

1392
ABSTRACT

OF

“RESEARCHES ON MAGNETISM

AND ON

CERTAIN ALLIED SUBJECTS,”

INCLUDING

A SUPPOSED NEW IMPONDERABLE.

BY

BARON VON REICHENBACH.

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TRANSLATED AND ABRIDGED FROM THE GERMAN

BY

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ERRATA.

- Page 10, § 18, delete the last sentence of the paragraph.
 — 59, line 4 from bottom, for SECTION VI. read SECTION V.
 — 86, line 6-7, for "from 7 to 14 inches broad," read from $\frac{3}{4}$ of an inch to $1\frac{1}{2}$ inch broad.

PREFACE.

THE 53d volume of the "Annalen der Chemie und Pharmacie," conducted by Baron Liebig and Professor Wöhler, a journal standing in the highest rank of chemical periodicals (the last number of which volume appeared in Germany about the end of April or beginning of May 1845), was accompanied by a supplement of great extent, reaching to 270 pages of the Annalen. The supplement appeared in two parts, of which the first reached Edinburgh in May or June, the second in July. It was entirely devoted to a minute account of "Researches on Magnetism and certain allied subjects," by Baron von Reichenbach.

The name of the author was well known to chemists, in consequence of his laborious and successful researches on the tar of wood and of coal, which filled the scientific journals for several years, and made us acquainted with creosote, parraffine, eupion, and many other new and interesting compounds discovered by him in tar.

Baron von Reichenbach's character, as an experimenter, has always stood particularly high, for minute accuracy and untiring perseverance; and it was not possible for any experiments or discoveries to be presented to the scientific world by one more entitled to its confidence in every point of view.

The translator read Baron von Reichenbach's memoir with that interest which a long and familiar acquaintance with his former researches naturally inspired; but soon found that his present subject possessed a much higher

interest, and that his researches promised to yield most interesting, as well as practically useful results. As he proceeded, he recognised the same ardent zeal in the pursuit of knowledge, the same powers of minute observation, the same accuracy in the details of his experiments, the same caution in devising all possible checks and control in these experiments, and the same logical turn of mind in drawing his conclusions, which had, from the beginning, characterised all the researches of Reichenbach.

However unexpected and even startling were some of these conclusions, the translator found it impossible, feeling secure, as he did, of the exceeding accuracy and truly scientific character of the author, to withhold his assent from the facts on which they rested; and from that time, he resolved to introduce these very striking and important discoveries in their proper place in his lectures.

But it soon appeared, that, from a variety of causes, these researches, in this country at least, were not attracting the attention they deserved. Appearing as a supplement, which was not only very long, but often very dry from the minute detail of facts, they appear to have been overlooked by the habitual readers of the *Journal*. Indeed the translator has not yet met with one such reader who has read more than the title.

On returning, in the very end of October, from the Continent, the translator could not find that any notice whatever of these researches had, up to that time, appeared in this country; and he therefore felt it his duty to prepare for publication an abridged translation of the researches of Baron von Reichenbach. He at first thought that the whole might be so far compressed as to appear in some of our scientific periodicals, perhaps in two or three successive portions. But he soon found that if any thing like justice were to be done to the author, the translation could not be reduced to such narrow limits.

It, therefore, appeared more expedient to condense only so far as should seem practicable, without injury to the author's argument, and to publish the whole in a separate form.

This has now been done ; and while thus giving to his countrymen the means of becoming acquainted with these very remarkable researches, the translator has to apologise to the reader for the very rough unpolished form in which they appear, and which is the result of the necessity under which he laboured of abridging and condensing the writings of another. In these circumstances, he was compelled to renounce all pretensions to elegance or even neatness of style, and to hope that he might, notwithstanding, succeed in making the facts and the conclusions deduced from them intelligible to the reader. To the author he has also to apologise for the mutilation which he has been compelled to inflict on that author's literary offspring ; which, however, was necessary, in order to give the translation a better chance of being read than the original, the length of which has been the chief obstacle to its being better known.

Such is the history of the present publication. It is, and professes to be, nothing more than a detail of the author's experiments, and a statement of the conclusions deduced from them. Its only claims to attention are the care and caution with which the experiments were made, their truly scientific character, and the minute accuracy with which they are reported, taken in connection with the fact, that these experiments throw much light on several very obscure departments of science.

The first of these is the so-called Animal Magnetism. The author has demonstrated, that magnets act on the human body, especially in certain conditions ; and thus restores to the statements of the early magnetisers on this point the credit of which they had been unjustly deprived. The author's experiments are the more valuable, because, as far as the present memoir extends, he never experimented with persons in what is called the mesmeric state.

But he goes farther ; for he demonstrates the existence, *in magnets*, of two forces ; one which attracts iron and affects the needle, and one which acts on the nervous system, and which he has found, unmixed, *in crystals*. This new force he is disposed to view as the true agent in Animal Magnetism.

At all events, it is so in the magnet, when it acts on the system.

This new power is transferable from one body to another, and it is conductible through matter. A body may be, for a time, charged with it, and this is the true explanation of the fact, now demonstrated by the author, that a glass of water, as stated by Mesmer and his followers, may be magnetised by contact with a magnet, although that term is improper.

But perhaps the most striking characters of this new power are, that it assumes, like electricity and magnetism, a polar arrangement in bodies, and that bodies charged with it are luminous, especially at the poles. The light, it is true, is only visible to certain sensitive individuals ; but not only are such persons of tolerably frequent occurrence, but the author has gone far towards demonstrating, that, although invisible to ordinary eyes, actual light, nevertheless, does emanate from the poles of powerful magnets. It is very interesting to remark that Baron von Reichenbach's discovery of the luminous appearance connected with the magnet has been so soon confirmed by the researches of Faraday.

The author's conclusion that the new power, existing as it does in crystals, as well as in magnets, plays an important part in crystallisation, has also received powerful confirmation from the recent researches of Mr Hunt on the influence of magnets on crystallisation.

The author finds the new power in many unsuspected quarters, in the sun's rays, the moon's rays, heat, electricity, friction, and above all, chemical action ; and the numerous and beautiful applications which at once suggest themselves give a tenfold interest to this part of his researches. The human frame, especially the hand, whether in virtue of the incessant chemical changes going on in the body, or independently, is a rich source of the new power ; and when we reflect on the author's facts, demonstrating the existence in almost all forms of matter, and especially in the human hand, of an influence, no matter of what nature, capable of acting on the sensitive nervous system, we see at once the true explanation of the results of Haygarth and others, who

supposed that they proved metallic tractors to be quite inert, because the same effects (attributed by them to imagination) were obtained with tractors of wood and other substances, painted so as to resemble the metallic ones. We perceive that, in both cases, the hand may have been the chief agent, and that at all events both metal and wood, as well as many other bodies, are capable of acting on the system in the same way, that is, in sensitive persons. The error of Perkins, who recommended metallic tractors, as well as of his followers, seems to have been this, that, *on theoretical grounds*, they supposed the influence observed to exist in metals, or rather in iron alone. His opponents, in combating this notion, have supplied ample evidence that the influence exists in other bodies. Viewed in this sense, these experiments serve to illustrate the author's, and are at the same time illustrated by them; and they are beyond suspicion, both from the respectability of Dr Haygarth and his friends, and the very different object they had in view.

Space only permits a reference to the very interesting and beautiful explanation furnished by the author's discoveries, of at least one, and that a very frequent, kind of ghost-stories; which is thus reduced to a simple and natural result of a chemical process. The same remark applies to the author's satisfactory explanation of the magnetic baquet.

Although these researches undoubtedly tend to establish on a foundation of fact some of the most apparently incredible statements of Mesmer and his followers, yet it is to be carefully borne in mind that they have been made, without any exception, on persons not in the mesmeric state. This circumstance indeed gives to the experiments, and to the conclusions deduced from them, in reference to Mesmerism, a greatly increased value.

It is easy to object to these researches, that they have been made with persons in a morbid state, and are therefore unworthy of confidence. This is a very convenient method of getting rid of facts, far more so than that of disproving them by researches as laborious and conscientious as those

of the author. But it is not a scientific method, and is, therefore, unsatisfactory.

Besides, a careful perusal of the following pages will convince the reader that many of the phenomena occur in healthy persons, and that the only essential difference between these persons and the most sensitive is the superior acuteness of the senses in the latter. A regular gradation exists from those who are utterly devoid of sensitiveness to the most highly sensitive, and while some phenomena are only perceived by the latter, others are observed by a large majority of mankind. The objection, therefore, is unfounded in fact.

But further, even were the evidence confined to the highly sensitive, or morbidly sensitive, the reader will perceive that the method of investigation effectually establishes the reality of the phenomena described by them. A considerable number of sensitive persons are examined separately as to a particular class of phenomena. They are ignorant of the object in view, and of the special experiment made at the moment, the essential part of which is often, indeed generally, conducted out of their sight; and they are merely asked to describe their sensations.

Now when, under these circumstances, and with every precaution which science can suggest, it is found that each observer is at all times consistent with himself, and, in all essential points, with the others also, no communication whatever having occurred between them; when it is further found that these observations, in points where they can be checked by those of healthy subjects, or by known facts (as, for example, when sensitive patients classify bodies, without seeing them, by the sensations produced, in an order coinciding with their electro-chemical arrangement, a principle unknown to the patient), are found to be exact—when this is the case, it appears to me impossible to maintain the objection above alluded to, or to doubt the genuineness of the phenomena.

Into the question, whether the new influence detected by the author in magnets, in crystals, in light, heat, electricity,

and chemical action, be due to the existence of a new imponderable, it would be premature to enter here. The author, adopting this view, gives it a name, and certainly the laws of its diffusion and distribution, as well as its very analogous characters, would induce us to place it beside magnetism and electricity, as a force distinct, yet of the same kind. It is very interesting to observe that Professor Draper of New York, from considerations connected with photogenic influences, admits a fourth imponderable as existing in the sun's rays. The current of discovery seems to set in that direction; and this is one more coincidence, strongly confirmatory of the author's accuracy and sagacity. He has certainly advanced farther than all others towards the establishment of his new imponderable; and it would not be easy to exaggerate the importance, especially to chemistry and to medicine, of such a discovery, if finally confirmed.

The most recent researches of Faraday, of which a very imperfect account has just appeared, evidently establish the existence of a new class of facts, related to magnetism; and without attempting to shew how far these researches may coincide with, or differ from, those of Reichenbach, this at least is evident, namely, that, in connexion with magnetism, much remains to be discovered.

It is also worthy of notice, that, in a pamphlet lately published in Calcutta by Dr Esdaile, that author comes to the following conclusions, among others, all supported by very numerous facts: *1st*, That there exists, in the human frame, an influence capable of being transferred from one body to another, and of affecting a sensitive person at considerable distances. To this power he attributes all mesmeric phenomena. And, *2d*, That water can be charged with this power; and that water so charged is at once distinguished from ordinary water by the sensitive, on whom it acts very powerfully. The attentive reader will easily perceive how the experiments of Dr Esdaile, made at so great a distance, about the same time, and in an entirely different manner, confirm and illustrate those of Reichenbach, by which they are, in turn, confirmed and illustrated.

