

Thousands of otherwise well-informed men, like Mr. Beckler, are in the dark on the subject of light—especially upon the scientific method of demonstrating its velocity. The matter is so easily explained we must take the space to give the method to our readers.

When the earth is between the sun and Jupiter, or at the point nearest that planet, it is an easy thing for the astronomer at one of our great telescopes to note the exact instant when one of Jupiter's moons becomes eclipsed, or disappears behind the body of that planet. Now it is evident that this moon has a regular periodic revolution around Jupiter, like our own moon around the earth, and that it will

be eclipsed to the same observer at precisely the same instant of time, if the earth is in the same direction from that planet, whether at a greater or less distance, provided the velocity of light is instantaneous.

But, the astronomer finds, when the earth has traveled a little more than half a year and has thus reached the side of the sun opposite the planet, being now 190,000,000 miles farther from Jupiter than before, that this moon of Jupiter is sixteen minutes later in disappearing behind the planet than when the earth was on the other side of the sun, or 190,000,000 miles nearer Jupiter. This is considered for all practical purposes a sufficiently near demonstration that it takes light eight minutes to travel from the sun to the earth—95,000,000 miles.

Of course the trifling thickness of our atmosphere, as compared with the whole distance under observation, is such a bagatelle that it is considered not worth taking into account. If there is any resistance to the travel of light through air it is evidently too small a factor to be calculated by any means within human reach.

THE GODS UNVEILED.

BY PROF. I. N. VAIL.

No. 1.

We enter the boundless waste of mythology through apparently an impenetrable tangle of moss-covered fiction. The outlying prospect, though a chaos, is by no means a desert, but an utter wilderness of world-thought, darkened by the tantalizing shades of unnumbered centuries. Into this region of "no light, but rather darkness visible," let us now carry the lamp of the "Annular Theory," for here we are to re-discover the glories of a forgotten world.

We must go back far enough in time to see the earth in its swaddling bands of annular vapors, just as we see the planet Jupiter to-day. A darkly striated and variegated canopy, ever changing as the earth revolved in the full light of the sun, shut out every other view from the gaze of man. Dense columns, black as night, towered up from the east and west, and joined their titan hands in the zenith, just as they do in Jupiter's annular canopy to-day. Between these columns, or giants, stood light vapor-columns, shining like torches of eternal light. So that in the dark world of mythology, the physical world enjoyed an era of eternal day. The optician will have no difficulty in understanding how the earth-enveloping vapors were brilliantly illuminated by the diffusing and tranfusing tendency of solar light.

The earth was simply surrounded by bands, broad and deep, *some of which carried the mild, mellow light of eternal day all around the globe.* These are facts of easy occular and experimental demonstration. So that I say, that just as surely as this planet has followed in the tread of philosophical world-building, so surely was it surrounded by a light-giving and heat-supplying ocean of vapors; and was, in the fullest sense, an Eden world, without change of seasons and without the alternation of day and night as we now see.

Why should man be informed by the voice of Deity, immediately after the deluge, when the canopy had fallen and the rain-bow became a possibility and a reality, that henceforth summer and winter, seed-time and harvest, *and day and night* should alternate forever. We now know why. They could not alternate before. Neither could there be a rain-bow with that annular curtain before the sun.

It is near high time that all men should begin to realize the fact that the Mosaic cosmology stands upon this rock, and stands there forever. But what a measureless view is now before us! The plant did not receive the direct action of the solar beams, and the consequence is very obvious. Unless the sun shines upon the plant, it can not reproduce itself. Seeds grown without the vitalizing aid of the solar ray will not germinate, but the plant will grow on and on, an emblem of eternal life. The non-vitalization of plants means life, but its vitalization means fruit-bearing, *reproduction* and *death.* Man lived under a canopy that sifted this vitalizing and death-dealing chemism from the solar beam. In a green-house world the plant and all animated nature would bend under the beck of this inexorable law. If the ripening process ever planted the elements of death in the plant, *it also planted them in man's physical being!*

What, then, does it mean, that immediately after man was deprived of his original Eden home, the God of Nature informed the race that it should now begin to reproduce itself? "I will *multiply* thy conception," etc. (see Gen. iii. 16). What does it mean that not until man's Eden life was taken from him that he begat offspring? What does it mean that at this very time this sentence of death was carried into execution? And what does it mean that during all that period from the so-called expulsion till the fall of the deluge-waters and the advent of the rainbow, man's reproducing capacity was so inactive? And why did the latter become more active immediately after the water's fell? There is but one answer, and that answer is backed by the God of Nature in all his dealings with the universal cosmos: man's Eden home was the green-house world, protected by a perfect canopy of vapors, through which the sunlight was *shorn of its death dealing actinism.* His Eden was taken from him by a *thinning* of those vapors and a transmittance of more solar light—by a fuller glow of the cherub flame.

