The Origin and Problem of Life

A PSYCHO-PHYSIOLOGICAL STUDY

BY

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PREFACE

THE objections likely to be taken to the opinions I have expressed in this little work may perhaps be summed up in words spoken by Professor Schäfer in his presidential address to the British Association in the year 1912. He said: "If the terms of life given in the purely mythological part of the Old Testament were credible, man would in the early stages of his history have possessed a remarkable power of resisting age and disease. But, although many here present were brought up to believe in their literal veracity, such records are no longer accepted even by the most orthodox of theologians, and the nine hundred odd years with which Adam and his immediate descendants are credited, culminating in the nine hundred and sixty-nine of Methuselah, have been relegated, with the account of Creation and the Deluge, to their proper position in literature."

It is not by any means a difficult matter to cast doubt upon anything. The theory of Ontogeny as propounded by Haeckel, and at least partly upheld by men of scientific eminence to-day, is destructive of beliefs without giving anything that the mind does not instinctively reject in return. We are told that the Biblical account of Creation is relegated, by inference, to the waste-paper basket, and are offered the alternative hypothesis that all forms of life generated spontaneously from lifeless inorganic matter, and that although the original ancestor which generated in this remarkable manner was a *permanent* imperfect cell without structure, it, in an even more extraordinary way, ceased to be permanent, and grew, indifferently, into plants, tadpoles, birds, elephants, and men.

My own research work has begotten in me rebellion to this theory, and I venture to submit some of my reasons therefore to thinking men and women.

A. E. BAINES

London

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The Origin and Problem of Life

PART I

ORIGIN

It is a relief sometimes, especially when advancing years awaken us to a sense of our limitations, to get away from the hard scientific fact, and occasional illogical deduction, of the text-book and do a little thinking along independent lines. There are many things of vital importance about which we know nothing and can obtain no information, and to guide us in the interpretation of natural phenomena and the sifting and weighing of evidence for and against any hypothesis we have only our intelligence and commonsense, unless we admit the possibility of guidance and instruction from some supermundane source.

Education consists, mainly, in the absorption of facts discovered by other people, and in ability to compare things we have seen; while scientific attainment is simply successful specialisation in one or more branches

of that education. What we have never seen or never had explained to us we are not capable of understanding. Commonsense is merely the faculty of comparison highly developed, or possessed in an unusual degree.

A few simple experiments will serve in illustration.

First we will take a strip of paper. It has three dimensions, *i.e.*, length, breadth, and thickness. And it has two sides, because we can put a mark such as a cross upon one side and another mark, such as a circle, upon the other. Therefore, we know it has two sides, and we will call them *a* and *b* respectively.

If we gum the ends of the strip of paper together, thus :—

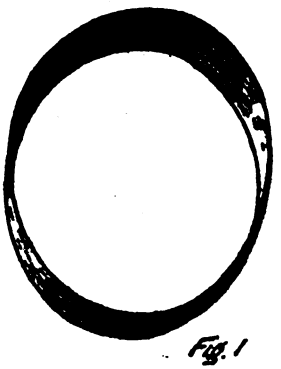

FIGURE 1.—A SIMPLE LOOP OF PAPER

and imagine a wingless insect to be upon side *a*, we can be quite sure it cannot make its way to side *b* without crawling over the edge of the paper. It is impossible, and we should have no hesitation in declaring it to be so.

But it is not impossible. It is, in fact, easy. All that requires to be done is to take a half-turn in the strip of paper before the ends are gummed together, in this way :

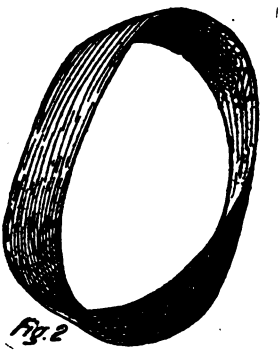

FIGURE 2.—THE LOOP WITH A HALF-TURN IN IT.

Something has happened. Perhaps we have introduced a fourth dimension—curvature—but, anyhow, the insect can now pass from side *a* to side *b* by keeping to the path; there is no longer any occasion to crawl over the edge.

Such things are the opportunity of the

theorist. It may be postulated that the paper is now one-sided instead of two-sided, and if we had recourse to the higher mathematics we could no doubt explain the problem to our own satisfaction if to no one else's. But to the great majority of people the phenomenon would be new and therefore incomprehensible; our intelligence and commonsense would be at fault. But if some learned professor gave a solution which looked at all feasible it would pass into the text-books in the ordinary course and live out the long or short life accorded to theories in general.

Voltaire was an atheist of a very pronounced type. He scoffed at religion, but is reported to have said that if anyone could tie a knot in a piece of string that had no free ends he would accept the New Testament as a whole, because the knot would be a greater miracle than any of those attributed to Our Saviour, and would, moreover, be proof of their genuineness.

If you take a slip of paper, or ribbon, a foot or so in length by half an inch or less in breadth, give it three half-turns before the ends are joined, and then cut it down the centre throughout its length with a pair of scissors or a knife, the knot, said by Voltaire

to be impossible of accomplishment, will be in evidence.

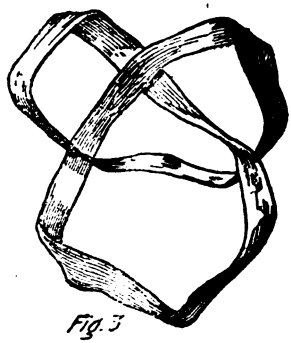

FIGURE 3.—KNOT IN A STRIP OF RIBBON THAT HAD NO FREE ENDS.

Why, or how, it happens I do not know, but having done it or seen it done, we must admit its feasibility. We did not see, for instance, the miracle of the awakening of the dead, but it was the privilege of others to do so, and they testified to its occurrence. Voltaire did not witness the experiment just described, but we who came after him know his judgment to have been at fault. A coming generation may similarly criticise us. Are we entitled to disbelieve in anything and everything we fail to understand? We have been told about miracles on very good authority, and the only bar to our unqualified acceptance of them is our inability to fathom how they were done. Perhaps that

will be made clear to us, after we have found out all about the fourth dimension—and not a few other things.

If by miracles we mean the work of God, we have not far to look for them; they surround us and are contained within us. Our part is to endeavour to comprehend them.

It behoves us, if only for the reasons I have given, to keep an open mind, but when it becomes a matter of the theoretical explanation of that which no one has ever seen or had described to him, we must beware of scientific as well as non-scientific imagination and be slow to accept any hypothesis which rests merely upon the foundation of a great name. Our common-sense may not be worth very much, but it is worth something, and mine, at any rate, refuses to acknowledge Simian descent or to accept the theory of evolution propounded at length by Haeckel, but really first set forth by Wolff, and elaborated, in 1744, by Jean Lamarck, in a work entitled *Philosophie Zoologique.*

In this, Lamarck held that there was no essential difference between living and lifeless beings—a statement repeated in almost the same words by Professor Schäfer a few

years ago. "Life," wrote Lamarck, "is only a physical phenomenon. All the plants and animals, with man at their head, are to be explained, in structure and life, by mechanical or efficient causes, without any appeal to final causes, just as in the case of minerals and other inorganic bodies. . . . All the different kinds of animals and plants which we see to-day, or that have ever lived, have descended in a natural way from earlier and different species; all come from one common stock, or from a few common ancestors. These remote ancestors must have been quite simple organisms of the lowest type, *arising by spontaneous generation from inorganic matter*." The italics are mine.

There is no falsehood, nor any fallacy, which is so difficult of disproof as the falsehood in which there is a modicum of truth. The fallacy in this case I believe to be that all forms of life arose originally by spontaneous generation from inorganic matter, and the truth that of the different kinds of animals and plants which we see to-day many have descended by evolution from earlier and similar, but possibly different, species.

Spontaneous generation is the fatally weak

link in the materialistic chain of reasoning. On the one hand we are asked, on the authority of the Scriptures, to believe that God created all living things, and on the other that they arose from something that had no life. To support belief in the work of God there is a mass of evidence; in corroboration of the other view there is isolated and admittedly fallible human opinion.

Some writers urge that if we believe that God created all forms of life we must consider them as having been made like toys in a shop. But toys are not modified by different conditions of environment, nor do the manufacturers of such toys create all sorts of different conditions to bring modifications about, conditions of which the toys may avail themselves. In Nature we have a basic principle and variety of structure, and that structure is again susceptible of almost infinite variation, modification and change. But the change is not from violet to sunflower, from turnip to rose, or from tadpole to eagle. The seeds of, for instance, the geranium, the gloxinia, the pansy, if sown in different soils or treated with manures of varied chemical composition, produce hybrids which, so far as colouring

and size of bloom are concerned, often present new features. But the plants do not cease to be geraniums, gloxinias, and pansies, and become something else of altogether another structure, any more than a child's drum could by evolution be transformed into a rocking-horse.

Haeckel was not by any means certain of his ground. In *The Evolution of Man* he wrote : " The first of our documents, paleontology, is exceedingly incomplete . . . . the second chief source of evidence, ontogeny, is not less incomplete . . . . finally, the third and most valuable source of evidence, comparative anatomy, is also, unfortunately, very imperfect."

That is the usual apology for untenable theory.

According to Haeckel, the first living things were the wonderful organisms we call the monera. " They are the simplest organisms known to us. Their whole body consists merely of a simple particle or globule of structureless plasm."

That is not, necessarily, a statement of fact. It should be qualified by the words " so far as we know."

" The soft slimy plasm of the body is generally termed protoplasm . . . The

earlier and lower stage are the unnucleated cytodes, the body of which consists of only one kind of albuminous matter. . . The monera are permanent cytodes."*

If the body consists of only one kind of albuminous matter and the monera are permanent cytodes, evolution could not change them.

"However carefully we examine" (this plasm) "with our finest chemical reagents and most powerful microscopes, we can find no definite parts and no anatomic structure in it. Hence, the monera are literally organisms without organs; in fact, from the philosophic point of view, they are not organisms at all, since they have no organs. They can only be called organisms in the sense that they are capable of the vital functions of nutrition, reproduction, sensation, and movement."

The word *only* is quaint.

Commonsense is sufficient to assure us that if they are capable of vital functions they are not structureless. That their structure cannot be detected by us does not disprove its existence. We only see what we look for, some particular thing or things that we have, consciously or unconsciously, pictured to ourselves. The logical outcome

* Cytodes are imperfect cells.

of the argument is this : " We have not, so far, been able to find evidence of definite parts or anatomic structure in the monera."

That is the foundation upon which the materialistic theory of evolution has been erected. Because we are unable to see or understand it, the thing cannot be there.

" Our phylogenetic interpretation of the ovum," says Haeckel, " and the reduction of it to the same ancient amœboid form, supply the answer to the old problem : " Which was first, the egg or the chick ? " We can now give a very plain answer to the riddle with which our opponents have often tried to drive us into a corner. The egg came a long time before the chick. We do not mean, of course, that the egg existed from the first as a bird's egg, but as an indifferent amœboid cell of the simplest character."

Indifferent, perhaps, as to whether it became an egg or not !