It now only remains for the translator to repeat his entire confidence in the accuracy of every statement of fact made by Baron von Reichenbach, and his admiration of the perseverance and sagacity which have already led to such valuable discoveries, and which, he rejoices to know, are now engaged in pursuing some of the countless investigations opened up by these discoveries, and already with distinguished success. He entertains no doubt that in this country the example of Baron von Reichenbach, in making these interesting, but obscure phenomena the subject of regular scientific study, will soon be widely followed, and his results confirmed. In the few instances in which the translator has himself been enabled to repeat some of Baron von Reichenbach's experiments, he has found them, as might be expected, entirely accurate; and he can already bear his testimony to the fact that crystals exert *an influence* on the human system, in a large majority of persons; while in some, the sensitive, their action is exceedingly powerful.

Without, therefore, adopting, as established truth, all the conclusions of the author, the translator considers it of great importance to direct attention to his very numerous, well made, and carefully reported experiments, which, at all events, demonstrate the existence of a power or influence hitherto overlooked, yet playing a very important part in many natural operations, and throwing light on many obscure although well established facts.

While preparing his translation, the translator took the opportunity to describe, in two lectures, to a numerous audience, composed of his regular pupils and their friends, a considerable part of the results obtained by Baron von Reichenbach. These lectures excited a good deal of interest; but as some misapprehensions as to their scope and object seem to have existed, all who feel any interest in the subject are referred to the following pages for a full account of the matter.

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February 4. 1846.

ABSTRACT, &c.

INTRODUCTION.

MAGNETS of 10 lb. supporting power, when drawn along the body, downwards, without contact, produce certain sensations in a certain proportion of human beings. Occasionally in 20, 3 or 4 sensitive individuals are found; and in one case, out of 22 females, examined by the author, 18 were found sensitive.

The sensation is rather unpleasant than agreeable, and is like an *aura*, in some cases warm, in others cool: or it may be a pricking, or a sensation of the creeping of insects on the skin: sometimes headache comes rapidly on. These effects occur when the patient does not see the magnet nor know what is doing: they occur both in males and females, although more frequently in females; they are sometimes seen in strong healthy people, but oftener in those whose health, though good, is not so vigorous, and in what are called nervous persons. Children are frequently found to be sensitive. Persons affected with spasmodic diseases, those who suffer from epilepsy, catalepsy, chorea, paralysis, and hysteria, are particularly sensitive. Lunatics and somnambulists are uniformly sensitive.

The magnet is consequently an agent capable of affecting the living body; but although some physicians have attempted to employ the magnet as a curative agent, no fixed or decided results have been attained. The subject, having a close connection with physiology on the one hand, and physics on the other, has been neglected both by physiologists and natural philosophers; while among medical men it has not always fallen into the best hands. The object of the author is to solve some of the disputed questions, and to bring a number of the phenomena under fixed physical laws.

A

SECTION I.

APPEARANCE OF LIGHT AT THE POLES AND SIDES OF
POWERFUL MAGNETS.

1. Healthy sensitive subjects observe nothing farther than the sensations above noticed, and experience no inconvenience from the approach of magnets. But the diseased sensitive subjects experience different sensations, often disagreeable, and occasionally giving rise to fainting, to attacks of catalepsy, or to spasms so violent that they might possibly endanger life. In such cases, which generally include somnambulists, there occurs an extraordinary acuteness of the senses: smell and taste, for example, become astonishingly delicate and acute; many kinds of food become intolerable, and the perfumes most agreeable at other times become offensive. The patients hear and understand what is spoken three or four rooms off, and their vision is often so irritable, that, on the one hand, they cannot endure the sun's light or that of a fire; while, on the other, they are able, in very dark rooms, to distinguish not only the outlines, but also the colours of objects, where healthy people cannot distinguish any thing at all. Up to this point, however strange the phenomena, there is nothing which may not easily be conceived, since animals and men differ very much in the acuteness of the senses, as is daily experienced.

2. The author had the opportunity of studying a patient *M^{lle}. Nowotny*, aged 25, subject for 8 years to headaches, increasing in severity, and latterly affected with cataleptic fits, accompanied with spasms both tonic and clonic. She possessed a very high degree of acuteness of the senses: she could not endure the daylight, and in a dark night perceived her room as well lighted as it appeared to others in the twilight, so that she could quite well distinguish colours.

She was very sensitive in various ways, to the influence of the magnet, and although not somnambulist, was quite equal to somnambulists in the acuteness and excitability of the senses.

Considering these things, and remembering that the aurora borealis appears to be a phenomenon connected with terrestrial magnetism or electro-magnetism, it occurred to the author that possibly a patient of such acuteness of vision might see some luminous phenomenon about the magnet. Dr von Eisenstein, who took much interest in these and in

all the subsequent experiments, gave every facility to the author in his researches.

3. The first experiment was made by the patient's father. In profound darkness, a horse-shoe magnet of 9 elements, capable of carrying 80 lb., was presented to the patient, the armature being removed; and she saw a distinct and continued luminous appearance, which uniformly disappeared when the armature was applied.

The second experiment was made as follows, on her recovery from a cataleptic attack, when the excitability of her senses was greatest. The room being artificially darkened, and the candles extinguished before the fit was ended, the magnet was placed on a table, 10 feet from the patient, with the poles upwards, and the armature removed. None of the bystanders could see any thing whatever, but the patient saw two luminous objects, one at each pole, which disappeared on joining the poles, and reappeared on removing the armature. At the moment of breaking contact, the light was somewhat stronger. The appearance was the same at both poles, without any apparent tendency to unite. Next to the metal she described a luminous vapour, surrounded by rays, which rays were in constant shooting motion, lengthening and shortening themselves incessantly, and presenting, as she said, a singularly beautiful appearance. There was no resemblance to an ordinary fire: the colour of the light was nearly pure white, sometimes mixed with iridescent colours, the whole more like the light of the sun than that of a fire. The light was denser and brighter towards the middle of the edges of the ends of the magnet, than towards the corners, where the rays formed bundles, longer than the rest. I shewed the patient a small electric spark: this, she said, was more blue, and left on the eye a painful and lasting sensation like that caused by looking at the sun, when the image of the sun is afterwards seen on every object.

The experiment was more than once repeated with the same results; also with a weaker magnet, nothing being said of this to the patient, who saw this time only two luminous threads, no doubt the edges of the poles. The first magnet being now substituted for the other, she again saw the phenomena first described. Some time later, when the cure of the patient was far advanced, even the stronger magnet gave rise to less distinct luminous appearances; after another interval, the patient saw with this magnet only the two luminous threads, and at last she saw nothing more, except a kind of flash when the armature was re-

moved. Her rapid recovery put an end to farther experiments with her, but from the character and circumstances of the patient, there was every reason to confide in her statements.

4. Through the kindness of Dr Lippich, Clinical Professor, the author obtained the means of experimenting with M^{lle}. Sturmman, a patient aged 19, suffering from pulmonary tubercles, and subject to the lower stages of somnambulism, with attacks of spasms and catalepsy. She was far more sensitive to the magnet than the former. When the magnet (capable of supporting 80 lb.) was placed at the distance of 6 paces from the feet of the patient (then in bed), in the darkened ward, and the armature removed, the patient, then quite conscious, gave no answer, having instantly fallen into a state of spasm and unconsciousness. After an interval she came to herself, and declared, that at the moment when the armature was withdrawn, she had seen fire rise from the magnet, which fire was the height of a small hand, white, but mixed with red and blue. She wished to examine it more closely, but the action of the magnet (the circuit being then not closed) instantly deprived her of consciousness. It was not considered advisable, on account of her health, to repeat this experiment with M^{lle}. Sturmman, but the author had obtained a confirmation of the observation made with M^{lle}. Nowotny.

5. A young lad of 18, subject to frequent convulsions, caused by fear and bad usage, saw fire and flame proceeding from the magnet as often as the armature was removed in the dark. He was too stupid and ignorant to permit of accurate experiments being made with him, especially as far more interesting cases occurred, which enabled the author to pursue the investigation in detail.

6. The next case was that of M^{lle}. Maix, aged 25, daughter of a house-steward in one of the imperial castles, to whom the author was introduced by Dr von Eisenstein. She had paralysis of the lower extremities, with occasional spasms. She was neither somnambulist nor lunatic, nor a speaker in her sleep; she was not subject to any affection of the temper or spirits, and was a lady of clear intellect and sound understanding.

As often as the armature was removed from a large magnet in the dark, she instantly saw the luminous appearance above the poles, about a handbreadth in height. But when affected with spasms, she was more sensitive, and the phenomenon increased in her eyes amazingly. She not only now saw the magnetic light at the poles much larger than before,

but she also perceived currents of light proceeding from the whole external surface of the magnet, weaker than at the poles, but leaving in her eyes a dazzling impression, which did not for a long time disappear. We shall soon see how all these things are related together. This was the fourth confirmation of the existence of the magnetic light. Dr von Eisenstein had collected several more among his patients; but the author has not dwelt on them, because he soon saw that from all quarters there might be obtained abundance of confirmation, if it were only looked for. But he had yet to become acquainted with the most remarkable and most distinct observer.

7. This was M^{lle}. Barbara Reichel, aged 29, of stout build, daughter of a servant in the imperial castle at Laxenburg. At the age of 7, she had fallen out of a window two stories high, and since that time she had suffered nervous attacks, passing partly into lunacy, partly into somnambulism, and speaking in her sleep. Her disease was intermitting, often with very long intervals of health. At this time she had just passed through severe spasmodic attacks, and retained the entire sensitiveness of her vision, the acuteness of which was singularly exalted during her attacks. She was at the same time in full vigour, perfectly conscious, looked well externally, and went alone through the crowded streets of Vienna to visit her relations in their houses. The author invited her to his house, and she came as often as he wished it, so that he was enabled to employ her extraordinary sensitiveness to the magnetic influence in researches with such apparatus as could not conveniently be brought into other houses.

This person, although strong and healthy, saw the magnetic light as strongly as any sick individual; she could move about freely, and was very intelligent; and in addition to these rare advantages, although highly sensitive, she could bear the approach of magnets, and experimenting with them, far better than sensitive persons generally do. It has already been stated that M^{lle}. Sturmman, for example, could not endure the approach of an open magnet without insensibility and convulsions being brought on. Such a rare case as that of M^{lle}. Reichel was invaluable for the purposes of science; and in fact by means of M^{lle}. Reichel, the author has obtained most precise and valuable results in reference to the theory of Electro-magnetism. In the present paper, however, he only brings forward those observations which bear on the luminous emanations from the magnet.

M^{lle}. Reichel saw the magnetic light, not only in the dark,

but also in such a twilight as permitted the author to distinguish objects, and to arrange and alter the experiments. The more intense the darkness, the brighter and larger she saw the flaming emanations, the more sharp and defined was their outline, and the more distinct the play of colours.