Man's longevity in the antediluvian period, then, proves the existence of a canopy or veil before the sun. All Nature unites in one persistent acclaim that if man ever reached the age of 800 or 900 years, the maturing power of the solar beam was held in check. I say, then, that under a perfect annular canopy man was naturally immortal. My Bible tells me man was immortal in Eden, and I am thus forced to claim a perfect sun-sifting canopy as the physical cause.

I wish now to direct the reader's attention to one more Bible fact before we enter upon the mythologic record. It is the inherent evidence traced all through this ancient legend that there was a change in man's environment. There is a hint of this change in almost every scene; and sometimes it is too plain to be misinterpreted. It is seen in the opening act of creation, when the *earth* was waste and dark-

ness covered the "*deep*," through which light broke forth at the command of Deity; and is seen as the clear, unveiled sun, when the last remnant of the "great deep" was cast down to the earth and the rainbow arched the firmament as man's eternal sign of safety. Nothing can be plainer than the fact that the Deity now made a "*covenant with the whole earth*" that it should be *exempt as it never was before.* Now subject this act of exemption to the test of law, and where do we land? We are simply impelled to the conclusion that the earth was again lifted to a higher condition, as it had been again and again, by the self-same potent cause. That a deluge, vast beyond conception, did come under the former condition, but could not afterwards. That man did live to an extreme longevity before the covenant was made, but could not afterwards. These and numberless other conditions that underwent a complete and permanent change, all point to the "breaking up" of the "waters above the firmament."

I mention these evidences of change that the reader may be able to carry them as parallel testimony through our new field of thought.

The father and progenitor of the gods among the ancient Greeks and the still more ancient Pelasgians, was Uranus, whose very name (Ουρανος—the sky, or heaven) means the all surrounding heaven, and is identical with the Vedic *Varuna*, the vault or sky. But there is nothing more emphatic in ancient Grecian thought, than the claim that after Uranus had reigned and was worshipped as a god for unknown time, *he was banished from on high.* That the ancient empire of this parent of deities was usurped by Chronos, the god of time. The same is well known of Varuna, the heavens of the ancient Hindoo, and *I find it as an ancient world thought everywhere, that the first genius or spirit of the heavens was dethroned or banished, or put to death.* It is a record of that stupendous change so graphically figured in Genesis. Uranus dethroned! *The ancient heavens banished!!* It is not necessary, it would seem, for me to tell the most ordinary thinker, that the only heavens that could be banished, was a revolving or annular canopy. The only celestial genius that could be dethroned, was the presiding spirit of the hovering waters. The person that can not see, on the very threshold of ancient mythology, the collapse of supra-ærial vapors, is blind indeed. *Uranus was then, the annular canopy, and I here produce the* KEY *to all ancient mythology.* With it we will open the door to this magnificent new world, and we challenge the thinkers of earth to close it again.

Elsinore, Cal., September 10, 1891.

THE PHILOSOPHY OF MIND-READING.

BY THE ASSOCIATE EDITOR.

Our attention has been drawn lately to the subject of thought transferrence from the mind of one person to another, and we have seen several experiments performed in which we took an active part, and have heard from many of our acquaintances of numerous other mind-reading seances in which remarkable feats were performed by persons who of themselves knew nothing of what they were doing, but were simply the passive instruments of a second person who, by concentrating his thoughts on a certain object, transferred or communicated these thoughts sensibly from his own mind to another, by the mediumship of the clasping of hands tightly.