" The egg lived for thousands of years, as an independent unicellular organism, the amœba. The egg, in the modern physiological sense of the word, did not make its appearance until the descendants of the unicellular protozoon had developed into multicellular animals and these had under-

gone sexual differentiation. Even then the egg was first a gastræa-egg, then a platode-egg, then a vermalia-egg, and chordonia-egg; later still acrania-egg, then fish-egg, amphibia-egg, reptile-egg, and finally bird's-egg."

I have no doubt that the War produced a few other, and previously unknown, varieties of egg, but, seriously speaking, why, in a continuously progressive process of evolution, is a full-stop come to at bird's-egg? Why not some further advance—other than in price? I read a short time ago of a chimpanzee having the good sense to spread a sheet of paper upon his mistress's lap before he sat upon it, and in this there are possibilities. So Haeckel considered, by inference, there are in eggs. If all forms of life originated from a simple unicellular organism and that organism originated by spontaneous generation from inorganic matter, it would be more consistent with theory to acquit the inoffensive ape of complicity in the matter of man's descent, and, waiving a few evolutionary stages, bring in a verdict of guilty against the too frequently offensive egg.

No one could accuse the late Professor Huxley of being other than a Christian.

In a lecture upon "*Animal Automatism*," he said: "I really have no claim to rank myself among fatalistic, materialistic, or atheistic philosophers. Not among fatalists, for I take the conception of necessity to have a logical and not a physical foundation; not among materialists, for I am utterly incapable of conceiving the existence of matter if there is no mind in which to picture that existence; not among atheists, for the problem of the ultimate cause of existence is one which seems to me to be hopelessly out of reach of my poor powers. Of all the senseless babble I have ever had occasion to read, the demonstrations of these philosophers who undertake to tell us all about the nature of God would be the worst, if they were not surpassed by the still greater absurdities of the philosophers who try to prove there is no God."

In the course of another lecture, delivered some fifty years ago, upon *The Physical Basis of Life*, Huxley asked the question, "What is the origin of the matter of Life?" and proceeded to answer it in these words: "Protoplasm, simple or nucleated, is the formal basis of all life. . . . Thus it becomes clear that *all living forms are fundamentally of one character*."

That, to my mind, is a view we should subject to very careful examination.

Roughly speaking, a drop of nucleated plasm may be compared to a shell-less egg, the nucleus being the yolk and the plasm the white thereof. And all that these great scientists could tell us of the origin of life was that from one species of egg, which sometimes had no yolk, all living forms originally arose; one particle of protoplasm growing into a tadpole, another into an elephant, a third into a tree, a fourth into man, and so on through the interminable gamut of Creation.

Let us make another call upon our commonsense.

In the beginning of things mundane the world was in a state of incandescence.

As Figuier says, in *The World before the Deluge*: "During the primitive epoch the temperature of the earth was too high to admit the appearance of life upon its surface. The darkness of the thickest night shrouded this cradle of the world; the atmosphere probably was so charged with vapours of various kinds that the sun's rays were powerless to pierce its opacity. Upon this heated surface and in this perpetual night organic life could not manifest itself. No

plant, no animal, then, could exist upon the silent earth. In the seas of the epoch, therefore, only unfossiliferous strata were deposited. . . . Nevertheless, our planet continued to be subject to refrigeration on the one hand, and, on the other, continuous rains were purifying its atmosphere. From this time, then, the sun's rays, being less obscured, could reach its surface, and, under their beneficent influence, life was not slow in disclosing itself."

We can fix with approximate accuracy the temperature at which life became manifest, because protoplasm dies at about 45° Centigrade, and therefore no form of life which had its origin in protoplasm could have existed until the earth had cooled down to that temperature.

And then where did the plasm in all its diverse, its tens of thousands of diverse forms, come from? I say diverse forms because of the innumerable seeds representative of plants and of the germ-cells of fish, bird, reptile and animal no two are exactly alike, but each contains, in embryo, the plant or creature it is designed to produce, and there is no evidence to show, or at all events to prove, that there were not as great a variety of living things in the early

days of life as there are now. What evidence there is, in the sediment of the oldest seas, and in the vestiges that remain to us of the earliest ages of organic life on the globe, that is to say in the argillaceous schists, goes to show that there were then both plants and animals of advanced organisation.

I ask again, where did these masses of nucleated and non-nucleated plasm come from? Is it more reasonable to believe that they were rained upon the earth from the skies, or grew spontaneously from lifeless inorganic matter, than to give credence to the statement that God in His wisdom created them? I submit that it is not, and I propose to offer substantial proof that not only is a marvellous intelligence manifested in structure, but in the measures taken to safeguard and ensure growth.

It has been said, and, I believe truly said, that the Scriptures do not contain a single scientific inaccuracy, although our interpretation of certain passages may be open to criticism. To quote from a pamphlet written by Dr. Bowman, the account of Creation as given in the first chapter of Genesis stands alone in the conception and the unity of purpose which it discloses.

Considering the time at which it was written, it is one of the most remarkable documents in existence. It requires little alteration to fit in with our modern scientific opinions. The existence of light and the earth before the sun assumed its present condition, the appearance of vegetable before animal life, the age of gigantic reptiles and then the cattle serviceable for man, and, lastly, the appearance of man as the ultimate result of evolution. Take any standard work on geology and see how wonderfully near is the similarity in the record. As an introduction to the Bible, which was given not only to the Jews but to all mankind, it is worthy of the position which it occupies. In the declaration that "in the beginning God created the heavens and the earth," it reveals the only satisfactory explanation of the cause and origin of the cosmos.

The order of creation as given in Genesis has never been departed from. It was, after plant life, fish, bird, reptile, mammal, and man. I read somewhere, but regret that I have forgotten both the title of the book and the name of the author, that "the brain of the civilized and cultured man of to-day, in its progress to perfection, assumes successively the aspects of the fish, the bird, the

reptile, the mammal, and man," and the alleged transmigrations of Haeckel's egg are merely instances of divine economy in the production of organic life.

Where Haeckel and his school are so utterly wrong is that their reasoning is based upon fallacy. Evolution which accounts for the development of an organ does not account for its origin before development began. So far as I can see, Science and the Scriptures are, in this matter, in complete accord, and the only logical conclusion we can come to is that protoplasm, if it is the formal basis of all life, owes its existence in multiple form to the creative hand of the Almighty.

The issue is a plain one: either we must believe that life originated in all its various forms from plasm which performs vital functions without having any structure and which arose by spontaneous generation from something indefinite which had no life—or accept the orthodox view. The choice should not be a difficult one.

Let us consider the problem in detail, and commence by asking ourselves the question: "What is life?"

What is Life?

The American Medical Dictionary defines it as "A peculiar stimulated condition of organised matter."

As the logical outcome of my own research work I would add to that:—

And the force or combination of forces from which such stimulus comes is separate and quite distinct from the organised matter itself.

I have said "or combination of forces" for this reason: Nature never, in my belief, relies entirely upon the constant and uninterrmittent maintenance of any single condition on which the performance of vital functions depends, and it is therefore probable that organisms are called into the state of activity known to us as life by more forces than one, and that these forces may consist of energy generated by oxygen and iron in combination with the salts of plasma, of energy of which the atmosphere is a vehicle, and of energy from light.

The view that I hold is concisely expressed by Messrs. Carrington and Meader, in a work entitled *Death*. The authors say:—

"Let us postulate life as a separate energy or force in the universe. In order to become manifest to us here, it must operate through or by means of a material organism. For it to manifest in this way, the material basis, intermediary for such manifestation, must be perfect, the delicate relations and inter-relations of all the particles of the material body, as well as its affinities and forces, must be adjusted to one another with the utmost exactitude. If this perfect balance or adjustment is not present, life cannot manifest through that material body. It cannot utilize that particular combination of matter to manifest through. On the other hand, if these material conditions are perfect, then life can become manifest to us, because it can utilize the material basis as a medium for its expression or transmission. Life, therefore, might well be a separate force or energy which only becomes manifest to us when such conditions are supplied as render this manifestation possible."

That, of course, is hypothesis pure and simple, and, unfortunately, the writers offer very little in the shape of proof to support it. But it is not only their theory, it is my theory, and I will endeavour to justify it. If it is based upon truth, everything that

our finite intelligence is capable of grasping should be made clear; if upon fallacy, discrepancies must inevitably appear and bring apology if not discredit with them.

The difficulty in the way of the student of animate Nature is to find something in which there is no life, but which can be made to live; something possessed not of latent but only potential life.

In the animal world, needless to say, search would be made in vain. Germ-cells, if they do not live in the fullest sense, are parts of a living organism and the embryo, the fœtus, lives from the moment of inception, if only with the life of the mother. What is it, we may ask, that enables it at birth to begin an existence independent of the mother?

It is, undoubtedly, the act of breathing.

Immediately prior to birth the fœtus is structurally perfect, and its circulation is completed, with one important exception; there is practically no circulation through the lungs. It is dependent for its blood supply, its energy, and nutriment upon the maternal blood-stream. When, however, it is able to draw its first breath, oxygen is brought, in sufficient volume, in direct contact with hæmoglobin in the lungs, and, with

the salts of plasma as an excitant, nerve-force is at once generated. That being so, it follows that the blood is the carrier of energy as well as of oxygen, and as that energy is a motive power to which they are responsive, all the body functions can be called into instant operation. At birth there is a certain amount of reserve energy—the gift of the mother—stored in the unipolar ganglion-cells of the infant, but unless independent generation follows the severance of the umbilical cord before those reserves are exhausted, the newly-born animal dies.

That, I think, is sufficiently clear.

We are told in the second chapter of Genesis: (1) That the Lord God formed man of the dust of the ground; (2) that He breathed into his nostrils the breath of life and; (3) that the man then became a living soul.

Interpret that to mean that the life-giving principle is inseparable from the air, from the act of breathing or an intake of energy of which air is at once a vehicle and an essential to generation; and, furthermore, that the soul, as a separate entity, was then able to operate and control the human organism.

It appears to me to be a plain statement of fact, and we can only regret its brevity.

Page 22, line 3. For " causer " read " carrier."

In the same sense that the germ-cell of the animal lives, so does the pollen-grain of the plant. The process of sexual reproduction is in all essential respects identical in plant and animal, and the seed is to the plant what the fœtus is to the animal; the main difference being in the number of the offspring.

Prior to the birth of the young animal the mother is the source of its energy; while the seed is in process of growth it is equally dependent upon the mother-plant. But there is this important distinction between the two.

The animal is a self-contained organism, able to generate its own power. The seeds is not. It is a piece of apparatus, without motive force. In other words, a perfected electrical system is withheld from it, as it was withheld from the unborn animal; otherwise it would be liable to germinate under conditions unfavourable to continued life.

Now, what the act of breathing is to the animal, so is the natural environment of warmth, moisture and energy to the seed. From an electro-physiological point of view, warmth gives increased conductivity by decreasing internal resistance, and moisture

confers conductivity upon the soil, without which the earth-current could not reach the seed.

The motive power is in the earth itself, and the seed is constructed in such manner as to be actuated by it.

It is, in a sense, a potential Leyden-jar; a structure to which activity can be imparted when the conditions essential to the manifestation of life are complied with—and not before.

Here, then, we have something which is structurally perfect, which contains, in embryo, the plant it is designed to reproduce, but which has, as yet, no life.