8. When a magnet was laid before her in the dark, she saw it giving out light, not only when open, but also when the poles were joined by the armature. This may appear strange at first, but we shall see that this statement of M^{lle}. Reichel entirely corresponds with the essential nature of the phenomena. The luminous appearance was different in the two cases. With the closed magnets, there were no points where the light appeared concentrated, as was the case when the magnet was open: but all the edges, joinings, and corners of the magnet gave out short flame-like lights, uniform in size, and in a constant undulatory motion. In the case of the magnet of 9 elements, capable of carrying 80 lb., these were about as long as the thickness of a little finger.

9. But when the armature was removed, it presented the beautiful appearance, fig. 1.* This was drawn by M^{lle}. Reichel, to the best of her ability, but she regretted her inability to represent nature with perfect fidelity. Each arm of the magnet was about $8\frac{1}{2}$ inches long, and the light rose almost to an equal height above the magnet, being rather broader than the bar. At each depression, where two plates of the magnet are laid together, there appeared smaller flames ending in points like sparks, on the edges and corners. These small flames appeared blue, the chief light was white below, yellow higher up, then red, and green at top. It was not motionless, but flickered, undulated, or contracted by starts, continually, with an appearance as of rays shooting forth. But here, as in the case of M^{lle}. Nowotny, there was no appearance of mutual attraction, or mutual tendency towards each other of the flames, or from one pole to the other; and as in that case both poles presented the same appearance. Fig. 2 gives a side view, in which each separate edge gives out its bundle of light. For the sake of distinctness, this was omitted in fig. 1., which was represented as a simple, not a compound, magnet. In fig. 2, however, may be seen a little repulsion of like sides of the magnetic flames. Along the back and the inner, or concave side of the magnet, weaker lights everywhere appear, as already observed in part by M^{lle}. Maix. On the inside they are all directed upwards, on the outside only for a little distance upwards, then for a space

* See Plate I., fig. 1.

horizontally outwards, and, lastly, they are turned downwards. These weaker lights are very delicate, and also motionless. They are represented in fig. 10, as occurring in a magnet of one bar. In the compound magnet, along the joinings of the bars, the flames from the adjacent edges of two adjacent bars diverge at their origin, and, consequently, converge towards the remaining flames from the opposite edges of the same bars, causing the appearance seen in fig. 3.

10. The author placed before M^{lle}. Reichel a straight bar magnet, of about $1\frac{1}{2}$ foot long, and quadrangular, and of the width of ordinary bar-iron (1 inch wide), and she made the drawing, fig. 4, of the appearances. At the pole pointing to north, or negative end of the magnet, the flame was larger than at the opposite end; it was sometimes undulating, sometimes starting, and shot out rays, as in the horse-shoe magnet; it was red below, blue in the middle, green at top. At each of the four solid angles of each pole there streamed out a more intense light; each of these was inclined 45° to the horizontal plane, and had a screw-like motion, which was not seen in the chief flame in the middle. At each pole, therefore, the division of the flame was fivefold. The 4 long edges of the bar were, like those of the horse-shoe magnet, furnished with a weaker light, exhibiting white, red, blue, and green, but motionless. This light in the bar magnet was of equal intensity in every part, and no indifferent points were observable as in the horse-shoe magnet.

11. The position of the magnetic bar, whether in the meridian or in any of the magnetic parallels, with the poles directed backwards or forwards, or in the direction of the magnetic inclination, had no influence on the form and direction of the flames; and the terrestrial magnetism appeared too weak to exert a visible counter-influence.

12. The author now took an electro-dynamic apparatus, partly for the purpose of forming an electro-magnet under the eyes of M^{lle}. R., partly in order to study the action which such a magnet and a common steel-magnet might have on each other, in reference to the luminous appearances. The steel-magnet consisted of a horse-shoe bar, the limbs widely separated, between the poles of which a horizontal electro-magnetic coil, protected by silk, could be made to rotate. The steel-magnet itself, the poles of which were directed upwards, had limbs of $\frac{1}{2}$ inch square. In the dark it exhibited appearances very similar to those of the large horse-shoe magnet first described: namely, at the four corners of each pole obliquely ascending flames, with a tendency to rotatory

motion about themselves, and in the middle, a longer perpendicular flame, not, as in the former magnet, the broadest part, but like a long thin needle, a difference probably depending on the size and power of the magnets. Possibly it may have been caused by two small hollows made near the ends for the purpose of rotation. In this form the luminous appearance was stationary, and almost exactly alike at both poles. As soon as the electricity of a Grove's pair was made to pass through the protected coil of thick copper-wire, within which the iron-bar of the electro-magnet was placed, this bar shot forth rays of fire at both ends, and instantly exhibited all the luminous appearances of a magnet. Nay, more, after the current was stopped, the bar continued for some time to give out light at the poles with little change. (The origin and explanation of this last result is given in a subsequent section). Consequently, an electro-magnet, in its radiation of flaming light, as visible to a sensitive person, entirely agrees with an ordinary steel-magnet.

13. But the action of the two flames on each other was very remarkable. The flame of the steel-bar magnet gave way or yielded uniformly to that of the electro-magnet, as decidedly as the flame of a taper yields to the blast of the blowpipe. The figures 5, 6, 7, 8, and 9 exhibit the results. It remains to be ascertained whether they are due to the different power of the magnets or to other causes.

M^{lle}. Reichel was therefore the fifth, and at the same time the clearest witness for the luminous appearances at the poles of magnets. The sixth was M^{lle}. Maria Atzmannsdörfer, aged 20, who had headach and spasms, and walked in her sleep. She looked well and walked alone in the streets. She was highly sensitive, and saw the magnetic poles flaming vividly. She drew the appearance as larger than M^{lle}. R., but in all other respects her description was the same. The light dazzled her eyes by its brilliancy.

14. The following were the general results obtained with the horse-shoe magnet of 9 elements, in regard to the magnetic light.

a. M^{lle}. Nowotny, far advanced in her recovery, saw a kind of shining vapour, surrounded by and mixed with rays $\frac{1}{2}$ to $\frac{3}{4}$ inch long, shining, fitful, or shooting, white, with a play of colours.

b. M^{lle}. Maix, in the normal state, saw a white flame a handbreadth in height.

c. M^{lle}. Sturmman, a flame as high as the length of a small hand, with play of colours.

d. The lad, a flame a hand high.

e. M^{lle}. Maix, while in a spasmodic condition, saw a general luminous appearance over the whole magnet, dazzling her eyes, largest and brightest at the poles.

f. M^{lle}. Reichel saw a flame with play of colours, shooting out rays, as large as the magnet, that is, about 10 inches high; also side flames from each plate of the magnet, and a general weaker light over the whole surface at the junctions of the plates.

g. Lastly, M^{lle}. Atzmannsdörfer saw the same phenomena still more distinct, and so brilliant as to affect the eyes painfully.

15. From the above facts it appears that the foregoing six sensitive individuals, each according to the degree of sensitiveness or to the diseased state of the body, saw, more or less vividly, a luminous appearance, like a moving flame, at the poles of powerful magnets. These individuals were highly sensitive, although of unequal sensitiveness, and, although unacquainted with each other, and with each other's observations, their accounts agree in all essential points, and were, in each case, uniformly consistent, not only with themselves, but with the known laws of electricity and magnetism. The author, having no reason to doubt the perfect honesty of these persons, and feeling at all events confident of his own caution, accuracy, and *bona fides*, has no hesitation in admitting the reality of the phenomena, although invisible to ordinary men; and he considers the fact of the existence of such luminous appearances at the poles of powerful magnets as fully established as the researches of one man can establish a fact. He confidently anticipates confirmation from other observers, since sensitive persons, although not numerous, or readily found in small towns, are quite easily obtained in large cities.

16. He then proceeds to examine some properties of the magnetic light. That it is invisible to ordinary eyes is not wonderful, when we reflect that the sun's light, according to Wollaston, is 5560 times, according to Leslie even 12,000 times, as powerful as the light of a candle; that many flames, as those of alcohol or pure hydrogen, are invisible not only in the sun's light but in strong daylight. From these latter to entire invisibility to ordinary eyes, even in the dark, is a step easily conceived.

17. But in order to prove, if possible, that this was real actual light, the author, with the aid of M. Carl Schuh, made the following experiment. A very sensitive daguerreotype

plate, being prepared, was placed opposite to a magnet, the armature of which was removed, in a closed box surrounded with thick bed-clothes, so that no ordinary light could enter. After 64 hours' exposure, the plate, when held over mercurial vapour, was found fully affected, as by light, on the whole surface. In a parallel experiment, made without a magnet, the plate was found entirely unaffected. This proves that, unless other imponderables, such as magnetism, act on the prepared plates as light does, the emanation from the magnet is of the nature of light, however feeble and slow in its action on the daguerreotype.

18. The following experiment was next made. The large magnet, with flames (to the sensitive) 10 inches high, was placed opposite a lens (of about 8 inches aperture, and 1 foot focal distance for a wax light 18 inches distant) at about 23 inches distance, in a perfectly dark room; and it was found necessary to remove the lens and magnet to nearly 5 feet from the wall before M^{lle}. Reichel observed the image of the flame concentrated to a point the size of a lentil, to which apparent size it was gradually reduced like any other luminous image in the same circumstances. Even this very considerable concentration did not render the light visible to the bystanders. But it enabled them to test M^{lle}. Reichel's accuracy; for while one experimenter moved the lens, in the dark, another caused M^{lle}. R. to point to where she saw the image on the wall, and it was invariably found that although she and all the assistants were ignorant of the actual change of position, whether upwards or downwards, &c., she always pointed to the precise spot where, on inquiry, the image ought to have appeared. She described the focal image as red, and saw the large lens red by the magnetic light. It is remarkable that while the focal distance of the lens for wax light was about 12 inches, that for the magnetic light was about 4½ feet. This indicates a different angle of refraction, which would point to an essential difference of intimate structure.

19. The magnetic light gave out no perceptible heat; at least none sufficient to affect Nobili's Thermoscope.

20. The *magnetic flame* is to be distinguished from the *magnetic light*. The former is tickering, and does not radiate: the latter radiates strongly. The flame yields like other flames when blown on, and when solid bodies are introduced into it. It would therefore appear that the *light* is distinct, imponderable; but that the flame is probably compound, consisting of a material substratum along with the imponder-

able light. M^{lle}. Reichel saw the light radiate from the magnet to the distance of 19 inches on the table.

21. The first application of these observations which occurs is towards the explanation of the aurora borealis; and since it is generally admitted that these phenomena occur within our atmosphere, there appears a great probability that they may be visible magnetic lights. The similarity of the light, as seen by M^{lle}. Reichel, to the aurora, is striking, and it must be borne in mind that the aurora, or the magnetism of the earth producing it, affects the needle very strongly; just as the magnet used by the author, and giving out light visible to sensitive persons, did also. The author here enters into a long description of the aurora borealis, and of the very similar appearances described by the patients. He is far from considering their identity as proved, because between light which is visible to healthy eyes and that which is invisible, there is a gap not easily filled up. But at least the analogy is so great that their identity acquires a high degree of probability.

SECTION II.

CRYSTALS.

22. In the preceding section, the author has endeavoured to establish the following propositions, which are here given, for the better understanding of what follows.