This subject of mind-reading has been prominently before the public for a number of years through the apparently wonderful performances of Bishop, Johnstone and Brown, who claim to be able when blindfolded, to find an object wherever it may be hidden, by taking the hand of some mentally sensitive person who knows the location of the object. It is claimed by these men that pins and pennies have been placed miles away in places unknown to them, and that they have been found by taking the hand of some person who knows their location. They also claim to have opened safes having very difficult combination locks which have never before been seen, or heard of by them in this same way. The philosophical basis of all their claims being that thought is transferred from mind to mind through the arms and hands of the operators.

Many inquiries having come to us from our subscribers for explanations of these seemingly wonderful things, on the basis of the Substantial Philosophy, we decided to take the matter into consideration. Immediately we saw that if the doctrine of mind-reading was at all true in the sense intimated by the numerous class of experiments just noted, that the only possible explanation would be in making mind-force a substantial entity which could be conducted by means of vital force through the bodies of men, and transmitted to the brain, and there interpreted. But though this explanation would beautifully solve the mysterious problem, we had yet to learn that a totally different kind of explanation was necessary.

Having become acquainted with a very able and scholarly gentleman in whose ability we have great confidence and whose whole life has been devoted to scientific work, and who believed thoroughly in mind-reading and claimed ability in that direction for himself, we determined if possible to test the matter and learn positively the truth or falsity of the claims. Accordingly in our editorial offices Dr. Hall, the before described gentleman and the writer met one evening and the seance began by Dr. Hall offering a $10 gold piece if the gentleman would find a pin where he should place it, the only condition being that the gentleman would submit to being blindfolded in another room while the pin was being hidden. This being agreeable Dr. Hall and the writer placed the pin in a very difficult location and the writer then joined the scientific gentleman, whom we will describe as Mr. B, in the inner office where Mr. B was blindfolded. We then came inside, Mr. B holding the writer's hand, the writer having his mind ardently concentrated on the location of the pin. To the

surprise of all present Mr. B immediately went in the direction where the pin was hidden and felt all around it, but did not find it as it was behind the heat-radiator and very difficult to get at.

This satisfied us that there must be some support for the claims of the mind readers. The writer was then induced to make the attempt and again surprised himself and Dr. Hall, by finding three distinct objects, after being blindfolded in the inner office and taking hold of the hand of Dr. Hall and Mr. B alternately in the three trials. He found a book on a far off corner of a table, took the spectacle case from Dr. Hall's pocket and picked up a broom that was lying on the floor, all of which things he had no knowledge of before receiving them through the hand of the operator on entering the room.

These experiments and results are a fair sample of all those honestly accomplished by mind-readers, and we here make the broad statement that there is nothing occult or mysterious in the whole performance, and that all such claims made for so-called mind-reading are fallacious. There is no mysterious conduction of mind-force through the arms of the operator; and any such idea arises from an incomplete examination and understanding of the subject.

The impressions which are received by the mind are made through the five senses and no impression can be made upon the mind in any other way. In speaking we convey our ideas and thoughts to another by means of the sense of hearing; we can convey our thoughts by the sense of sight as in the mute language of signs, or by feeling, as is the case with the blind who can read raised letters with their fingers. Impressions are made upon the mind also by taste and smell. The senses of hearing and seeing being more adapted to distance and taking in a greater amount of impressions are of more value, the other senses requiring immediate contact with the exception of smelling.

Unless through the medium of one of these senses, no impression can be made upon the mind, and as there is undoubtedly an impression made as shown by the experiments described, it must be attributed to one of the senses and this we have decided to be the sense of touch. By this we mean that the general thoughts of the person whose mind is being read, to use the popular expression, is transferred to the other by means of the mechanical or muscular movement of the hand. We do not intimate for a second that this is intentionally done by honest experimenters, but on the contrary we positively know that in our personal experiments before referred to, we were honestly seeking for the truth and any muscular impressions given were unintentional and unavoidable.

The governing and controlling power of the mind over the actions of our bodies is a principle of constant observance. We know that when the mind is troubled by some harassing difficulty the face is contorted by muscular action so that the trouble is immediately noticed, when on the other hand some pleasant or amusing circumstance occurs to the mind, the face and the eyes beam accordingly. Thus anger or pleasure of the mind are portrayed by the muscular action of the body, not by any intention or desire on our part, but unavoidably so unless the mind is particularly and forcibly directed against such manifestation.