What is it that creates life within it and stimulates it to growth?

Primarily and principally it is electricity.

All seeds are fundamentally the same in structure.

There is an outer integument—the seed coat—an inner fibroid lining, then an insulating capsule enclosing the nucellus, and finally the nucellus itself, containing an acid secretion.

While the seed-coat remains in a dry condition the seed is inert, because, if we regard the fibroid lining and the capsule of the nucellus as the dielectric of the jar,

and the nucellus as the inner coating of tinfoil the jar, so to speak, cannot receive its outer coating of tinfoil until such time as the seed-coat is rendered conductive by moisture.

Before germination can occur the nucellus must be continuously and adequately electrified. In other words, it must be in a condition to receive and be retentive of an induced charge, and to do this it must have electrostatic capacity; the earth supplying the charge, and air in the soil completing the circuit.

It may be argued that this is in accordance with natural laws and is to be accounted for by selection, transition, environment, and so forth. My point is that, admitting the importance of those factors in evolution, in bringing about modification of structure and greater perfection of detail, seeds were, nevertheless, constructed on that principle from the beginning. That is, of course, a statement which may not be a statement of fact inasmuch as I am unable to prove it, but it is a much more reasonable statement than the assertion that they originated from a structureless particle of plasm of which no authenticated trace remains.

I have said that what the act of breathing

is to the animal, so is the environment of warmth, moisture, and energy to the seed. The animal is able to breathe at once and is intended to take up its own life at the instant of birth. That, obviously, is not the case with the seed. Its natural environment is not always immediately forthcoming. If seeds were intended for the use of mankind, as we cannot doubt they were if we believe in God, some of them would require to be kept until the proper season for sowing and for transport from place to place, while cereals are largely foodstuffs. It follows, then, logically I think, that life is designed to be given only to such seeds as are purposely or accidentally sown to reproduce their species.

Later on we shall see what provisions are made for their safety and well-being during growth. We shall find that methods which have taxed the intelligence of man have been in force in the vegetable world for untold ages, methods which, consciously or unconsciously, we have copied, and if we follow the reasoning of the materialistic philosopher we arrogate to ourselves an intelligence that we deny to God.

In the meantime let us examine the amœba, the alleged original ancestor.

The Amœba.

We are not able, from the descriptions given to us, to draw any hard and fast line of distinction between the amœba and the organisms called the monera, but in order to be quite certain of our ground it will be as well to refer again to Haeckel*, bearing in mind that the monera, although said to be structureless, are nevertheless capable of the vital functions of nutrition, reproduction, sensation, and movement.

Haeckel's words are these :—

"*Hence, the monera are literally organisms without organs.*"

They move, but they have no muscles, eat and digest without a stomach, feel but have no nerves, and reproduce themselves in the absence of structure.

In a work upon Spiritualism, the late Dr. Chas. Mercier said : " To perceive the truth of an axiom we need no evidence. We need no evidence to enable us to decide whether a hen can lay an egg larger than itself, or whether two straight lines can enclose a space, or whether a pain can exist without being felt, or whether a solid thing is liquid. As soon as we have experience enough to comprehend the relation that is asserted, we see that it must be false. The mind refuses

* *The Evolution of Man.*

to entertain it, and asserts at once that the contradictory must be true."

And again : " If a person thinks he sees a heavy object, such as a table or a man, rise from the ground and remain suspended in the air without visible means of support, he should assume as a matter of course that there are means of support invisible to him ; and in the improbable event of his investigating the matter closely and still discovering no means of support, his proper attitude of mind is to assume that the means of support are so cleverly hidden that he is unable to discover them. In face of the universal experience of the human race that the relation is constant in experience he would be guilty of unjustifiable credulity if he believed, on the uncorroborated evidence of his senses, that an exception could occur."

Can we doubt that Haeckel was guilty of unjustifiable credulity in believing and making the assertion that a structureless organism, a thing having no organs, could perform the vital functions of nutrition, reproduction, sensation, and movement ? He should have assumed that the structure existed, although he was unable to discover it.

Haeckel says : " We are bound to conclude that all the multicellular organisms originally

sprang from a unicellular being. . . We next turn to the question whether there are to-day any unicellular organisms, from the features of which we may draw some approximate conclusion as to the unicellular ancestor of the multicellular organisms. The answer is: Most certainly there are. There are assuredly still unicellular organisms which are, in their whole nature, nothing more than permanent ova. These are independent unicellular organisms of the simplest character which develop no further, but reproduce themselves as such, without any further growth. One of them has an especial interest for us, because it at once suggests itself when we raise our question, and it must be regarded as the unicellular being that approaches nearest to the real ancestral form. *This organism is the amœba.*

When we place one of these amœbæ in a drop of water under the microscope and examine it with a high power, it generally appears as a roundish particle of a very irregular and varying shape.

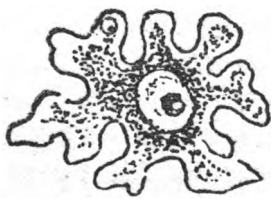

FIGURE 4.—OVUM OF A SPONGE; INDISTINGUISHABLE FROM THE COMMON AMŒBA (AFTER HAECKEL).

In its soft, slimy, semi-fluid substance, which consists of protoplasm, we see only the solid globular particle it contains, the nucleus. This unicellular body moves about continually, creeping in every direction on the glass on which we are examining it. The movement is effected by the shapeless body thrusting out finger-like processes at various parts of its surface; and these are slowly but continually changing and drawing the rest of the body after them. After a time, perhaps, the action changes. The amœba suddenly stands still, withdraws its projections, and assumes a globular shape. In a little while, however, the round body begins to expand again, thrusts out arms in another direction, and moves on once more.

If you touch one of these creeping amœbæ with a needle, or put a drop of acid in the water, the whole body at once contracts in consequence of this mechanical or physical stimulus. . . . The amœba either takes its food directly by imbibition of matter floating in the water, or by pressing into its protoplasmic body solid particles with which it comes in contact. . . . The amœba grows by thus taking in food and dissolving the particles eaten in its protoplasm. When it reaches a certain size by this continual

feeding, it begins to reproduce, by the simple process of cleavage. First the nucleus divides into two parts. Then the protoplasm is separated between the two new nuclei, and the whole cell splits into two daughter-cells, the protoplasm gathering about each of the nuclei. The thin bridge of protoplasm which at first connects the daughter-cells soon breaks. . . . Without mitosis, or formation of threads, the homogeneous nucleus divides into two halves. These move away from each other and become centres of attraction for the enveloping matter of the protoplasm."

Now, I am not concerned at the moment as to whether all living things originally arose from a single unicellular organism or not. That is not the question before us. We are asked not only to believe that in the beginning there was only one species of cell—an imperfect cell—from which, in some extraordinary manner, all the diverse forms of life proceeded by evolution, but that this cell was structureless and sprang spontaneously from inorganic matter.

We may pass over the obvious contradiction that the original ancestor was of a type that developed no further but reproduced itself as such without any further

growth, that *permanent* ova could be the foundation of all the different forms of animate Nature, and review the evidence submitted to us.

The only evidence is that no structure could be discovered. In support of the other statements there is no evidence worthy of the name.

Let us, in the light of recent research work, consider the matter of structure.

Some Forces of Nature.

In normal conditions of weather the air is always the positive and the earth the negative terminal of Nature's electrical system. But the air is not the source, it is only a vehicle of energy, so that the source, whatever it may be, is supermundane. As regards the vegetable world we can readily understand what happens. The earth absorbs energy from the air and returns it through the roots, stem, and venation of the plant, the circuit being completed through the stomata—the lungs, as it were, of the plant.

That is one thing that Haeckel does not appear to have taken into consideration.

A second important factor is that moisture gives capacity, or power to absorb electrical

energy, either directly or by induction, from any outside source of energy. It therefore follows that as the air is positively charged, anything in which there is moisture is certain to pick up that charge, the tension varying with the area over which the charge is distributed. In confined spaces, such as rooms, the atmosphere is also subject to charge from electrical emanations from animal bodies, the sign of such electrification being inconstant by reason of polar differences in the animal bodies present at various times.

Furthermore, we have light-energy. Sir Oliver Lodge tells us that optics is a branch of electricity, and we can postulate with reason that as progress is made from the red to the violet end of the spectrum, from the long slow, to the short rapid, waves, the potential of light must increase.

Now, animals and plants breathe not only oxygen and nitrogen plus some fractional quantity of other gases—but also both these forms—if they are not the same form—of energy; and everything that is moist absorbs them to a greater or lesser extent.

These considerations have a distinct bearing on the problem of the origin of life, but the materialistic theory does not take them into account.

In what way do they, or either of them, explain the movements or the reproduction of the amœba? If we can clear up one or both of those points we shall, I think, demonstrate the existence of structure.

Amœboid Movement.

There is in all animal cells and in the chloroplasts of plants a certain amount of iron. Iron is next to zinc in the list of electro-positives, and comes fifth. Oxygen is the most active of electro-negatives, so that the two, in conjunction with the salts of plasma, are all the elements necessary for the generation of electricity. Intra-cellular generation therefore becomes possible.

Furthermore, the semi-fluid character of the protoplasm would in any case ensure electrification from the surrounding atmosphere, if from no other source of energy outside the cell.

The chemical composition of the dead amœba can be resolved by analysis, but such is not the case with the living cell, in which the chemical substances are represented by their groups of ions. If that is so, and we know it to be so, it follows, I think, that with an oxygen intake and air

and light-energy, a complex electro-chemical action may be set up which, by attraction and repulsion, gives rise to the phenomenon of movement.

In this connection reference may usefully be made to the experiments of Ampere. He proved by means of movable wires that attraction was shown when the currents ran in the same direction, and repulsion when in opposite directions; also that when two finite currents are inclined to each other without crossing, they attract when both run towards or both run away from the common apex, but repel when one runs towards and the other away from the apex.

When the currents are in the same direction, the surfaces oppositely electrified will be directly opposed, and therefore attraction ensues. If the currents are in opposite directions the surfaces similarly electrified will oppose, and therefore repel each other.

In protoplasm there are many possible "surfaces" in the form of more or less vertical divisions of the cell, and as the whole body is elastic, or rather gelatinous in consistency, we can conceive different portions of it being thrust out and withdrawn.

Professor Schäfer provides us with further proof.* He said: "Living substance or

* *Presidential address to the British Association*, 1912.

protoplasm always, in fact, takes the form of a colloidal solution. In this solution the colloids are associated with crystalloids (electrolytes), which are either free in the solution or attached to the molecules of the colloids. Surrounding and enclosing the living substance thus constituted of both colloid and crystalloid material is a film, probably also formed of colloid, but which may have a lipoid substratum associated with it (Overton). This film serves the purpose of an osmatic membrane, permitting of exchanges by diffusion between the colloidal solution constituting the protoplasm and the circumambient medium in which it lives. Other similar films or membranes occur in the interior of protoplasm. These films have in many cases specific characters, both physical and chemical, thus favouring the diffusion of special kinds of material into and out of the protoplasm and from one part of the protoplasm to another."