1. A powerful magnet exerts on many persons, both healthy and diseased, a peculiar exciting influence; it acts on the vital force.

2. Those who are in a high degree susceptible of this influence generally possess very acute senses, and are in that case able to perceive light and flame in connection with the magnet. The strength and distinctness of this perception increases with the excitability of the individual, and the darkness of the place.

3. The — M pole exhibits the larger, and + M the smaller, flame in the latitude of Vienna. The flame at each pole is divided, according to the form of the magnet, into several flames of different colours. It changes its form and colour according as the magnetic circuit is open or closed, according as the magnet is one made by streaking with another magnet, or is an electro-magnet; and also according as it is free, or under the influence of other magnets.

4. Positive and negative flames (magnetic) exhibit no mutual attraction.

5. The magnetic flame may be moved hither and thither like an ordinary flame.

6. It gives out light which is red, acts on the daguerreotype, and may be concentrated by a glass lens, but without perceptible rise of temperature.

7. It is so exactly like the Northern Lights, that it is very probable both are in nature identical.

[Since Baron von Reichenbach's researches were published, the discoveries of Dr Faraday have been made known, according to which lines of magnetic force are luminous, and a connection is thus established between light and magnetism, more close than was previously known. It is evident that the researches of Reichenbach coincide essentially with those of Faraday; and even if we hesitate about the evidence of the sensitive patients, we cannot reject that of the very interesting experiment with daguerreotype. Of course both series of experiments, those of Faraday and of Reichenbach, were made independently, although priority of publication belongs to Reichenbach; and their agreement as to the conclusion, arrived at in ways so different, adds much to the interest and importance of their researches.—W. G.]

23. The author and others had tried to repeat with M^l^{re}. Nowotny, some of the experiments formerly described by Dr Petetin of Lyons, and other observers, such as the attraction of the hand by a magnet, and the distinguishing, by the patient, of water along which a magnet had been drawn, from ordinary water. This last experiment was one of Mesmer's, and has been sufficiently ridiculed, but as often again maintained by his followers as true. We shall soon see how much of it, when tested by physics, turns out true and false.

The adhesion of a living limb to a magnet is a fact unknown in physiology as in physics, and few have seen it; it therefore requires explanation. M^l^{re}. N. being in catalepsy, insensible and motionless, but free from spasms, a horse-shoe magnet of 20 lb. power was brought near to her hand, when the hand attached itself so to the magnet, that whichever way the magnet was moved, the hand followed it as if it had been a bit of iron adhering to it. She remained insensible; but the attraction was so powerful, that when the magnet was removed, in the direction of the feet, further than the arm could reach, she, still insensible, raised herself in bed, and with the hand followed the magnet as far as she possibly could, so that it looked as if she had been seized by the hand,

and that member dragged towards the feet. If the magnet was still further removed, she let it go unwillingly, but remained fixed in her actual position. This was daily seen by the author between 6 and 8 P.M., when her attacks came on, in the presence of 8 or 10 persons, medical and scientific men.

At other periods of the day, when she was quite conscious, the phenomena were the same. She described the sensation as an irresistible attraction, which she felt compelled, against her will, to obey. The sensation was agreeable, accompanied with a gentle cooling aura, streaming or flowing down from the magnet to the hand, which felt as if tied and drawn with a thousand fine threads to the magnet. She was not acquainted with any similar sensation in ordinary life; it was indescribable, and included an infinitely refreshing and pleasurable sensation, when the magnet was not too strong.

The author being at first much surprised at these results, and indeed incredulous, tested the accuracy of these experiments, and the veracity of M^{lle}. N. in every possible way. Among other trials, he found that when a large open magnet was brought near her bed-head, without her knowledge, on the opposite side of the wall, she instantly detected the vicinity of an open magnet. The armature being attached, she became quiet, and so on any number of times. Again, M. Baumgartner, the distinguished natural philosopher, one day tried on her a magnet which he said was the most powerful he had, and requested her opinion of it. She declared that it appeared to her very weak indeed, in fact it had almost no action at all. M. B. then stated that it had been, in reality, a very powerful magnet, but that he had destroyed its power by drawing a magnet the contrary way along it before he brought it out. No one present knew of his intention. Many such tests were applied, but invariably proved the perfect integrity of the lady.

Similar results were obtained with M^{lle}. Reichel and M^{lle}. Sturmman; and they all established the fact, that, in certain diseases, especially catalepsy, an attraction exists between the hand and a magnet. In the case of M^{lle}. N. a certain amount of this attraction was observed also in the foot, but far weaker; and in no other part of the body has the author observed it.

24. The next question was, is the attraction mutual? or will the hand attract bodies that are attracted by the magnet? Experiment shewed, that the hand of the cataleptic patient had no attraction for iron filings, did not in the least

affect the needle, and exerted no appreciable attraction on a magnet which was counterpoised on the beam of a balance, and brought near to the hand, although it required some force to prevent the hand from rising to the magnet. That is to say, while the magnet attracted the hand vitally, as may be said, the hand did not attract the magnet statically, but the beam remained strictly horizontal.

The author could not find that his cataleptic patients were capable of magnetising needles by contact with the hand, as Thilorier has stated to be the case in certain nervous diseases. The apparent magnetisation of some needles, in the author's experiments, arose from the circumstance that the needles were not previously tested for magnetism. Had they been always examined, they would probably have been found in many cases already magnetic, as the author found a few to be.

25. The attraction, therefore, between the hand and magnet has nothing ponderable about it; and is therefore a different phenomenon from the attraction between iron and a magnet.

It is worthy of remark, that, in physics, every known attraction is mutual. In animal and vegetable life, however, this is not always the case; as, for example, in the case of the force by which a root penetrates hard rocks. Something analogous occurs when a patient's hand is attracted by a magnet, whether we can explain it or not.

26. A magnet of 80 lb. power, placed in M^{lle}. N.'s hand, was seized so firmly that it was difficult to loosen her hold. She herself could not do it.

27. The author, although strongly prejudiced against the mesmeric idea of magnetised water being recognisable, was yet compelled to admit what he saw daily, that his patient could easily distinguish a glass of water, along which a magnet, unknown to her, had been drawn, from any others; and this without failure or hesitation. He found it impossible to oppose a fact like this by arguments: but when he saw the same result in many other patients, he ceased to struggle against that which, whether he understood it or not, was obviously a fact. He then perceived that it was more rational to admit the fact, and to wait with patience for the explanation.

[Here, then, in an investigation conducted according to the most careful principles of physical research, we find, among other strange facts, one which hitherto had only been observed by mesmerists, and which had been most unsparingly ridiculed; for no other reason than that it appeared to those

who laughed at it to be absurd, impossible, and inexplicable. It is still as inexplicable as ever, but I do not think we can rationally doubt the fact: and I would take this opportunity of pointing out, as I have formerly done elsewhere, that in matters of observation, especially when new, the only question is this, "Is it true?" and not, "Is it possible?" or "Is it not absurd?" We cannot say what is possible, and *no fact can be absurd*. That we cannot explain it is only what might be expected, if we consider that multiplied observations are necessary before we can properly attempt to trace those general laws, which we often call explanations, when they are only statements of the facts in a new form. Newton's law of gravitation does not explain the facts: it only aids our comprehension of them. I repeat that we have here one of the most ridiculed facts of mesmerism established, independent of mesmerism, by simple observation; and this ought to teach caution to those who denounce the whole of Mesmerism as imposture.—W. G.]

28. The author was still more surprised to find that not only the magnet, but a magnetised glass of water, possessed the property of attracting the hand of M^{lle}. Nowotny. This took place in an inferior degree, but the hand never failed to shew a tendency to follow the magnetised water, whether the patient were in a state of catalepsy or not.

29. Being convinced that such a phenomenon could not be an isolated one, the author tried, whether the same effect might not be produced by other bodies besides water, hoping, if this were so, to be enabled to trace some general laws. All sorts of minerals, preparations, drugs, in short, objects of all kinds were therefore magnetised in the same way as the water, by drawing or passing the magnet along them, and tried on the patient; and all of them had acted as the water had done, more or less powerfully. Some of them caused spasms over the whole body, others only in the arm, others again only in the hand, and, lastly, others not at all, although all were equally magnetised. It was clear that a difference existed in the different kinds of matter, which here came into operation.

30. To investigate this, the same substances were tried, without being previously magnetised, in their natural condition. To his astonishment they still acted on the patient, and that with a power often little inferior to that which they had when magnetised. They did not, however, always give to the hand a tendency to follow, but more frequently caused it, as described in § 25, to grasp the magnet convulsively, with various degrees of force. It was also observed that the effect in

the cataleptic state was much more distinct and powerful than when the patient was in the normal condition. When the substance to be tried was laid in the hands of the cataleptic (insensible) patient, the result was, either, *a*, That the fingers were spasmodically closed on the body or substance—(The substances which acted thus were subdivided into, 1. Those which drew the hand after them; and, 2. Those which had no such effect)—Or, *b*, That the hand remained still, no visible effect being produced. It was therefore easy to arrange the substances according to their action, under *a* or *b*. The effect under *a* took place with varying energy; and sometimes occurred instantly on contact, at other times more slowly and gradually. The latter was also the case when very weak magnets were employed. On comparing together the bodies employed, they did not agree in structure, or in electrical character; indeed the same substance, in different states, was found to belong to different classes. At last it was observed that no one amorphous body was to be found among those which M^{lle}. N. clasped convulsively in her hand; and on the other hand, that all those bodies which had that effect were crystallized. There were still, however, among crystallized bodies, a certain number which were inert. Finally, all amorphous bodies being left out, and the crystallized bodies being arranged in two groups, those which were inert, and those which had the effect above described, it appeared that the former, the inert, included all bodies confusedly crystallized, such as loaf-sugar, Carrara marble, and dolomite; and those with many groups of crystals opposed to each other, as prehnite, wavellite, and sugar of lead, &c., while the active group included all loose single crystals, and all these, where the groups of crystals had their chief axes parallel, as celestine, gypsum, red and brown hæmatite, &c.

31. The author gives the following lists of the substances he tried.

I. INERT.

a. AMORPHOUS.

Ivory, Wood, &c.
 Anthracite.
 Cannel coal.
 Mineral pitch.
 Amber.
 Glass of all kinds.
 Osmium, Rhodium.
 Palladium.
 Mercury.

Silver and Gold coin.
 Copper, Brass.
 Iron Bars.
 Zinc, Lead, Cadmium.
 Compact Limestone.
 Red Copper Ore.
 Potassium, Sodium.
 Dry Hydrate of Potash.
 Chromate of Iron.
 Selenium.

Liver of Sulphur.

Roll Sulphur.

Compact Talc.

Gurhofian ?

Magnesite.

Pumice Stone.

Obsidian.

Menilite.

Common Opal.

Petrified Wood.

Egyptian Jasper.

Compact Quartz (with fatty lustre.)

b. CRYSTALLIZED.

Crystalline Limestone.

Dolomite.

Orpiment.

Wavellite.

Kakoxene?

Native Silver. Irregular crystals.

Loaf Sugar.

Ore of Antimony.

Prehnite.