We have often noticed in our own experience, seeing an intoxicated man walking near the curb-stones on the streets of the city, or near basements, reeling from one side to the other, how we have involuntarily turned our whole body as we saw the man approaching a dangerous spot. The only explanation of this is the strong action of sympathy which the mind put forth, exercising a reflex action on the nerves and muscles of the body.

This is precisely the operation which occurs in the experiments on mind-reading. One person, having his mind definitely and ardently fixed upon a certain object in a certain location, guides and directs the course to be followed by the other man and enables him to settle on the object by the involuntary muscular action of his hand, which is in tight contact with the hand of the second person. For example, when the so-called mind-reader attempts to follow a direction away from the object to be found, a restraining influence is felt from the hand of the operator, which influence is the result of the concentration of his mind in the opposite direction, and which he can not help giving expression to by his nervous movement. When the mind-reader has reached the location he feels immediately a steadying, firm grasp, which, if his perceptions are acute, will indicate that he is in the right place, and it is then, of course, an easy matter to pick up or find the definite book or other object which was settled upon.

The story is told of a dog, owned by a celebrated Frenchman, which would bark upon a certain number, from 1 to 25, being called, the number being previously decided upon by any member of the party. His master would call in rotation, beginning at 1, and as soon as the number decided upon was reached the dog would bark. The explanation of this wonderful performance can not be made by attributing to the dog an ability to read the minds of the men, but is much more satisfactorily and reasonably explained by a very acutely developed sense of perception, by virtue of which he noticed, in the eye of his master that involuntary muscular action which could not be avoided when the correct number was called.

To decide positively whether our analysis of this subject is correct or false, let there be a thin cord of one or two yards long hanging loosely between the mind-reader and the one whose mind is being read, or if it should be claimed that the vital force of the body is necessary to the transmission of the thought, let a young child who has no knowledge whatever of the experiment or of its philosophical bearing be placed between the mind-reader and the person whose thought is being read, in order that any possible conveyance of mechanical or muscular or nervous impressions will be prevented. We prophesy that under either of these conditions such experiments will fail totally.

We might pursue this subject and explain how combination safes are opened through the interpretation by the mind-reader of this same involuntary muscular hand action, which results when the different numbers or letters are reached, and we might also explain all the other legitimate and honest phenomena connected with the subject of thought transferrence, but space does not permit any further elucidation, and it would be useless, as the reader can easily make for himself the appli-

cation of the general principle of muscular action resulting involuntarily and unavoidably from the action of the mind to the peculiar circumstances of the experiment. We will simply say, on this safe-opening mystery, let both parties in the experiment be blindfolded, so that the person whose mind is being read can not see the numbers on the lock when they are reached and, therefore, can not give any muscular assent when the proper place is reached, and Johnston and Brown would herald no further victories in this realm of mystery. Being blindfolded will not prevent concentrated thought on the numbers of the combination and, therefore, can not be in any way objectionable to an honest experimenter.

We do not care here to give any further consideration to the claims of blindfold letter reading and similar accomplishments, except to say that we do not believe they are honestly accomplished. If any person can demonstrate their truth to us we shall be very glad to rescind our statement.

No intelligent information can possibly be conveyed through any of the senses unless some code of impressions has previously been agreed on, therefore all experiments which pretend to prove that intelligent consecutive information is transferred from mind to mind by the simple taking hold of hands we can not believe honest till further proof is manifested. Of course there are certain intuitive signals which are recognized by our continual experience, *e. g.*, if a mute were to take your hand and hold you firmly you would immediately understand he wanted you to stop, if he pushed your hand, he meant you to go on, or if he pulled it towards him it meant to follow, but none of these actions on his part would convey to your mind any impression additional to that of simply stopping, or going away, or following. Whatever else he might have on his mind, no matter how ardently concentrated his thoughts might be, and no matter how sensitive your state of perception might be you could get no further consecutive information.

What we have here said indicates very forcibly, definitely and practically the influence which the mind exerts over the body. We have all known of persons who have actually brought upon themselves severe sickness by continual fear and worry, lest they should be effected, and conversely we have heard of persons who have been cured of severe maladies by mental healers, who do nothing more than impress upon the ailing person the fact that he is well and only needs to exercise strong faith or belief to that effect. In such cases where a cure is effected it is due solely to the mechanical influence of the mind in exhilarating the body and raising it from its lethargic condition to one of muscular activity.

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EDITOR.

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