Assuming, as I think we are entitled to assume, that amœboid movement is due to attraction and repulsion causing the irregular projections we can realize that upon one current momentarily ceasing to flow or diminishing in intensity such projection

would vary in form because it had its origin in the first instance in a force, and upon that force being no longer operative or altering in intensity a change of form would almost certainly occur in an elastic body.

It will be remembered that early in the last century Davy passed a current of electricity through a solution of potash, and finding that the potassium went to one of the poles and the oxygen to the other, concluded that the two elements of a compound are charged with different electricities, which are neutralised on combination. That is the view now held—after so long, and so lamentable a loss of time.

In the energy of which air is a vehicle and light a probable source, we have, in a sense, a current of electricity, but Arrhenius recognised that an electric current was in no way necessary to produce the dissociation of compounds into ions. In dilute solutions—one milligramme or less to one litre of water—the bodies dissolved are separated into ions by the mere fact of solution.

That seems to me to explain amœboid movement, and to make it clear that although the structure of the amœba may so far have defied detection, it nevertheless

exists, or the movements could not take place.

Other evidence there is in plenty. Movement, for example, is suspended in an atmosphere of hydrogen or carbonic acid, but is resumed on the admission of air or oxygen. Complete withdrawal of oxygen after a time kills protoplasm, and in the absence of air no movement can occur. Moreover, weak currents of electricity stimulate movement, and this in itself is sufficient to demonstrate the existence of structure. Moderate heat also acts as a stimulant by lowering internal resistance, and the movement stops when the temperature is lowered near the freezing point because of the enormous increase of internal resistance so created. One could go on multiplying proofs, but enough has, I think, been said to show that the amœba and therefore the monera cannot be structureless.

Amœboid Reproduction.

In "*Studies in Electro-Physiology*," and more especially in "*Germination*," I have given a full and detailed account of cell-reproduction in animal and plant bodies, and reference may be made to either of those works. The uni-

cellular organism, however, divides by cleavage; a somewhat simplified and lower form of reproduction. In mitosis two centrosomes are developed within the cell, and these, being similarly electrified bodies, repel and move as far away from each other as the structure of the cell permits. The nucleus then breaks up. It contains a number of rod-like substances, called chromosomes; always in even numbers. Each of these splits into two, and all are marshalled by the lines of force exerted by the centrosomes into the equatorial plane, or, in other words, into a position equidistant from the centrosomes. On regaining their insulation, which they parted with on splitting, the chromosomes become oppositely electrified bodies and are attracted in two equal groups by the centrosomes. Two new nuclei then form, the exoplasm contracts, and two daughter-cells result, each with a single centrosome. That, roughly, is somatic mitosis.

In division by cleavage there are no centrosomes, and apparently no chromosomes. The nucleus itself divides into two similarly electrified parts, which repel each other. Then the protoplasm is separated between the two new nuclei, and two daughter-cells are formed. Both processes are

essentially electrical in character, and it is quite certain that no such complex electrical process can occur in anything in which there is no structure.

The only difference between the monera and the amœbæ, so far as I can see, is that the former are unnucleated and the latter nucleated. The monera are said to be permanent cytodes, and if they are *permanent* cytodes they certainly could not become nucleated cells and could not therefore progress by evolution towards any higher form of life. The nucleus is to the ovum what the yolk is to the egg; one kind of yolk gives birth to a sparrow, another to a stork, a third to an ostrich, and so on through the ornithological list, but it requires the courage of a Haeckel to postulate that any sort of bird, let alone every sort of bird, ever issued from a yolkless egg. Furthermore, it is abundantly evident that if all living things had a common ancestor, that ancestor was not a permanent cytode, and therefore is not proved to have been structureless.

I do not wish to labour the point, nor am I prepared to express any opinion as to whether the amœba is alive in the sense I have tried to convey of life, although the

performance of the functions of nutrition and reproduction might seem to suggest it. It is worthy of note, however, that B. Moore, in *Recent Advances in Physiology*, laid special stress on the transformations of energy which occur in protoplasm; while Professor Schäfer, in his presidential address to the British Association in 1912, said in reference to the spontaneous generation of organic matter: "If the formation of life—of living substance—is possible at the present day—and for my own part I see no reason to doubt it—a boiled infusion of organic matter—and still less of inorganic matter—is the last place in which to look for it."

If the chemist did succeed in forming living substance—and the suggestion that such a thing may be possible is but the expression of an "open mind" on the subject—he would do no more than imitate the work of the Creator. His achievement would add no weight to the materialistic theory of evolution. It is satisfactory, however, to find that Professor Schäfer agrees that life could not have arisen from boiled inorganic matter.

Carpenter*, who, if out of date, is always interesting, sums up the principal facts of organic development in the general formula

* *Animal Physiology.*

of Von Baer: That *the more special forms of structure arise progressively out of the more general*—an observation with which we cannot but agree—and continues as follows:—

"The Unity of Plan which is visible through the whole Animal Kingdom is nowhere more remarkable than in the function of which an outline has now been given. We have seen that, however apparently different, the essential character of the Reproductive process is the same in the highest animal as in the lowest. It has been shown that the development of the highly-organised body of Man—though it is to serve as the instrument of those exalted faculties, by the right employment of which he is made 'but a little lower than the angels'—commences from the same starting point with that of the meanest creature living: for even Man, in all the pride of his philosophy, and all the splendour of his luxury, was once but a single cell, undistinguishable, by all human means of observation, from that which constitutes the entire fabric of the simplest Protozoon. And when the physiologist is inclined to dwell unduly upon his capacity for penetrating the secrets of Nature, it may be salutary for him to reflect that—even when he has

attained the furthest limits of his science, by advancing to those general principles which tend to place it on the elevation which others have already reached—he yet knows nothing of those wondrous operations which are the essential parts of every one of those complicated functions by which the life of the body is sustained. Why one cell should absorb—why another, which seems exactly to resemble it, should assimilate—why a third should secrete—why a fourth should prepare the reproductive germs—and why, of the two germs that are exactly similar, one should be developed into the simplest Zoophyte, and another into the complex fabric of Man—are questions that Physiology is not likely ever to answer. All our science is but the investigation of the mode or plan on which the Creator acts; the Power which operates is Infinite, and therefore inscrutable to our limited comprehension."

The Developing Seed.

I have explained the electrical structure of the seed. We will now examine it in process of development, and for the purpose will select the horse-chestnut seed—the "conker" of boyhood—as every-

one is more or less familiar with it. We must therefore see it in its pod and imagine it to be still attached to the parent tree. (Fig. 6.)

FIGURE 5.—HORSE-CHESTNUT SEED.

The pod in which the growing seed is contained is connected to the tree by a stalk which is really a feed-wire, a connecting wire from the negative terminal, the earth, of Nature's battery. On the seed itself there is a circular patch of a lighter colour than the rest of the seed-coat, and near the centre of that again another circle about $\frac{1}{8}''$ in diameter. With this last the stalk makes electrical connection, so that current is conveyed directly from the negative earth to the seed-coat, which before exposure to light and air is colourless.

Just inside the pod, and to be seen in the next figure, is a layer of white pith, positively charged by the atmosphere, probably through the pores of the pod-substance, or the spines which protrude from it.

FIGURE 6.—SECTION OF HORSE-CHESTNUT SEED IN ITS POD.

The nucellus is enclosed in a membranous capsule of a lipoid or insulating nature—equivalent to the glass of the Leyden jar—and as the seed-coat is conductive and the nucellus also conductive by reason of its markedly acid secretion, it would appear on the face of it that the seed must, by induction, be positively charged.

But, curiously enough, it is very feebly electrified. Sufficient energy is imparted to it to enable the seed to grow, but not to stimulate it to premature germination.

Very efficient precaution is taken to that end.

When it became necessary to run a number of telegraph and telephone wires together in a confined space the problem that confronted electricians was how to prevent inductive interference. This was finally accomplished by winding copper taping outside the insu-

lating covering of each wire to intercept induced currents and prevent them reaching the conductor of the wire in question. Nature knew all about that ages ago. Inside the outer membrane of the immature horse-chestnut seed and between it and the membrane enclosing the nucellus there is, as will be seen in Figure 6, a moist, markedly acid layer of white pith, which is shown by the galvanometer to be in a state of high electrification. This surrounds the nucellus and intercepts charge, dispersing it through the large circular patch of lighter colour on the seed-coat; the patch being of much lower resistance than the capsule of the nucellus. (See Fig. 5.)

Add to that that the seed itself lies in a bed of chemically neutral substance—a species of placenta—and it becomes obvious that during such time as it remains attached to the parent tree germination cannot possibly occur. Equally is it clear that before germination *can* occur important changes in the constitution of the seed must take place.

When the pod falls from the tree and, splitting segmentally, ejects the seed, two things happen almost simultaneously. The seed-coat becomes brown in colour, to pro-

tect the embryo from actinic light, and the inner, moist, acid layer of white pith dries up and becomes fibroid. If now the seed is picked up and kept dry its electrical condition is that it possesses three insulating coatings, in (1) the dry outer membrane, or seed-coat, (2) the inner, dry, fibroid lining, and (3) the capsule enveloping the nucellus. The Leyden jar has only one coating of tinfoil—the nucellus—and no battery.

Up to this point it has had no life of its own, and is possessed only of potential life. We may compare it with a recording instrument in a properly constituted telegraphic circuit. Everything is in order, but until some agency depresses the key bringing the battery into play and enabling the activating current to traverse its coils, the instrument cannot respond. Nor can the seed; it is inert.

But when it is placed in its natural environment the conditions essential to the creation of life—given warmth to lessen resistance and moisture to ensure conductivity—are at once complied with. The erstwhile dry seed-coat is transformed by moisture into a conductor, and is charged by the earth-battery. The inner fibroid layer remains fibroid, the capsule of the

nucellus interposes further high resistance in the path of the current, and the Leyden jar is now in its completed form.

Germination can at once proceed because the seed substance—the nucellus, containing the embryo—is continuously and adequately electrified.

For a horse-chestnut tree to grow from this embryo, it follows that the seed must contain the embryo of a horse chestnut and not the embryo of any other species.

If the seed is cut in section a knob-like projection of the nucellus—similar to the end of a dumbbell—will be seen.

Fig. 7

FIGURE 7.

In this the embryo radicle and plumule, joined to the stalks of the cotyledons, is ensconced. It cannot be seen, but beyond all manner of doubt it is there—the organised matter awaiting stimulus to enable it to manifest itself.

In the acorn the embryo is in a different

position, and in a mature seed can, shortly after stimulation, be seen with the naked eye. It is situated at the apex of the seed, and presents the following appearance :—

FIGURE 8.

The spot in the centre of the ellipse is the embryo radicle and plumule, and the ellipse itself the stalks, as it were, of the first leaves, which, as in the case of the horse chestnut, are underground growths.

Can it be suggested that the horse-chestnut and the oak are evolved from the same particle of protoplasm ? Trees and plants, or the seeds of them, and the germ-cells of all the then living things must have been constructed, created, in their various forms by some agency when the world had cooled down to a temperature compatible with life, and if we are not to attribute that agency to God I shall have a poorer opinion of commonsense than I at present possess.

Measures of Protection.