Natrolite.

II. ACTIVE.

These were all beautifully crystallized, often large fine single crystals from the Imperial Collection.

a. Such as caused the fingers to close on the body with hardly perceptible spasm.

Diamond, very small.

Metallic Antimony.

Mesotype.

Witherite.

Tinstone.

Mica.

Corundum.

Prussiate of Potash.

Sugar Candy.

Leucite.

Garnets.

Augite.

Hornblende.

Staurolite.

Blue Vitriol.

Foliated Graphite.

Wolfram.

Metallic Bismuth.

Fahlerz ?

Rutile.

Lievrite.

Asparagus stone.

Sphene.

Iron Pyrites.

Analcime.

Adularia.

Felspar.

Boracite.

Celestine.

Topaz.

Apatite.

White Lead Ore.

Gold-crystal, $\frac{1}{4}$ inch thick.

Alum.

b. Those which caused the hand to be closed with spasm, but did not attract it to follow.

Pistacite.

Glance Cobalt.

Zinc Blende.

Elba Iron Ore (specular.)

Magnetic Iron Ore.

Rock Salt.

Rock Crystal.

c. Those which caused the hand to contract with violent spasm, and attracted it also when made to pass near it.

Meteorite of Macao.

Sandstone from Fontainebleau.

Arragonite.

Tourmaline (cold or hot.)

Beryl.

Gypsum.

Fluor Spar.

Heavy Spar.

The general result is, that distinct solitary crystals acted on the hand very distinctly, as described; and therefore *such crystals appeared to possess a power not previously noticed, and of a peculiar nature.* As far as we have gone, this property appears to depend on the structure of matter, and par-

ticularly its state of aggregation. Pouillet remarks that it has not hitherto been found that the form of matter, or the arrangement of its particles, has been the cause of new powers acting at sensible distances. This is the case, however, here ; for matter must be crystallized, or it does not act in this way.

32. When one body was examined by itself, the patient easily distinguished two points in the crystal, in which the power was concentrated, or two poles. These were always diametrically opposite, and constituted the poles of a principal axis. Their action was similar, only one was always more powerful than the other, and the aura of one was cool, of the other lukewarm.

33. In trying the effect of drawing the point of a rock crystal, 7 inches long and $1\frac{3}{4}$ thick, from the wrist to the points of the fingers, and back, as in magnetising, the author found that the sensation experienced by the patient was the same as when a magnetic needle or bar, nearly 5 inches long, $\frac{1}{2}$ inch broad, and $\frac{1}{30}$ inch thick, weighing nearly 180 grains, and supporting about $\frac{3}{4}$ oz. The patient felt an agreeable cool aura in both cases, when the crystal or magnet was drawn from the wrist to the point of the middle finger ; if drawn in the opposite direction the sensation was disagreeable and appeared warm. A crystal, thrice the size of the first, produced, when drawn downwards, the same effect as a magnet, supporting 2 lb. of iron ; and when drawn the opposite way, a spasmodic condition of the whole arm, lasting several minutes, and so violent that the experiment could not well be repeated.

34. The experiment was tried on M^{lle}. Angelica Sturmman, with a crystal 5 inches long, and $1\frac{3}{4}$ inch thick. The effects were the same, when the point was used, reaching to the shoulder. With the other end or pole, the effects were weaker and reversed. A crystal, three times as large, acted so violently that the patient became flushed, then pale, and it was found inexpedient to repeat the trial. Similar results were obtained with M^{lle}. Maix and M^{lle}. Reichel, who was sensitive in a high degree to the crystalline poles, perceiving the effect at some distance ; she felt the streak with the north (-M) pole, when downwards cool, when upwards warm ; but with the south (+M) pole the reverse. But the most sensitive was M^{lle}. Atzmannsdörfer, who perceived very distinct sensations from small crystals of fluor-spar, gypsum, pyrites, &c., about 1 inch long. The sensation was cool when the streak on the hand was made downwards, and when it was made upwards, the sensation was warm, and so

very disagreeable as to affect her whole system unpleasantly and even to cause spasms.

35. The author found among his friends several individuals sensitive to crystals, and is allowed to name M. Carl Schuh, and Dr Endlicher, both men of science, and in good health. About one-half of those in the author's neighbourhood have been found more or less sensitive. Many, with averted faces, could tell whether the streak were made with the positive or negative pole of the crystal.

36. The crystals should be large, single, with natural acuminations; heavy spar, fluor spar, gypsum, and rock-crystal, are the best. They must be drawn as near the inner surface of the hand as possible, 5 seconds being taken to a streak, and held perpendicularly. The author describes minutely the precautions observed, and the occasional contradictions naturally occurring in regard to a sensation so feeble as this must be. It appears that individuals are often more or less sensitive at one time than at another. The power of distinguishing the sensations appears to be increased by practice. The upward streak and the south pole seem to be the most efficacious in many persons.

37. The question now arose; is the force existing in crystals the same as magnetism? If so, it ought to attract iron, and to communicate to steel the power of attracting iron. But the author could not detect the smallest trace of this magnetic power, even with a rock-crystal of 8 inches diameter, which caused, in the case of M. Schuh, a very strong aura.

38. The needle (magnetic), however finely suspended, was in no degree affected by any crystal, neither was a suspended crystal in the slightest degree acted on by a powerful magnet.

39. No effect was produced on a suspended crystal by the approach of an electro-magnetic wire.

40. A coil of protected copper-wire, in connection with a delicate multiplier, exhibited no effect when a crystal was introduced within the coil or withdrawn from it.

41. Haüy, Biot, and Coulomb, have made experiments, according to which all or most substances are capable of magnetism. Haüy experimented, however, with compounds of iron. Biot hinted at the existence of *another power analogous to magnetism*. Coulomb's experiments proved that a mere trace of iron could give magnetic properties. It was necessary to ascertain whether crystals, free of iron, were in any way affected by terrestrial magnetism. The author suspended a crystal of gypsum, as delicately as possible, but

there was not the slightest tendency to the position occupied by a magnetic needle, or, indeed, to any fixed position.

Although, therefore, the action of magnets and of crystals on the animal nerve is the same, yet, in regard to iron, to the electric current, to the magnetic poles, and to terrestrial magnetism, they are entirely different.

42. The *polar force*, therefore, which exists in *crystals*, and produces on healthy and diseased persons the above described effects, is not identical with the *magnetic force*.

43. But, on the other hand, the *magnetic force*, as we find it in magnets, is accompanied by the crystalline force, because magnets act on the living nerve exactly as crystals do.

44. Hence the magnet is the seat of two forces, not one alone. They can be separated, for one of them is found in crystals, unaccompanied by the other.

The phenomena of magnetism, therefore, separate into two subdivisions, which, being found together in magnets, yield complex manifestations. It will, therefore, be necessary to subject to revision a part of the great accumulation of observations made by scientific men on magnets.

45. On the nature of this new force in crystals, the author has made investigations, with a view, in the first instance, to ascertain, whether this force admits of being transferred from one body to another, whether it can be concentrated, and whether bodies can be charged with it, as with magnetism or electricity. Having no re-agent except the nervous system of healthy persons, and of those affected with nervous maladies, and the sensitiveness of healthy subjects being so limited as not to be sufficient for the investigation, he was compelled to employ the more acute senses of those affected with disease. This proved perfectly satisfactory. Different persons, in the most different circumstances, agreed in their experience; and the statements, when arranged on a theoretical view, harmonized among themselves.

The objections which are made to this method of investigation will have no weight with the sober observer who keeps steadily within the limits of experience. Every thing that we know of the external world, we must learn ultimately through our senses, having no other means of doing so. But we know that many things go on around us, and in us, which, for want of appropriate senses, we cannot perceive. Numberless electric changes, for example, are taking place around us at each instant, of which we perceive not the slightest trace. If now an individual were to appear, gifted with a sixth, an electrical sense, by means of which he could perceive and describe the most delicate electrical changes,

as acutely as we can perceive light with our organs of vision, should we not eagerly listen to his instructions, and ask him a thousand questions, to clear up and to extend our notions on the subject? A person born blind is led by one who sees, and soon learns to believe that the latter has eyes, with which he sees objects, when he finds that the obstacles in his path of which he has been previously warned, actually exist. A person affected with some nervous malady is to ordinary men just such a guide as he who sees is to the blind man, for in him there is a sensitiveness to electrical and magnetical changes which amounts almost to a peculiar sense, opened up to him, and denied to the healthy. By nervous maladies, in reference to this matter, the author does not mean exactly somnambulism or lunacy, but, generally speaking, diseases characterised by spasms or convulsions. It is true that in somnambulists the sensitiveness in question, on account of the disturbance of the nervous system, reaches a maximum. They exhibit the strongest re-actions, and perceive the most delicate differences; but they are not indispensable for such researches. M^{lle}. Nowotny, during the six weeks that the experiments made with her lasted, was not at all affected with somnambulism; but she suffered from cataleptic spasms. M. Schmidt, a surgeon, who was very strongly affected by the magnet, by crystals, and by terrestrial magnetism, was a young man otherwise healthy, who through a partial chill suffered for a short time from spasms in one arm. There exist all degrees of sensitiveness down to the absence of all sensitiveness; and when we see thus an unbroken chain, it is impossible to deny the relation of cause and effect in the phenomena. It would be absurd to reject this means of research, in cases where Nature seems to have most obstinately concealed her secrets. The peculiar sensitiveness or new sense of certain persons is specially adapted to magnetic phenomena; and for these it is a most precious re-agent, superior, in this matter, to all others. The effects are not merely vague sensations, as has been often believed, in consequence of the unscientific proceedings of individuals, but every thing follows laws and rules which, if we carefully look for facts, pursue them with the aid of physical and chemical knowledge, and test them by experiment, will soon be discovered.

Is, then, the peculiar force residing in crystals capable of being transferred, concentrated, or accumulated in other bodies, as electricity and magnetism are?

When all manner of substances, such as wood, a glass of water, leather gloves, scraps of paper, &c., were streaked

with the pole of a crystal, every patient could distinguish them, provided no time was lost in making the experiment, from substances not so treated. The sensation was that of warmth in the hand, and which, by degrees, rose to an intolerable burning sensation. This transference of power or influence, seemed to be weakest in the case of paper. Thus a book produced a very trifling effect on M^{lle}. Sturmman, and that not when the crystal (a large rock-crystal) was drawn over it, but only when it was kept some time in contact with the pole, and instantly placed in her hand. A bit of porcelain, previously touched with the pole, she felt distinctly warm. A rod of packfong treated in the same way, she felt very warm. Malleable iron, a portion of a saw-blade, and a hard steel-file, all previously inert, produced warmth in the hand, after they had been streaked with the crystal. When the author placed his hand in that of M^{lle}. S., till she was accustomed to its temperature, then passed it several times backwards and forwards over the point of the crystal, and again placed it in her hand, she perceived a very marked difference; she felt the hand now much warmer, and this apparent increase of temperature lasted more than four minutes. Similar experiments with M^{lle}. Maix and M^{lle}. Reichel gave the same results. The substances charged were copper, zinc, linen, silk, and water. M^{lle}. Atzmansdörfer could instantly tell whether the rod of packfong had been in contact with a crystal of gypsum, or an amorphous body, and in particular, whether it had been streaked with the warming or the cooling pole of the crystal. *The crystalline force, therefore, may be transferred to and collected in other substances.* But, although it could be transferred to iron or steel, these bodies, thus charged, had no attractive power for iron-filings.

It appeared quite indifferent whether these bodies were charged by drawing the crystal along them, or by contact with the point or pole of the crystal. A large rock-crystal, placed so that its point rested on a glass of water, produced water as strongly magnetised as a horse-shoe magnet.

46. The next question was, whether matter possessed the power of retaining permanently this force? Whether it is durable or fugitive, and after what intervals? Experiment shewed, that some bodies lost the power almost instantly, as paper, others after a few minutes; and in no case did the power remain in the body charged longer than ten minutes. This was in the case of steel. In all cases, therefore, the charge soon disappears, but not instantaneously, as when the magnet is removed from an iron-bar which immediately

lets fall the filings it had previously attracted. Hence we may conclude, that in all matter there resides a certain though small amount of coercitive power for the crystalline force.

47. Is this force capable of being isolated, or does it penetrate matter? Experiment shews, that a thick mass of paper, as a book, refuses, at least for some time, a passage to the force. Wood, marble, porcelain, &c., acted more or less in the same way. But a plate of iron, when the crystal was brought near, allowed a sensation of warmth to pass; and on contact, the sensation became very strong, and was felt like a blow as far as the shoulder. A thick copper-wire conveyed a slight sensation of heat from the crystal, from the distance of about 16 inches, gradually increasing as the distance diminished to 5 or 6 inches. An iron-wire 1-15th of an inch thick, and $4\frac{1}{2}$ feet long, conveyed a sensation of warmth to the hand when the crystal actually touched the further end. At 27 inches the sensation was stronger, at $4\frac{1}{2}$ inches very strong. A rod was placed in the patient's hand, and a crystal of medium size approached to the further end. Even without contact she felt warmth, but on contact the sensation of heat suddenly sprang through the hand to the elbow. When the same experiment was made with the large crystal, it extended to the shoulder, and caused spasmodic sensations. In the case of M^{lle}. Maria Maix, the force penetrated all substances, but metals more easily, and so to say instantaneously, than vegetable substances, cloth, &c. Wool, silks, glass, and zinc, were tried with M^{lle}. Reichel. Threads of wool, 1 yard long, were passed through in a very short moment of time; with silk, glass, and zinc, it appeared to pass with so great velocity, that the time employed was inappreciable. The very sensitive M^{lle}. Atzmansdörfer observed the same instantaneous conduction in brass-wire, the rod of packfong, glass-tubes, rods of lead, platinum-foil, bar-iron, gold-thread, copper-shavings. The general result is, that the crystalline force passes through all bodies, although with different degrees of facility. Paper, wood, and wool, retard the passage, at least for a short time, as do marble and porcelain. Silk and glass are perfect conductors. Metals not only allow it to pass on contact, but on a near approach alone. With contact, they conduct instantaneously. The more sensitive patients find every substance a conductor, the less sensitive perceive considerable differences.

48. In regard to the amount of possible charge, experiment proved, that no amount of streaking or contact could increase

the charge, as measured by the sensations of the patients, beyond a certain point, which was soon reached.

49. In regard to the amount of force relatively to the size of the crystals, it appears, that in crystals from the size of a lentil to $1\frac{1}{2}$ inches long, the force was hardly perceptible; and that above that size, it increased with the size of the crystal in a ratio not yet ascertained.

50. The difference of the poles in their action on the nerves was shewn in an opposition of the sensations of cool and warm. The downward streak generally produced the cool agreeable feeling, the upward streak a disagreeable lukewarm sensation. In the case of M^{lle}. Sturniann, and with crystals of tourmaline, arragonite, rock-crystal, gypsum, and cleavage forms of Iceland spar and tellurium, the stronger pole regularly caused a cool, the weaker a warm sensation. M^{lle}. Reichel could distinguish at some distance the poles of all crystals by the cool or warm sensation, and that with perfect accuracy. M^{lle}. Atzmannsdörfer, as already stated (§ 33), was even more sensitive. But even healthy people, such as Prof. Endlicher, M. Studer, and John Klaiber, a carpenter, could distinguish the poles, even of small crystals. The poles, therefore, are distinguished, in their action on the nerve, by the sensations of coolness or warmth they produce.

51. The sensitive not only perceive the force in crystals, but feel distinctly its concentration in points which they point out by feeling, and all their statements in regard to these active points or poles agree among themselves. In double crystals, the axes joining these poles always ran through the plane of junction of the two crystals.

52. The electricity excited in crystals, as in tourmaline, by heat, had no effect analogous to that of the crystalline force, and did not affect the latter.

53. It would also appear that this force stands in no definite relation to terrestrial magnetism, because in most crystalline groups there is no prevailing direction of the axis of the crystals.

54. While this force thus appears free from all attraction to inorganic matter, it is worthy of the most marked attention and interest, that it shares with the magnet the power of attracting organised living structures. In M^{lle}. Nowotny, the hand was attracted by the large crystal, exactly as by a magnet of middling size. As we have already seen, the magnet appears to possess two forces, one which attracts iron, &c., the other identical with the crystalline force.

55. It was natural to try whether crystals exhibited any

thing like the magnetic light. The experiment was made with M^{lle}. Sturmman. In a room absolutely dark, after her eye was accustomed to it, the author shewed her the large rock-crystal, when she saw at once a flame like light above it, half a hand high, blue below, white above, and different from the magnetic light, which she saw more yellow and red.

The experiment was several times repeated, and always with the same result. She described the form of the light as that of a tulip, beginning below with an arch extending horizontally, then turning upwards and reaching nearly the height of a finger. She always described the colour as blue below, passing into pure white above, with occasional red stripes or threads. The flame was in undulating motion, and shot out sparks, and cast a luminous appearance on the surrounding objects to a circle of 2 yards in diameter.

M^{lle}. Reichel found the flaming luminous phenomena of crystals singularly beautiful, surpassing those of the magnet in splendour of colour and regularity of form. She described the flame over the poles like M^{lle}. Sturmman, but saw besides luminous phenomena in the interior of the crystal, like stars, which changed their form as the crystal was moved round. These appearances, no doubt, depended on the crystalline structure and the cleavage planes of the crystal, and could not, therefore, be seen in the opaque magnet. M^{lle}. R. made drawings of what she saw, and these the author means to publish, with a description of all the magnetic luminous phenomena he has become acquainted with. M^{lle}. Maix used, when ill, to lie awake many nights enjoying the sight of the white star, half a hand high, over the pole of the large rock-crystal, which the author left for this purpose on her stove. She was a person of very quiet nature, and a very exact observer. M^{lle}. Atzmannsdörfer was able to point out the luminous poles of a number of crystals in the dark, and to arrange them according to the intensity of the light.

The conclusion seems unavoidable, that all crystals, like the magnet, give forth a flaming light at their poles, not usually visible to the healthy eye, but visible to the eyes of persons suffering from certain nervous diseases, in whom all the senses are generally much more acute.

The light given out by many bodies during crystallization, seems to connect itself with this subject. For it has been proved by H. Rose, that that light is not connected with the evolution either of heat or of electricity; and it becomes, therefore, highly probable, that during the rapid combination into crystals of the molecules previously dissolved, cir-

cumstances occur, in which the crystalline light becomes so far concentrated as to be visible to the ordinary eye. Many questions, as to the nature of this light, as of ordinary light, can only be answered by future investigations.

The author recommends that these experiments should be repeated in the most absolute darkness; and, as all his have been, not with somnambulistic patients in the state of somnambulism, but either with other nervous patients, or with them in their normal condition. The crystals should be as large as possible.

56. From what has been said, it appears that the peculiar force thus detected, opens up a new leaf in the book of the imponderables. The new force appears to be subject to the general laws of imponderables, but has its specialties and peculiar laws, the study of which must henceforth be a problem of physics. It is exceedingly desirable to discover an inorganic test or re-agent for it, a means of recognising and measuring it, which shall relieve us from the dependence, often more than disagreeable, on sick persons, hospitals, and unscientific people of all kinds. The author is engaged in this research, and has good hopes of success.

SECTION III.

AN ATTEMPT TO ESTABLISH SOME FIXED PHYSICAL LAWS IN THE VARIED PHENOMENA WHICH HAVE BEEN CALLED ANIMAL MAGNETISM.

57. A retrospect of the last section, which is necessary for the connection with it of this one, yields the following points as established.

a. Every crystal, natural or artificial, exerts a special action on the animal nerve, feeble in healthy persons, powerful in many diseased individuals, strongest of all in cataleptic cases.

b. This influence is seated chiefly in the axis of the crystal, and being most active at the opposite ends of the axis, is consequently polarised.

c. At the poles light is sent forth, visible to eyes rendered preternaturally acute by disease, especially by nervous disease.

d. In certain diseases, the crystal attracts or solicits the hand of the patient, by a kind of attraction, analogous to that of the magnet for iron.

e. But the crystal, in virtue of this peculiar influence, does not attract iron, has no tendency to any peculiar direction, when freely suspended does not attract the magnetic needle, and induces no electric current in a coil of wire. The new influence or force is, therefore, not magnetism.

f. The force may be transferred to other bodies, which may be charged with it by contact.

g. Matter possesses some degree of coercitive power in regard to this force, so as to retain it, but only for a limited time, within which the charge disappears.

h. Different bodies conduct it, with different degrees of facility.

i. The power, in matter, of being charged with this force, is directly proportional to the strength of the force in the crystal employed.

l. The force differs, qualitatively, at the opposite poles; at the — M pole, causing a sensation of coolness, at the + M pole one of warmth. Quantitatively, the — M pole (pointing, in the magnet, to the north) is weaker than the + M pole.

m. No perceptible change has hitherto been produced in regard to the force, by warming the crystals.

n. In the powers exerted by magnets, this force is included, and forms, therefore, a part of those powers which may be isolated.

58. Such are the laws, hitherto developed, of this new force. Let us now try to apply them to another series of phenomena, and thus give them greater extension.

From time immemorial, certain unexplained phenomena have been known, produced by the action of the magnet on many sick persons, and especially on somnambulists. In the last century it was discovered that similar phenomena could be produced without the magnet, and indeed, by the human hand alone. It was found impossible, in the actual state of our physical knowledge, to trace any certain connexion between the power of the magnet and that of the human hand, &c.; or to recognise any uniform law in the phenomena. The consequence was, that scientific men neglected the subject, and did not admit it as a branch of physical enquiry. Individual physicians and lay amateurs, partly kept alive the tradition, partly added to the heap of unconnected observations. For want of a better name they called it Animal Magnetism, a name not well chosen, because the phenomena so called do not agree with those of magnetism, in the strict sense of the word. Numerous works have since that time appeared on the subject, chiefly written in a medical point

of view. A few are good; many partial and one-sided; many, again, such as cannot be read with patience.