We have seen how the horse chestnut seed is, as it were, watched over and safeguarded, until, fully grown, it finds its natural environment, and if we were in a position to devote equal time and attention to every other variety of seed we should no doubt have additional cause for wonderment and admiration.

Some other measures of protection of seeds, as given by Davis*, may be briefly touched upon:—

"The seed is protected in a variety of ways when ripening—for example, by a firm shell, as the hazel, or by the inedible nature of the unripe fruit. The same end is sometimes subserved by movements. The dandelion lowers itself and remains close to the ground for about twelve days, while its fruit is maturing, and water-lilies sink to the bottom. In *valisneria* the spinal stem of the female flower is wound up and draws it downwards for the same purpose."

Some seeds, such as the horse-chestnut, the hazel, the acorn, and probably many others, seek when injured to protect themselves from loss by evaporation and from actinic light by throwing out a waxy secretion upon exposed surfaces, but the measure is only

* *A Text-Book of Biology.*

effectual when the absolute insulation of the nucellus is preserved. The resinous excretion by trees upon an injured surface is well known.

"The *dispersion* of seeds is assisted by numerous active and passive arrangements. In the former case special movements are performed. The dandelion raises itself from the ground when the fruits are ripe, and in a number of plants *seed-throwing* takes place. Thus, the capsules of the dog-violet separate into three diverging valves, in each of which there is a row of smooth seeds. These are clasped by the edges of the valve, and its contraction ultimately causes them to be shot for some distance. In the split fruit of geranium five mericarps are present, produced upwards into elastic rods attached to the apex of the fruit. These act as springs by which the mericarps are thrown to some distance. The pods of the broom and vetch spring open when ripe, and the seeds are scattered with some violence. Another interesting example is the squirting cucumber, which contains a large number of seeds enclosed in pulp. The ripe fruit is in a high state of tension, owing to the absorption of fluid, and injury at the stalk end causes the seeds to be squirted out as far as twenty feet.

Some few plants possess fruits of two kinds, one of which is specially adapted for self-sowing, being placed near the ground, into which it may even be forced by the growth of the flower stalks. Passive distribution is mainly effected by the wind and by animals. In the former case the fruit or seeds may possess wings, as frequently happens in trees "—to prevent them growing too closely together—" or a crown of feathery hairs may grow out. In porous capsules the seeds are shaken out by the wind, and to prevent them from simply falling out the pores are in the upper part of the capsule. . . . Many fruits possess hooked appendages, by means of which they can stick to the coats of animals, but arrangements of this sort are only found on plants the height of which renders them likely to be brushed against."

Not less marvellous in their almost infinite variety are the means devised to shield the young buds of trees and plants and young seedlings from the depredations of insects, from disease and injury, and more particularly from the danger of the short waves of light. Everyone knows that young seedlings must be screened from sunlight, but may not be aware that it is because the energy from

certain light-frequencies is too violent for their infantile constitution. Generally the screen is provided by a colouring of red or shades of yellow and red or yellow-brown, and those who dabble in photography will understand why. It is most interesting to watch the buds in early spring and to note how with the gradual formation of chlorophyll the non-actinic colourings merge into it.

The Rev. Geo. Henslow, in *The Origin of Plant Structures*, says : " With regard to the climatic environment, high latitudes are deficient in heat, but this is compensated for by a more prolonged sunlight during the period of growth and development ; so that the increase in the quantity of chlorophyllous tissue is due to prolonged sunlight, *but which is feeble in intensity.*"

The words italicised would appear to be corroborative of my view, but one would like to be quite sure why the light is feeble in intensity. If the energy exerted by light is, as I do not doubt, electrical in character, we can readily understand that with a deficiency of heat, involving increased resistance of all the electrolytes present, the effect would be lowered tension. Prolonged sunlight would favour the production of

chlorophyll, and in the absence of high light potential I should expect to find the non-actinic and protective colouring existing only in a minor degree, or not at all.

Dr. White Robertson* has a good deal to say on the subject. He writes: "At this season of the year" (February) "when the light is fast increasing in potential and vegetable life is running free with sap from the high electrolyte store in the moist soil, one can learn much of the influence of light frequencies by a visit to the hedgerows. Here one can select young shoots of thorn, briar, willow, privet, etc., and examine the earliest stages of budding. The stems vary in depth of colour pigment from emerald green to deep red-brown, according to the nature of the requirements of the contained sap and cell protoplasm. The husks about the young buds are of varying pigmentation also, but they vary only in their range of capacity for absorption of the harmful high-frequency rays. The infant seeds and leaves within these capsules have no chlorophyll covering as yet to protect them, and only as the capsule edges thin out do they acquire their own protective pigments, carotin and xanthophyll. These capsules vary from bright red to coral, from orange to green, to green-brown

* *Studies in Electro-Pathology.*

and to brown that is almost dull black. And they one and all absorb the high-frequency chemical rays which would speedily destroy their young charges, and, absorbing them, store up energy for transmission in turn as electric potential, just as the brown earth and the tawny sand store potential from these rays against the coming of rain, which, through its electrolytes, will convey the stored charge to the seeds beneath the surface. No stem cuticle, no capsule, no leaf, no fruit is exactly of the colour of another species. The peculiar chemical constitution of each species demands *and depends upon* the peculiar properties of the light absorbed and transmitted or transmuted, and the apple and the orange and the lemon depend for their sugars, their proteids, and their waxy or fatty matters upon the particular light frequencies which are absorbed by their colouring matters, their light screens, and upon the activity of their phosphorus substrates.

"Later in the season, if we examine a fruit we shall see the protection given against actinism to the whole organism whose function in turn it is to provide for and to protect the seeds within. During the hot

months of the year the colouring matters of the fruit take on a deeper hue of anti-actinic pigments, and storage of energy against the coming spring is redoubled for the sake of the seed. The leaves turn to yellow, to golden, to red, to brown, and carry their stored energy to the soil, where, as compost, they will retain their charge until the whole pass again to the seed. . . Every cell in the plant, every cell in the animal body, requires light, and it requires light frequencies of very definite wave-lengths which will determine the resonances of its own molecules, and thereafter activate them in accordance with that specific resonance. That is why the plant and the animal tissues alike are provided with so marvellous a complex of light screens, pigments, and dyes. Its constitution and the chemical processes going on within each cell are determined by the wave-lengths it receives."

I do not see how *electrical* energy can be stored up by colouring matter in the sense that it is absorbed and stored by an accumulator, but can quite conceive that by reason of that absorption certain chemical processes essential to the life of the plant or to reproduction are activated.

Installations of the Great Electrician.

Not to be found in any text-book is there mention of the wonderful one-wire system of which the vegetable world is full of examples. Even cursory examination of our trees and plants will be sufficient to convince the student that the permanent cytode from which all these things are said to have come must also have been a remarkably clever electrician. He will find that, taking the air as one pole and the earth as the other pole of a battery, everything growing in the soil is joined up, according to its requirements, in parallel, series-parallel, or series, and that as continuous current is employed the sectional area of the feed-wire is in proportion to the supply called for. I have given a somewhat detailed account of this in *Germination*, but anyone with an elementary knowledge of applied electricity need only study acorns and hazel nuts in their arrangement upon the trees to realize how perfect their electrical structure is and how the first are connected in series and the second in parallel. Nature's favourite method, however, is series-parallel.

I am labouring the point, and tender my excuses. But that permanent cytode must

have been an embodiment of most if not of all of the sciences. Nature's chemical processes are incomparably more complex than those of the human chemist. In applied electricity it would appear that many of our modern methods are borrowed from Nature, and presently we shall see, in the device of the coryanthes to secure pollination, that the cytode had a profound knowledge of engineering! If further proof is asked for it can be seen in, among other things, the construction of the organ of corti in the human auditory apparatus, a very beautiful example of bridge building.

Measures to Ensure Pollination.

These are almost endless in their variety and are too well known to need description. Darwin*, however, instances one method which had it been designed by man would have shown extraordinary ingenuity. It is a device to be found in the coryanthes. "This orchid has part of its labellum or lower lip hollowed out into a great bucket, into which drops of almost pure water continually fall from two secreting horns which stand above it; and when the bucket is half full, the water overflows by a spout on one side.

* *The Origin of Species.*

The basal part of the labellum stands over the bucket, and is itself hollowed out into a sort of chamber with two lateral entrances; within this chamber there are curious fleshy ridges. The most ingenious man, if he had not witnessed what takes place, could never have imagined what purpose all these parts serve. But Dr. Crüger saw crowds of large humble-bees visiting the gigantic flowers of this orchid, not in order to suck nectar, but to gnaw off the ridges within the chamber above the bucket; in doing this they frequently pushed each other into the bucket, and their wings being thus wetted, they could not fly away, but were compelled to crawl out through the passage formed by the spout or overflow. The passage is narrow, and is roofed over by the column, so that a bee, in forcing its way out, first rubs its back against the viscid stigma and then against the viscid glands of the pollen-masses. The pollen-masses are thus glued to the back of the bee which first happens to crawl out through the passage of a lately expanded flower, and are thus carried away. . . . When the bee, thus provided, flies to another flower, or to the same flower a second time, and is pushed by its comrades into the bucket and then crawls out by the

passage, the pollen-mass necessarily comes first into contact with viscid stigma and adheres to it, and the flower is fertilised.

Darwin attributes all this and every variation of it to Natural Selection, and asks why, on the theory of Creation, there is so much variety and so little real novelty. The answer is, I think, that there is really only one law governing all forms of life, but that natural selection, environment, and transition have brought about numberless modifications of it. If every form of life is studied closely it will be seen that there is no novelty at all in principle, but only in detail.

Upon the evidence, scantily as it is given in these pages, we have I think to recognise that in all this there is a manifestation of intelligence of an order higher than our intelligence, and as no one has as yet credited the plant with any intelligence at all, we are entitled to ask: "Where does it come from?" Nature, it may be answered. But what is Nature, if not the work of God? Did all these wonderful things emanate from senseless, lifeless matter? In man, it is argued, there is a directing intelligence—the soul. But man is not the only animal with intelligence. That is merely a matter of comparative brain development, of struc-

ture. Animals, then, may possess souls. The same argument denies a soul to a plant, but, in the matter of growth and resourcefulness under unfavourable conditions, some plants appear to have more sense than some animals. The whole theory of the origin of life as it is postulated in ontogeny to-day, is, to my mind, opposed to reason, if belief in the evolution of all living forms from a common ancestor, a piece of *structureless* plasm, without the intervention of God as the Creator, is the basis on which it is founded.

As Professor Kingsley said, in a lecture delivered at Reading in the sixties: "Go to the water-butt in the nearest yard, and there, in one pinch of green scum, in one spoonful of water, behold a whole 'Divina Commedia' of living forms, more fantastic a thousand times than those with which Dante peopled his unseen world; and then feel, as you should feel, abashed at the ignorance and weakness of mortal man; abashed still more at that rash conceit of his which makes him fancy himself the measure of all things; and say with me: . . 'Let them praise the name of the Lord; for He spake the word and they were made; He commanded and they were created.'"

I do not propose to engage in theological discussion further than to give emphasis to what appears to me to be evidence of a very real nature. For many centuries man has sought to arrive at some understanding of the principle underlying life, of the force, or whatever it may be, that animates organised matter and enables it to perform vital functions.