The author has avoided the study of this literature, in order to retain an unfettered judgment, and to raise his work on the foundation of his own observations. He has studied the subject in a physical, not in a medical, point of view, being convinced that thus the investigation will be more successful, and that whatever is discovered, may easily be applied hereafter.

59. Having detected in crystals a force, which, although quite different from magnetism, yet exhibited a very marked analogy with it; and considering, on the other hand, that Animal Magnetism, although likewise different from ordinary magnetism, yet shewed a similar analogy to it, he was led to inquire whether he could discover any common properties in the phenomena of these two forces, and to what extent? And also, whether Animal Magnetism, like the crystalline force, might not be subject to physical laws? As crystallisation seems to mark the transition from organic to inorganic nature, he ventured to hope, that by experiment he might discover a point of connection between Animal Magnetism and Physics, or perhaps even obtain, for Animal Magnetism, that firm foundation in physics which had so long been sought for in vain.

60. But to prepare the way, it appeared, before all things, necessary to ascertain the part which in all these phenomena is played by Terrestrial Magnetism. If a magnet or a crystal produces so decided an effect on sensitive persons, it is certain that the magnetism of the earth, which gives the needle its direction, cannot be without influence on the animal nerve. And thus it was obvious, that it would be impossible to obtain any pure result from any experiment as long as this powerful agent, which must act in some way, was not subject to measurement and calculation, with a view to its elimination. With this idea, trials were made with both healthy and diseased individuals, as M. Schuh, M. Schmidt, surgeons; M^{lles}. Nowotny, Sturmman, Maix, Reichel, Atzmannsdörfer, and others, in different circumstances and at different times.

61. M. Schuh had, in the house then inhabited by him, the singular custom, when he awoke early in the morning, of regularly turning himself in bed, so as to place his head where his feet had been; on doing this, he invariably fell asleep again, and this second sleep, contrary to the usual opinion, was to him far more refreshing than the whole sleep preceding it. If he omitted this, or lost his second sleep, he

felt weary all day, and thus this strange custom had become a necessity for him. The author inquired, and found that the position of the bed was such, that the head of the sleeper, in his ordinary position, that is, the head of the bed, was directed to the south, the feet to the north. He advised the turning of the bed into exactly the opposite position, with the head toward the north; and from that time, the necessity for the second sleep never returned, the ordinary sleep was refreshing and sound, and the custom above mentioned at once given up.

62. M. Schmidt had experienced, in travelling, a chill in the right arm, and had suffered for some time from violent rheumatism, with most painful cramps, from the shoulder to the fingers. He was treated by his physician with a magnet, which relieved the cramps, although they always returned. He lay then with his head to the south, on the position being reversed, so that he lay in the magnetic meridian with his head to the north, he immediately felt comfort and relief. Instead of shiverings, he now felt an agreeable uniform warmth, the passes with the magnet were now much more cooling and beneficial than before; and before the author left him, the stiffened arm and fingers were quite moveable, and the pain had disappeared.

63. On examining the position of M^{lle}. Nowotny, she was found lying almost exactly on the magnetic meridian, her head towards the north. She had instinctively chosen this direction, and it had been necessary to take down a stove to allow her bed to be placed as she desired it to be. She was requested, as an experiment, to lie down with her head to the south. It took several days to persuade her to do so, and she only consented in consideration of the weight which the author attached to the experiment. At last, one morning he found her in the desired position, which she had assumed very shortly before. She very soon began to complain of discomfort, she became restless, flushed, her pulse became more frequent and fuller, a rush of blood to the head increased the headach, and the sensation of nausea soon attacked the stomach. The bed with the patient was now turned, but was stopped half way, when she lay in a magnetic parallel, with the head to the west. This position was far more disagreeable than the former, indeed, absolutely intolerable. This was at half-past eleven A. M. She felt as if she would soon faint, and begged to be removed out of this position. This was done, and as soon as she was restored to the original position, with the head to the north, all disagreeable sensations diminished, and in a few minutes

were so completely gone, that she was again cheerful. But besides these very disagreeable feelings which acted profoundly on her, in the altered position, all her sensations, in regard to external matters, were altered. For example, the streaking with a magnet, usually so agreeable, was now disagreeable; and if strong, intolerable; and, in short, all her relations to different substances took a new and very different form.

All these experiments were at different times repeated, and with exactly the same results. She could hardly endure the position from west to east, or that from east to west more than a minute, without feeling all the symptoms above described, with a tendency to syncope, and recovered instantly when the position was changed to that of north to south.

As she had long been affected with a gradually increasing illness, the author inquired if at any former period this sensibility to position had occurred, and it appeared that she had lived in different houses, and had suffered uneasiness in some, while in others she had felt comfortable, without the cause being known. Her brother was now told to take a compass and ascertain the position of her beds in the different houses, as well as of her couches and work-chairs. It was found that in one house her bed and couch had accidentally been almost exactly in the magnetic meridian, and that she had lain with her head towards north, not towards south. In another house she had lain in a line north-east and south-west. In fact she had been comfortable in the former, while in the latter she had always suffered and struggled with illness. Even now, without knowing why, she could not bear to sit across her bed or sofa, neither could she lie on the sofa, but could only bear to lie in bed. In the first case her position was from west to east, in the second east to west, in the third south to north; only in the last could she obtain the indispensable position from north to south.

Of all positions, the worst by far was that from west to east, that is, the head to the west.

64. M^{lle}. Sturmann, in consequence of violent dancing, 3 years before, was attacked by her illness. She now suffered from tubercles in the lungs, and was subject to cataleptic attacks. The author found her lying in the position from west to east. In this position, the great magnet (carrying 80 lb.), placed above her head or under her feet, had hardly any effect. She was then placed in the position from north to south. The change was instantaneous. The

patient at once expressed a feeling of comfort, the previously existing restlessness ceased; a painful sensation of heat in the eyes, which had constantly annoyed her, disappeared, and in its stead she felt an agreeable coolness; a universal relief obviously spread over her whole being. Then followed a night of singularly sound sleep, such as for a long time she had not had. Another time the position from south to north was tried, with an equally rapid change for the worse: general restlessness, flushing, oppression of the head, and burning sensation in the eyes, at once returned; and all were, so to speak, as easily put an end to as soon as the patient again occupied the position from north to south. While she was in this, the normal position, the author again tried the magnet. But what a change! At the distance of 4 paces from the head, he removed the armature of the magnet. The patient did not speak, and was found insensible and affected with tonic spasms. After her recovery, he again, at 7 paces from her feet, removed the armature, and she had hardly spoken a word when she became speechless, and fell again into the same state. A third time he went, in the line of the magnetic meridian, as far as the ward permitted, upwards of 30 feet from her feet. When the armature was removed, she did not instantly feel any thing, but after about a minute she ceased speaking at once, in the middle of a word which was actually on her tongue. She was suddenly seized, and was found lying in convulsions, with clenched hands, her eyes open and turned upwards; so unconscious that he could lay his finger on the cornea without her moving the eyelids. What a difference of effect! The same magnet which had been placed above her head and under her feet without any marked action, while she lay in the line of a magnetic parallel, now, when she lay in the meridian, struck her down senseless at the distance of 30 feet.

65. M^{lle}. Maix, who was neither cataleptic nor somnambulist, gave similar results; she could only endure the position from north to south, and that from west to east was of all the most intolerable. In her case the experiment was tried in the afternoon, while with M^{lle}. Nowotny it was in the forenoon.

66. M^{lle}. Reichel also perceived a very marked difference; and as the author found her bed in the position from south to north, he recommended a change to that from north to south. From this change she derived much benefit, her rest being much improved.

67. M^{lle}. Atzmannsdörfer, on two occasions, one in the morning, the other in the evening, could only bear the posi-

tion from north to south, and found that from west to east the most disagreeable.

68. All these patients now recollected how painful and disagreeable it had always been for them to remain in church, although they could never tell why. But as all Catholic churches are built from east to west, those in front of the altar are necessarily in the position from west to east, which to all sensitive persons is the most intolerable. In fact, these patients, in that position, had often fainted and been carried out of church. At a later period M^{lle}. Nowotny could hardly ever bear to walk in the garden or on the street from west to east, if it lasted for some time.

69. Thus, eight different cases of sensitive individuals agreed in this, that every other position, except that from north to south, is highly disagreeable, but that from west to east almost intolerable, at least in our hemisphere. Probably in the southern hemisphere it is otherwise. The cause of these phenomena can obviously be found only in that great magnet which is formed by the earth with its atmosphere, that is, terrestrial magnetism. Like any other magnet, the earth interferes, and we thus arrive at the following law:—The terrestrial magnetism exerts on certain persons, both healthy and otherwise, who are sensitive, a peculiar influence, powerful enough to disturb their rest, and in the case of diseased persons disturbing the circulation, the nervous functions, and the equilibrium of the mental powers.

70. And since terrestrial magnetism is subject to variations, which are in connection with the lunar phases, inso-much that the terrestrial magnetism reaches a minimum, in reference to the moon, at the period of full moon, one of the causes which influence insanity comes out of darkness at least into twilight. On this point the author promises to return to the subject when the special investigation of it is further advanced.

71. If now terrestrial magnetism appears to be so powerful an agent on our bodily condition, that, in the above cases, it in a great measure decided the question of healthy and, morbid feelings, we are entitled, nay compelled, to conclude that in most, perhaps all similar sensitive cases, it will be impossible to produce any curative effect by the magnet, as long as the patient is not placed in a proper position with reference to the earth's magnetism; and that this point must be above all others attended to in all magnetic treatment. We must also conclude, that all magnetic phenomena in persons affected with nervous maladies, and probably also in those affected with other diseases, are essentially influenced by this

cause. These observations likewise furnish a key to many of the numerous errors and contradictions which have occurred in animal magnetism, from the time of Theophrastus and Mesmer to our own day, which have confounded the clearest heads, and have introduced everywhere contradiction in the facts and discord in the opinions. For if the same disease were treated magnetically in Vienna in the position north to south; in Berlin in that of east to west; and in Stuttgart in that of south to north, totally different results would be obtained in the three cases; and no agreement in the experience of the different physicians could be obtained. Nay, if the same physician, at different times, or even at the same time in different places, were to treat the same disease with the same magnetic means, while accidentally the beds of his patients were placed in different positions, he must necessarily see quite different results, so as to be entirely puzzled with magnetism and with himself. He must conclude it to be full of caprice and change; and finding it impossible to foresee and regulate its action, reject magnetism altogether as an unmanageable instrument. Such has been in fact, the sad history of magnetism. From the earliest times, often taken up, and as often cast aside, it now lies, almost unemployed, and yet is so distinguished, so penetrating, nay, we may say, so incomparable a means of relief in cases where man has hitherto been unable to afford any benefit. Nervous diseases are still the *scandala medicorum*. It may be confidently expected that ere long an improvement will be effected. The all-powerful influence of terrestrial magnetism will be measured and calculated, and the whole subject of magnetism will now admit of being regularly studied in reference to medicine. Progress will be made; experimenters will mutually understand each other; and the world may at length hope to derive some actual benefit from those extraordinary things, which have so long excited expectation without satisfying it. Having thus established the existence of a powerful influence exerted by the earth's magnetism on the magnetic phenomena in sensitive persons, all subsequent magnetic experiments were made with the patients in the position from north to south, which is considered by the author as the normal position for the living body, sensitive or affected with nervous maladies.