Ever since the Old Testament was written the truth has stared us in the face.

In the seventh verse of the second chapter of Genesis there are these words:

> "And the Lord God . . . breathed into his nostrils the breath of life."

The life-giving principle, the form of energy which actuates organised matter, whether human or otherwise, is contained in the atmosphere or the atmosphere conveys the one thing needed to complete the condition essential to life, to its manifestation.

In support of that statement, I have, I submit, adduced proof.

Let us, then, ask ourselves, as reasonable thinking people, where the information quoted above came from? We must, it seems to me, either credit our remote progenitors with more scientific knowledge than we possess to-day, or believe the statement

to have been inspired, to have emanated directly or indirectly from some supermundane source. The only possible supermundane source of intelligence we know is—God.

Nor is that the only reference made to "the breath of life." In Genesis vii. 15 it is written: "And they went in unto Noah into the Ark, two and two of all flesh, wherein is the breath of life," and in the twenty-second verse of the same chapter, "All in whose nostrils was the breath of life."

Three times, at least, was it repeated; and we took no heed.

PART II.

PROLONGATION

From time immemorial alchemists and philosophers have dreamed two dreams, *i.e.*, the transmutation of metals, and the restoration of that physical and mental vigour which is the prerogative of manhood at its prime. I say dreams, because they were for the most part little more than vague desires that such things might be possible, and that, being possible, were to be discovered. But there was no basis of fact, no starting point from which to begin research; nothing more tangible, one would think, than the phantasmagoria born of a disordered imagination.

They were, however, thought to be feasible by many persons of learning and discernment, and failure to arrive at the desired end does not finally dispose of them.

No doubt a large proportion of the alchemists were charlatans, but among the investigators were some really great men who, by their genius and labours, laid the foundations of modern chemistry. Such men, for example, as Paracelsus, Raymond

Lully, Glauber, Friar Bacon, Van Helmont, Albertus Magnus, Basil Valentine, and a host of others have left behind them enduring monuments of their ability in the form of medicines and preparations necessary to the chemist and pharmacist, even in these comparatively enlightened days. The objective of their researches was the Philosopher's Stone, which was to have the power of transmuting all metals into gold, and their ideas in this respect cannot with certainty be said to have been unreasonable or illogical, although success did not attend their efforts.

Following out the same line of reasoning, they imagined that this purifier of metals would, when found, play the same part with the human organism, and purify it so effectually as to prolong life indefinitely; hence their search for the Elixir of Life.

It was not supposed to be creative, nor to have the virtue—or otherwise—of resuscitating the dead. Its office was to replace waste, to expel morbid humours, and to confer upon its fortunate possessor the gift of perpetual youth.

As recently as 1782 a Fellow of the Royal Society—one Dr. Price—professed to have compounded a powder which would produce gold, and, if my memory serves me, the late

Professor Ramsay hinted more than once that he was "on the track."

The first book on the subject, the *Summa Perfectionis*, was written by Gebir in the eighth century, and much about the same period a Greek, Georges le Syncelle, followed with *Imouth*. Four hundred years later came Albert Theutonius, but ages before they were born, perhaps thirty centuries prior to the days of the Ptolemies, their predecessors were at work in the laboratories of Ancient Egypt.

For these and other similar reasons most of us are under the impression—I need hardly say the quite erroneous impression—that man has been progressing in scientific knowledge since prehistoric times. In reality it is only during the last century or two that we have learned anything at all; only now that we are beginning to have some glimmer of understanding of, for instance, the laws governing the human nervous system, Nature's application of electricity to agriculture and horticulture, and the precise office and usefulness of the electron.

To-day what should be the science of medicine is still more or less empirical, chemical engineering is in its infancy, nobody knows what electricity is, what the

force may be that provides the spiritualist with occupation for an enquiring mind, or what form of energy is supplied, during every second of our lives, to that wonderful pump, the human heart.

Experiment has demonstrated that the latter is not electricity, because those ganglion-cells which store vital force and to which our reserves of energy are entrusted, will no more absorb and store electricity than they will a brandy and soda; with magnetism, its value as a therapeutic agent, its powers and limitations, we are as yet imperfectly acquainted; a fourth dimension is even more difficult of comprehension than solid, imponderable ether, and altogether the earnest and enlightened worker in any field of research is forced to the conclusion that the only way to find out anything worth knowing is to devote his every thought, his every effort, to the elucidation of a detail which may haply fit in with and complete or further advance the unfinished labours of one or more, probably several, of his predecessors. Many problems have borne, and continue to bear, striking resemblance to a jig-saw puzzle, the pieces of which have been hidden away, some superficially, some deep down under rocks of

mistaken, though perhaps orthodox, theory. It is as true of scientific beliefs as of other beliefs that the orthodoxy of to-day may be the heterodoxy of to-morrow, and the established truths of which we are now quite sure are all too few in number.

With the transmutation of metals I have no further concern, but upon what has been termed the Elixir of Life something definite may be said.

There are at least three things which militate against a continuance of vigorous life—for prolonged periods. One is physical deterioration, as evidenced by, among other things, arterio-sclerosis, another is the gradual failure of generation of nerve-force, and the third a falling off in the production of the secretions of certain glands which vitalise body and brain.

The contributory causes are, in the main, advancing age, disease, worry, and the hard use to which we put the human machine.

Disease we must or should be able to assume is curable by the physician; advancing age, so far as years go, is inevitable; but if we can supply nerve-energy to man and repair the faulty glands we shall have taken an important step towards arresting senile decay, whether premature or other-

wise, and have, incidentally, lent the physician invaluable aid.

Both these things can, I am assured, be done without drugs or electricity, and by means which, being natural, are of course simple, both as regards their application and the scientific basis underlying them.

In the first place nerve-energy is not electricity in motion, and it is therefore of little avail to consider that force as an integral part in the composition of an elixir.

We are called upon to supply to the body the *nerve-energy* in which it is deficient; the form of energy with which Nature actuates the heart, and not any artificial substitute for it.

Consider for a moment the heart as a steam-pump and the natural generator of nerve-force as the boiler from which it derives its supply of power. If the boiler pressure is lowered—from any cause whatsoever—the pump must slacken down. That seems to be clear.

And now examine some of the consequences of this slackening down to man. The heart beats more slowly, the blood pressure decreases, the blood is imperfectly oxygenated, the extremities become cold, and, what is of far greater importance, lower

pressure of nerve-energy means being "run down" generally, and so not only exposed to all sorts of ills, but to a breakdown in parts of the human machine other than the heart.

In regard to life and death there are several schools of scientific thought. Some distinguished men—Professor Schäfer, Drs. Carrel, Loeb, and others—hold that life is a mere product of chemical reaction. This hypothesis presupposes the non-existence of nerve-force, negatives the possibility of an electrically charged atmosphere, and attaches no importance to light-frequencies. We may therefore enter a protest and pass it by.

Anyhow, the experiments upon which the theory is based are capable of a different interpretation to that put upon them.

Another group of thinking men see no reason why we should die. Mr. Hereward Carrington has given expression to their views in *Death*, and some of them may be briefly mentioned:—

Dr. Wm. Hammond stated: "There is no physiological reason at the present day why men should die." G. H. Lewes, in his *Physiology of Common Life*, said: "If the repair were always identical with the waste,

never varying in the slightest degree, life would then only be terminated by some accident, never by old age." Dr. Munro asserted that " the human body as a machine is perfect, it is apparently intended to go on for ever " ; while Dr. Gregory, in his *Medical Conspectus*, wrote : " Such a machine as the human frame, unless accidentally depraved or injured by some external cause, would seem formed for perpetuity."

On the other hand, we cannot, unfortunately, altogether disregard the Biblical records. According to them Adam and his immediate descendants lived an average of nine hundred years. They were probably vegetarians, and many of the diseases which now afflict humanity had not then made their appearance, nor were they cursed with alcohol. But degeneration, it would appear, was not long before it set in. Moses died at the comparatively youthful age of 120, and after him there was a further shortening of the span, culminating in the decease, in *his old age*, of King Solomon when only fifty-eight. The question we have to ask curselves is : " Can we undo the evil that long centuries of debauchery and folly have wrought ? "

I quote the following from *Old Age*,

pp. 538-39: "Numerous scientists affirm that old age finally results because it is impossible for an organism to repair the cellular losses by the formation of a sufficient number of new elements—that is to say, because of the exhaustion of the reproductive faculty."

One of the scientists who has more especially concerned himself with general questions, Weismann, expresses himself on this subject in a very categorical manner. According to him, the senile degeneration that ends in death does not depend on the wearing away of the cells of our organism, but rather upon the fact that that cellular prolification, being limited, becomes insufficient to repair that loss. As old age appears in different species and different individuals at various ages, Weismann concludes that the number of generations that a cell is capable of producing differs in different cases. It is, however, impossible for him to explain why, in one example, cellular multiplication may stop at a certain figure, while in another it may go much further. . . . The same rule is applicable, according to Bühler, to the genital glands and muscles, and all sorts of other organs."

It is not, in my belief, a matter of the number of generations that a cell is capable

of producing, but of the nerve-energy which enables the cell to reproduce. Cell reproduction is a neuro-electrical process, and with failure of the motive power there is naturally failure of production. The anabolic process is checked, but the katabolic process proceeds—to terminate in death.

Death, on the whole, is a physiological rather than a pathological fact. It might almost be said to be an electro-physiological fact, for the reason that whatever the contributory causes may be it is generally a direct consequence of failure of the heart's supply of energy.

Considering it from that point of view and assuming the human frame neither to be "accidentally depraved, nor injured by some external cause," conditions essential to a full continuance and enjoyment of life would appear to be (1) undiminished generation of nerve-force, and (2) maintenance of the insulating processes of the human organism.

There can be little, if any, doubt that nerve-force is, as I have said, generated in the lungs, with every inspiration, by the combination oxyhæmoglobin, and that its potential is dependent upon there being a normal quantity of iron in the blood and of

oxygen in the air. The blood is therefore the carrier of energy, and it is circulated by the heart at a given rate, so long and only so long as energy is supplied to the heart at a given pressure. A " depraved " condition which would militate against it is arterio-sclerosis.

Disregarding that for the moment it may, I think, be postulated that the insulation of every body-circuit must be unimpaired, otherwise there would be leakage, with consequent loss of supply to certain organs and cell-groups, and local disturbance of neuro-electrical equilibrium. We have, therefore, to keep in view also maintenance of the natural insulating processes of the body.

As to arterio-sclerosis I am in the difficult position that pathology is outside my purview, but I have heard that a radio-active preparation known as Thorium X is not only a remedy for this morbid condition, but has the remarkable property of enormously increasing the red corpuscles of the blood in a very brief period of time.

The question now arises : If we were able to prepare an Elixir of Life, for whom should it be compounded ? Not for the normally healthy, to whom nostrums should be anathema, but for the ailing and the old.

We have, then, to deal with deficiencies, deficient nerve-force and, it may be, deficient insulation—the latter with especial regard to the effective functionment of certain glands, the secretions of which are vital to the restoration or continuance of vigorous manhood. The glands in question may receive a normal supply of energy, but, by reason of defective insulation, fail to retain or fully utilise it. Nor is that all. The impulses which stimulate and activate our glands pass from the brain through the secretory nerves, and if they are not retained or utilised fresh demands are made upon the brain to replace the wastage.

The present practice is to administer animal extracts—from the thyroid, the pituitary, and other bodies—to supply any supposed deficiency, and but a short time ago the world was agreeably surprised to hear, upon the authority of a French scientist, that glands from healthy monkeys might be grafted upon the human organism—new lamps for old—to enable us to rival Methuselah in the length of our sojourn upon earth. It would be an interesting experiment, and might indeed furnish some direct and much-wanted evidence in favour of the theory of man's descent! But the main-

tenance of normal health in man is, I venture to suggest, a more rational measure than either of those above mentioned.

First of all we require a means of generating nerve-force in order to be able to supply it. For years we have heard of a new force called "Odic" and "Psychic" by Sergt Cox and Sir William Crookes respectively. It has been associated in the minds of most people with the occult, probably because no one has yet been able to satisfactorily demonstrate its nature, its value to humanity, or even to evolve it.

The Ancient Egyptians could, there is reason to believe, do so, and but for the burning of the library of Alexandria the secret might, although I do not think it would, have been disclosed before the Christian era.

My knowledge of a new force, which I have called "Vitic," came about in a curious way. Years of residence in Egypt had created interest in Egyptology, an interest which, upon my return to England, drew me not infrequently to the galleries of the British Museum.

In the bygone days of Egypt's greatness, scientific attainment was confined, or almost confined, to the priestly communities, and

Fig. 9.—Painted portrait statue of An-kheft-ka, a royal kinsman, IVth dynasty, B.C. 3700.

Fig. 10.—King Khufu (Cheops).

[*face p.* 76]

Fig. 13. — Head of a statue of one of the Ptolemies, about B.C. 300.

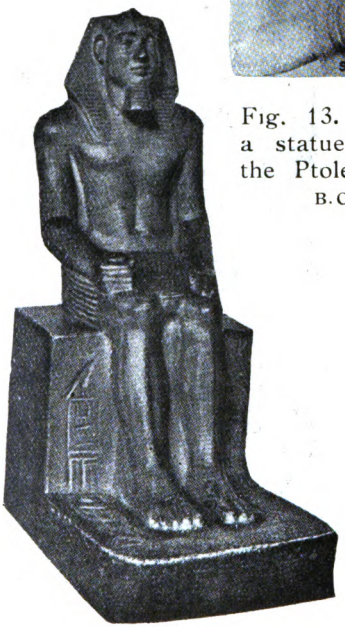

Fig. 11. — King Menkaura (Mykerinos).

Fig. 12. — King User-en-kā An, B.C. 3433.

[face p. 77

they kept it from the outer and unlearned world under the veil of an elaborate symbolism. Even then it appears likely that search for the Elixir of Life had begun. The first of the Ptolemies did much for learning, and founded the University of Alexandria, while the name of Cleopatra the *Savant*—wife of one of the Ptolemies—has been handed down to posterity in association with those of the earliest alchemists.

When, therefore, I noticed that a statue of one of the priests was shown holding a cylinder in each hand, my curiosity was aroused, and I determined upon investigation.

That the reigning Pharaoh was similarly equipped merely suggested reasonable concession on the part of the priesthood, and in no way negatived the supposition that the cylinders or short rods had some purpose or function of an important nature, of which they were symbolical in the statuary.

The most prominent statue—a painted limestone portrait—dates from about 3700 B.C.—almost six thousand years ago—and is of a royal personage named An-Kheft-Kā, who is shown holding a rod in each hand, much in the manner that a runner holds corks. (Fig. 9).

Contemporaneous with this personage (fourth to sixth dynasties) and of a period some thousands of years before the birth of Cleopatra, is the alabaster statue of a priest with rods, but the priesthood are not very well represented, it perhaps being deemed unwise to seek equality in this respect with royalty.

The remaining statues are of kings. There is Khufu (Cheops), who built the great Pyramid, "Khut" (Fig. 10); King Khâfrā (Chefren), builder of the second pyramid, "Ur," at Gizieh; King Men-Kau-Rā, the Mykerinos of Greek writers and builder of the third pyramid, "Her" (Fig. 11).

The next important ruler of the fifth dynasty, User-en-Rā, has a black granite statue dedicated to him by Usertsen I, but only the lower portion of this exists. The illustration (Fig. 12) is of a plaster cast of a stone statue of him in the Vestibule, date about 3400 B.C.

Some fourteen hundred years stretch between the above and the red granite seated figure of King Sekhem-uatch-tani-Rā, and, so far as the resources of the British Museum go, this would seem to be the last of them, although there is the upper part of a statue of one of the later Ptolemies (about 300 B.C.)

in the Southern Gallery, with the suggestion of a cylinder or rod in the right hand (Fig. 13).

In my belief, as I have said, these rods were symbolical; but of what? Surely not of Power, for that on the part of the priestly communities would have been to court disaster at the hands of a jealous and incensed Pharaoh. What was the keynote of ancient Egyptian character? Sensuality, perhaps; virility, in greater probability, for sensuality would not so freely advertise itself. That was the conclusion to which I finally came.

Diligent enquiry of the authorities at the Museum elicited the astonishing fact that nothing was known of the purpose or meaning of the rods. They had no information whatever in regard to them.

Years of experiment followed in the effort to discover something which, when held in the hand, would beneficially affect the nervous system. Finally, it was found, by accident, in carbon. Hard carbon, such as is used in arc lamps, will give out a certain amount of force which, experience has taught us, is not to be distinguished from nerve-force. But if the carbon is treated in such manner as to cause a violent disturbance of

its molecules and then specially hardened, the force evolved by it is greatly augmented and the rod becomes a real source of power, a power that is so readily absorbed and stored by the unipolar ganglion-cells that a five-minutes charge remains effective for at least twelve hours.

If it were a liquid and we were compounding the Elixir of Life, it would be the first and most essential ingredient.

Fig. 14

FIGURE 14.—THE ROD IN ITS MODERN FORM, 10c.m. x 22m.m.

In his *Studies in Electro-Pathology* Dr. White Robertson, writing of my hypothesis that the electric wave is not simple but compound, says: "That the second alternative is not far-fetched is suggested by a recent discovery of Baines that by a special hardening process applied to ordinary arc-carbon a 'new force' has been found to reside in the altered carbon which can be conveyed to and stored in the body for a period of several hours by simply holding these in the hand, with the result that subnormal galvanometric deflections are enor-

mously enhanced; and already we have been able to observe gratifying changes in cases of nervous breakdown apparently by increasing the nerve charge through these new carbons. What this force is we do not as yet know, nor is it known to the eminent physicists and physiologists to whom we have demonstrated it. It is not magnetic. And it differs from an electric charge in that it is not readily diffused, but is, as registered by the galvanometer over a period of twelve hours, stored probably in the unipolar ganglia of the nervous system."

In an article in *The Practitioner* in June, 1914, Dr. J. Horne Wilson wrote of this discovery of mine: "In this connection" (nerve deafness) "I may mention that a rod of carbon, which has its molecular condition altered in a similar way to that of iron when it is converted into a magnet, has a most remarkable effect on the body deflections. If held in the right hand it produces an off-scale positive deflection, and an off-scale negative if held in the left hand. If held in contact with the right side of the body for five or ten minutes it makes the hand-to-hand deflections strongly positive, and has exactly the opposite effect if held in the left side of the body. What this force is, I do not

pretend at present to say, but it has a marked influence on the electrical condition of the body, though no direct influence upon the terminals of the galvanometer. It evidently charges the body *with a force akin to nerve energy*, as it is retained for a much longer period than electricity is." The italics are mine.

In another article, in *The Medical Times* of July 25th, 1914, the same author wrote of the carbon rods: "This form of energy will . . . when suitably applied, raise the nerve currents to normal."

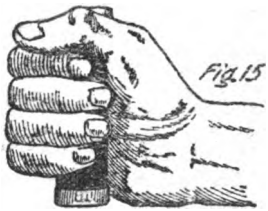

FIGURE 15.—HAND HOLDING THE ROD.

The rod held in the right hand acts as a stimulant without any depressing after effect, and in the left hand as a sedative. Under its stimulating influence the nervous system generally is benefited; mental fatigue rapidly disappears, and morbid conditions such as neurasthenia, insomnia, and feeble action of the heart readily yield to it.

The second component part of the Elixir would be a reversion to what Mr. Carrington, amongst others, calls the "natural food of man," to a diet rich in vitamines and lipoids unspoiled by cooking. It is with the lipoids that Nature reinforces and maintains the insulating processes of the body.

Temporary measures to this end, when required, call for little more than the external application and internal administration of a suitable hydro-carbon oil of the paraffin series, and there are to-day very many medical men familiar with its use.

And so, if we were able to compound the wonderful elixir it would not bear any resemblance to the form in which it no doubt presented itself to the imagination of the dead and gone enthusiasts who sought its discovery. The goblet of venetian glass, full to the brim with liquid amber, into which the bearded sage of the novelist shook two drops of crimson dew and watched the mixture amble through all the colours of the spectrum, has no existence in fact. There is nothing to drink but a little oil, no added temptation to incur the penalties of the law, nothing upon which the Inland Revenue authorities could levy even the pre-war tax upon patent medicines.

It is not a nostrum but a discovery, not a quack remedy but a treatment, almost childish in its simplicity, and, I believe, so free from danger as to be fool-proof.

The second cylinder shown in the left hand of An Kheft-Kā was probably of minor importance and was not of the nature of carbon, as that would have neutralised the charge. It was, I have little doubt, fashioned from a piece of magnetic iron ore.

Magnetism applied to the *left* side of the body stimulates the heart's action, but only so long as the body remains within the magnetic field.

The properties of magnetic iron ore—and perhaps this property—were known to the Chinese in olden times, and also to the earlier Greeks, who, as likely as not, gained their knowledge from the Egyptians.

If two rods are held, the carbon in the right and a permanent magnet in the left hand, the effect is accentuated, but while the charge imparted by the carbon endures for some twelve hours, that exerted by the magnet ceases to be operative upon relinquishment.

From the foregoing it will, of course, be gathered that, in my judgment, some prolongation of life beyond the allotted span

is possible. That is, indeed, my opinion, but no remedy or combination of remedies will avail to bring that about unless an observance of morality is one of them. We do all kinds of things to shorten our lives. The abuse of stimulants taxes the nervous system, to throw them off as toxins ; gluttony is even more mischievous in its effect, and what is known as " burning the candle at both ends " is worse than both of them put together. There is no occasion to go to extremes in the matter of diet. The nature of his digestive apparatus, as compared with that of the carnivora, suggests that man should be vegetarian. It is open to question whether changes of a drastic character can be made with impunity, but they can be made gradually, and, I am sure, with benefit. If we did not drink spirituous liquors, smoked only in moderation, lived to some extent upon raw vegetables, took plenty of exercise, and, above all, there was an observance of absolute fidelity between the sexes, we should, I am convinced, live much longer than we do. If, in addition, the aids I have sketched were called in requisition, life might be prolonged to an extent of which we at present do but dream.

There are a good many people who hold

similar opinions, and some who do not. Among the latter is a very distinguished dissentient in the person of Professor Schäfer. He said* : " When we consider the body as a whole, we find that in every case the life of the aggregate consists of a definite cycle of changes which, after passing through the stages of growth and maturity, always leads to senescence, and finally terminates in death."

Senescence is the result of a deficiency of nerve-force, due principally to the causes I have mentioned. It cannot be put off indefinitely, but, in my view, it can be postponed.

" The individuals of every species of animal appear to have an average duration of existence. Some species are known the individuals of which live only for a few hours, while others survive for a hundred years."

We are considering the highest animal—man; not any other kind of animal. Man has been given an order of intelligence which places him immeasurably above the rest of creation. The elephant, though far below him in the intellectual scale, is longer lived, while the cleverest of birds, the parrot, keeps a tenacious hold of life. If we have

* *Presidential Address to the British Association*, 1912.

more sense than the elephant, we ought to be able to so order ourselves as to attain greater longevity.

Let us collect a few statistics of longevity, apart from man.

The Indians assert that the elephant lives 300 years. Eagles have lived for more than a century, and many instances are recorded of ravens having exceeded that period. Swans also have been known to live 100 years. Among fish, the carp has been known to live 200 years; a pike has existed in a pond 90 years, and a story is related of one caught in a lake near Hailerun, in Suabia, which had attained the age of 267 years. Tortoises are also very tenacious of life, but if we seek evidence of spans of prehistoric length or over we must have recourse to the vegetable world.

Trees attain an age besides which the nine hundred and sixty-nine of Methuselah are comparatively trifling, the yew enduring for over 2,800, the baobab 4,000, and the dragon tree 6,000 years. Mortality is greatest among palms, which last only two to three centuries. In the ascending scale are the elm, with 355; cypress, 388; ivy, 448; maple, 516; larch, 263 to 576; chestnut, 360 to 626; orange and lemon, 400 to 640; plane, 720; cedar,

200 to 800; walnut, 900; lime, 864 to 1,076; spruce, 1,200; oak, 600 to 1,600; and olive, 700 to 2,000.

"In man himself the average length of life would probably be greater than the three-score-and-ten years allotted to him by the Psalmist if we could eliminate the results of disease and accident."

That is some concession, but I fear even that is unwillingly made. It is futile to argue with a scientist who has fully made up his mind, but we can at least differ from him. One of the arguments advanced to show that the dividing line between animals and inanimate matter is less sharp than it has hitherto been regarded is the growth of inorganic crystals.

"Should it," said Professor Schäfer, "be contended that growth and reproduction are properties possessed only by living bodies and constitute a test by which we may differentiate between life and non-life, between the animate and inanimate creation, it must be replied that no contention can be more fallacious. Inorganic crystals grow and multiply and reproduce their like, given a supply of the requisite pabulum."

With all respect, I submit that crystals do not *grow*, in the sense that living organ-

isms grow, from an embryo. They *form*, it is true, but they do not reproduce as a cell reproduces.

But there is more to come: "Leduc has shown that the growth and division of artificial colloids of an inorganic nature, when placed in an appropriate medium, present singular resemblance to the phenomena of the growth and division of living organisms. Even so complex a process as the division of a cell-nucleus by karyokinesis as a preliminary to the multiplication of the cell by division—a phenomenon which would *prima facie* have seemed and is commonly regarded as a distinctive manifestation of the life of the cell—can be imitated with solutions of a simple inorganic salt, such as chloride of sodium, containing a suspension of carbon particles, which arrange and re-arrange themselves under the influence of the movements of the electrolytes in a manner indistinguishable from that adopted by the particles of chromatin in a dividing nucleus."

I may be dense, but I am tempted to ask "What of it?" Karyokinesis is, as I have repeatedly stated, a process which is purely electrical in character, and I do not see why it should not be capable of imitation, up to a certain point. That point appears to be

the division of the nucleus *as a preliminary* to the multiplication of the cell by division. What would astonish me would be to hear that the process continued to the formation of two daughter-cells. As it is, the experiment, as described, proves nothing, interesting though it may be. "So intimate is the connection between electricity and the metabolic changes that occur in the fully ionized cell," writes Dr. Wilson in *The Practitioner*, "that it has actually been found possible to start the process of cell-division in the ovum of the sea-urchin by a simple electrochemical stimulus."

The movements of the amœba were similarly imitated, years ago, by means of drops of oil and soap and water upon glass, and someone was supposed to have created life. All that he did was to bring into association certain colloids and electrolytes and lipoids in solution. The water took up charge from the atmosphere and movement upon a smooth surface, such as a microscope slide, ensued as a matter of course.

Whenever colloids and crystalloids are associated in solution with a lipoid or lipoids, electrical interchanges must take place whether they are visible or not.

The theory that death is the inevitable

result of reproduction does not call for serious consideration, because there is no evidence to show that chastity and extreme longevity have any direct connection. Messrs. Geddes and Thomson* say: "The association of death and reproduction is indeed patent enough, but the connection is in popular language usually misstated. Organisms, one hears, have to die; they must therefore reproduce, else the species would come to an end. But such emphasis on posterior utilities is almost always only an afterthought of our invention. The true statement, as far as history furnishes an answer, is not that animals reproduce because they have to die, but that they die because they have to reproduce."

If that is true, and we cannot doubt that it is true, it only shows how necessary it is for men to keep their passions under control. At one period of our lives the anabolic process keeps ahead of the katabolic, and desire is a natural outcome. Later on there is equilibrium, and later still the katabolic, the destructive, process gains the mastery. We go down hill, but I feel sure that if we make full use of the intelligence that God has given us we can at least deprive the gradient of some of the steepness that to-day

* *The Evolution of Sex.*

hurries our footsteps prematurely to the grave.

An American writer—Dr. O. Phelps Brown—cited many instances of longevity. He wrote : " If it can be proved that any one man has lived one hundred, two hundred, or three hundred years, under favourable hygienic circumstances, it will be sufficient evidence of a physiological principle that most men may attain to similar extreme longevity by a mere simple obedience to the natural laws of his being.

"The examples of extreme longevity are numerous, but a few may be cited. Haller during his time collected more than one thousand cases of persons in Europe who attained the ages of from one hundred to one hundred and seventy years. In Baker's ' Curse of England ' we find a list of one hundred individuals whose ages ranged from ninety-five to three hundred and seventy. Twenty-two of these reached the age of one hundred and fifty and upwards, and thirty exceeded one hundred and twenty years. Modern statistics exhibit numerous examples of persons in the United States and all parts of the world attaining more than one hundred years. Indeed, it was common to the American Indians, previous to the introduction of

'fire-water' among them, to live to one hundred years of age. . . .

"Casting all speculation aside, it will not be denied that this earth was made the residence of man, and that God expressly enjoined upon him to be fruitful, and to occupy and replenish the earth, giving him at the same time dominion over all the vegetable and animal kingdoms, as a means for subsistence and happiness, while progressing through the gradual stages of his terrestrial existence. Hence the Creator did not bring man into existence without first furnishing him with the means of an abundant supply of all the elements requisite for a long life. Man, however, has grossly violated the laws of Nature, and blundered on in his perversity, till life has actually become a grievous burden, and extreme old age a great and moral curse instead of a divine and special blessing"; for, it might be added, it is generally only with the decay of our physical powers that the intellectual faculties are allowed full play. The true intellectual life of man is lived after he has ceased to be a factor in reproduction.

Reverting to the question of soul, Haeckel is obsessed by the monistic conception. He says*: "How can we reconcile this view"

* *The Evolution of Man.*

(the dualistic idea) " with the known facts of evolution ? It meets with difficulties equally great and insuperable in embryology and phylogeny. If we suppose with the majority of men that the soul is an independent entity, which has nothing to do with the body originally, but merely inhabits it for a time, and gives expression to its experiences through the brain just as the pianist does through his instrument, we must assign a point in human embryology at which the soul enters the brain ; and at death again we must assign a moment at which it abandons the body. As, further, each human individual has inherited certain personal features from each parent, we must suppose that pieces were detached from their souls and transferred to the embryo."

I fail to see in what way the dualistic idea is at variance with the known facts of evolution. That we are not at present able to say exactly when the soul enters the brain, nor to specify the precise moment when, after or at death, it leaves it, does not negative its existence as a separate entity. Suppose the soul does give expression to its experiences through the brain, as the pianist does through his instrument, would not the quality of the music depend upon the

quality of the instrument and the ability of the player? Most certainly it would. For all men to be equally good pianists and for the music produced by them to be equally harmonious, it would be necessary for embryologists to show that every brain is exactly alike; no man differing in respect of brain development from any other man. Obviously it is to some extent, but only to some extent, a matter of heredity, as physical defects or peculiarities are frequently matters of heredity, but if all brains were formed alike, one man would not exhibit unusual mathematic powers, another become a great painter, a third a pronounced dunce, and so on. Even if we assumed—which we certainly do not assume—that all souls are fashioned exactly alike, there is still the question of the quality of the instrument to be taken into consideration, as well as the probability of the soul having to acquire experience before it is able to efficiently operate the human organism. Haeckel makes much of the gradual unfolding of the soul of the child, but it could also be called the gradual unfolding of the intelligence of the child, with brain development and experience.

In accordance with the laws of Nature, men and women are instrumental in repro-

ducing their species, so far as the physical body is concerned, but my mind rejects the suggestion that they have anything whatever to do with the soul. How often do we hear of a vicious child being born of God-fearing parents? According to Haeckel, this, to be in harmony with the dualistic idea, must be due to pieces having been detached from the souls of the parents, which, then, must have been, like the curate's egg, only good "in parts." Alternatively, we should no doubt be told that the pieces were from the souls of some bygone ancestors, which, in the same remarkable way that the permanent cytode became all sorts of other things, performed a revolutionary instead of an evolutionary act by making bad be the outcome of good.

When we attempt to deal with mysteries beyond the comprehension of our finite minds, our theories cannot be but speculative. Reincarnation, however, seems to me to throw more light upon the problem than the laboured explanations of the materialistic philosopher. It may also give us a reason why genius sometimes emanates from the gutter, and vice coupled with a low order of intelligence from a palace. Those who regard this world as a school for souls and a

possible breeding ground for other planets or stages of some future form of existence may not be altogether wrong. They have, in my opinion, more reason on their side than those who postulate that the common ancestor of all life and intelligence was a piece of structureless plasm which created itself.

As Sir Humphry Davy wrote*, nearly a century ago: "The doctrine of the materialists was always, even in my youth, a cold, heavy, dull and insupportable doctrine to me, and necessarily tending to atheism. When I heard with disgust in the dissecting rooms the plan of the physiologist, of the gradual accretion of matter and its becoming endowed with irritability, ripening into sensibility and acquiring such organs as were necessary by its own inherent forces, and at last rising into intellectual existence, a walk into the green fields or woods by the banks of rivers brought back my feelings from Nature to God; I saw in all the powers of matter the instruments of the deity; the sunbeams, the breath of the zephyr awakened animation in forms prepared by divine intelligence to receive it; the insensate seed, the slumbering egg, which were to be vivified, appeared, like the new born animal, works of a divine mind."

* *Consolations in Travel.*