72. When a piece of pure soft iron is placed in contact with a magnet, it becomes, for the time, magnetic, and attracts iron. But as soon as the contact is put an end to, the iron ceases to be magnetic, and to attract iron. However

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often it may have been streaked with a magnet, it retains no magnetic power, strictly so called. It is generally supposed that, in this experiment, the iron returns exactly to its primitive condition as soon as the magnet is removed. But this is not entirely the case. It is true that we have hitherto had no test of any change in the iron; but the diseased human nerve is such a test. Thus, if a bar of soft iron, previous to contact with a magnet, was placed in the hands of M^{lle}. Nowotny, she found it quite indifferent; but after it had been in contact with a magnet, the case was very different. It now caused the same sensations as a weak magnet, such as warmth and contraction of the fingers; and this power lasted for a short time, gradually diminishing, till after 10 minutes it had disappeared. Similar experiments were made with the other sensitive patients, and in all the same sensations, except the contraction of the fingers, were experienced as in the case of a magnet; the patients felt as if the force of the magnet were transferred to the iron, although somewhat enfeebled. It is therefore obvious, that something must have remained in the iron, derived from the magnet, but which was not magnetism, and the nature of which is still unknown.

73. When a glass of water is placed between the poles of a horse-shoe magnet, that is, in the magnetic current, and thus magnetised, to use the term employed by animal magnetism, every sensitive patient could instantly distinguish this glass of water from all others. Nay, the magnetised glass of water, if instantly brought near the hand of a cataleptic patient, attracted it as a magnet would have done, and was even followed by the hand, just as happened with crystals (see § 26 and 27). Therefore something must have passed from the magnet to the water, and there continued adhering; a something which is not magnetism, which we cannot by chemical means as yet fix, and which we probably cannot even perceive by the aid of any perfectly healthy sense.

74. The distinguished botanist, Dr Endlicher, visited M^{lle}. Nowotny, and made the following experiment. He desired M. von Eisenstein to allow himself to be magnetised by passes with the magnet, and then to act on the patient. To his astonishment he found that he could now (what he had never before been able to do) attract her hand with his, and cause it to follow, wherever he moved his hand, exactly as the magnetised water had done. This power lasted $\frac{1}{4}$ hour, and then disappeared. The same unknown something, which had passed from the magnet to the iron-bar, as well as to

the water, had therefore taken possession of the whole person of M. von Eisenstein. The same cause produced, through his fingers, the same effect.

75. This experiment was repeated in various ways. Sometimes his hand was placed in that of the patient, while a strong magnet was drawn down his back. The patient felt, at each pass, the force swelling, as it were, or pulsating in his hand. Exactly the same result was obtained by the author himself, experimenting with M^{lle}. Maix, who, be it remembered, was not, and never had been, a somnambulist.

76. A large proportion of persons, both nervous and apparently healthy, are sensitive to the action of a magnet, when drawn or passed downwards along their person. In every town numbers may be found who are so. Now, every one of these, as yet tried, perceives the same effects, only weaker, from substances of all kinds along which the magnet has been drawn, as are caused by the magnet.

77. Since, then, all persons of a certain degree of nervous sensibility (possibly morbid) can detect the approach of a magnet, even when they cannot see it, by its producing a cool or warm aura: since, farther, the same persons perceive the very same effects in substances, no matter of what kind, which have been placed in the line of the magnetic current; there follows, logically, from these two facts, a conclusion, which people in general do not like to draw, against which, in fact, they have struggled hard *a priori*, and which seems especially offensive to chemists, namely, that all substances, so magnetised, have suffered, by means of the magnet, a temporary change, no matter of what kind; so that even magnetised water, however strange it may sound at first, is actually a *changed water*.

78. If we compare the effects of the force in crystals with those produced by magnets on other bodies, we perceive that the influence of both on third substances is exactly alike, indeed so much the same, that there are no means of thus distinguishing them. The magnetic force, taken as a whole, and the crystalline force, differ as the whole does from a part, as the sun's rays from the heating rays they contain. But their action on other bodies is perfectly similar, at least as far as concerns the phenomena above described; and since these effects are completely produced by the crystalline force alone, we must conclude, that, in the case of magnets, they are produced by the crystalline force residing in them; in other words, by a part alone of their force. In their action on the human nerve, the pole of a magnet and the pole of a crystal agree perfectly.

79. We have now, in this investigation, arrived at the threshold of the so-called Animal Magnetism. This "*noti me tangere*" may now be laid hold of. If the author drew a magnet several times downwards from the head to the feet of M^{lle}. Sturmman, she became insensible, and fell into convulsions, generally cataleptic. The same result followed, when the large rock-crystal was used in the same way. But the author could also produce the same effect with his hands alone. Therefore, the crystalline force of the magnet and of the crystal was also found in his hand.

80. To test this, many experiments were made. If it were so, then his hands must be capable of producing all the effects produced by the crystal. The effects produced by drawing the magnet or the large crystal along a sensitive person have been already fully described. When he caused his fingers of the right hand to follow each other in a line down the middle of the inside of the hand, but not in contact with it, all those who were sensitive to the magnet felt either a cool or a warm aura, and that generally more distinctly than in the case of a crystal. Indeed many healthy people were sensitive to this influence, among others M. Schuh, M. Studer, and M. Kotschy, the African traveller, all healthy vigorous men, the latter a rare specimen of manly vigour and hardy constitution. The fingers, therefore, act on the nerve exactly like a crystal of middling size.

81. The author now compared the conductivity of the influence from both sources. He made M^{lle}. Sturmman take hold of one end of a pair of callipers of packfong, and when she had become quite accustomed to the sensation of its contact, he placed his five finger points of the right hand in contact with the other end. Immediately she perceived a sensation of warmth at the point of contact, and this sensation extended to the elbow. He now added the five remaining fingers, when the effect was more than twice as strong, and extended to the shoulder. On removing the fingers, the sensation rapidly diminished, but did not suddenly disappear, and when the fingers were alternately laid on and taken off, the sensation corresponded to these changes. On another day, he induced Dr Lippich to do the same, and his fingers produced the same effect. On trying the experiment with M^{lle}. Maix, it was equally successful; with the author's ten fingers the sensation amounted to that of heat, and extended to the head. Her physician repeated the experiment successfully; but although more than 10 years younger than the author, the whole effect was decidedly weaker. Pater Lambert, of the Franciscans, her confessor, also tried his hands, which she felt to be equal to those of the author in power.

M^{lle}. Barbara Pschierl, the nurse, being sent for, her fingers were also tried, with a similar result; but they were much less powerful than those of men. When, instead of the callipers, an iron-wire of $4\frac{1}{2}$ feet long was placed, one end in her hand, and after five minutes the author's five fingers were brought in contact with the other end, she felt instantly the sensation of a current of decided warmth; and with ten fingers the sensation increased to apparent heat, which soon disappeared as often as the fingers were removed. This was established by very frequent repetition. When the ten fingers of her sister, also a nervous patient, were placed in contact with the further end of the wire, the effect was strikingly feeble. Even with ten more fingers, of another lady, the united effect was far below that of 5 of the author's fingers, although he has long been grey and bald. A copper wire, nearly 9 feet long, was also found to conduct the influence, but slower and rather less powerfully than the iron-wire. The same experiments, with many variations, were repeated with M^{lle}. Reichel, with complete success. The effect was particularly strong in the case of M^{lle}. Atzmannsdörfer. But even the healthy M. Studer was sufficiently sensitive to perceive distinctly the effect of the author's hands through metallic wires. From these experiments it follows that the influence of the human hand can be conducted through other bodies, in the same way and in the same degree as the influence of crystals.

82. In order to ascertain if the force could be collected in a body, the author took in his hands for a few seconds the callipers after M^{lle}. S. was accustomed to their temperature, and returned them to her. She now felt them so hot that the well-known sensation caused by crystals, was felt up to the elbow. This was frequently repeated with every possible precaution, and with complete confirmation. Dr Lippich took in his hand, for a short time, one of two exactly similar porcelain saucers, and then offered both to the patient, after an interval of some minutes. She instantly pointed out the one which had been in his hands, and the difference was perceptible till ten minutes had elapsed. The author tried the same experiment on M^{lle}. Maix, but with the callipers which were charged by his fingers; and the charge, which M^{lle}. Sturmann had recognised for 5 minutes, was perceived for 20 minutes by the more excitable M^{lle}. Maix. In both cases, the sensation was that of heat, and exactly similar to that caused, under similar circumstances, by the rock-crystal. The same results were obtained, some months later, from M^{lles}. Reichel and Atzmannsdörfer. The most singular ex-

periment is that with a glass of water. If it be grasped from below by the fingers of one hand, and from above by those of the other, during a few minutes, it has now acquired, to the sensitive, the taste, smell, and all other singular and surprising properties of the so-called magnetised water. "Against this statement," says the author, "all those may cry out who have never investigated the matter, and to the number of whom I formerly belonged: but of the fact, all those who have submitted to the labour of investigation, and have seen the effects I allude to, can only speak with amazement." This water, which is quite identical with that treated with the magnet or with the crystal, in all its essential properties, has, therefore, received from the fingers and hand an abundant charge of the peculiar force residing in them, and retains this charge for some time, and with some force. It was found that all substances whatever were capable of receiving this charge, which the sensitive patients invariably detected. The inevitable conclusion is, that the influence residing in the human hand may be collected in other bodies, in the same way and the same extent, as the influence residing in crystals.

83. That the charge, thus collected, again by degrees disappears, is obvious from what has been stated. The bodies, therefore, which can be charged with this influence, and which lose it again, possess the same coercitive power for it as, it has been shewn, they do for the influence of crystals. With the strength or rather power of the hand, the amount of charge conveyed to other bodies increased; and the capacity for charge of these bodies did not, as far as has been observed, seem to have any obvious limit.

84. The question whether this influence, in the animal body, was polarised, could only be decided by comparative investigation. All the sensitive patients pointed out in crystals not only the chief axis but secondary axes, always polar, in which the force was weaker. These secondary axes, as well as the principal, always coincided with the crystallographic axes, and it is, therefore, more than probable that the new force plays an important part in the construction of crystals. (The perfect agreement among so many sensitive persons, diseased and healthy, was the best security for the genuineness and accuracy of their observations.) Possibly the new force may be, in reference to crystallization, what the vital force is in reference to organic structures. At all events, the force or influence in crystals lies in axes and is polarised, the different axes being of different power. But it is not only polar in the crystals, it is also polar in the

bodies charged with it. Thus M^{lle}. Sturmman found a 6 feet long iron-wire, charged by the large rock-crystal, nearly indifferent in the middle, and increasing in force of charge towards each end. The wire was therefore polar, in reference to the charge of influence which it had received.

85. Similar relations may be traced in that intermediate condition where inorganic and organic influences combine together. M^{lle}. Maix took in her hand one end of a copper-wire 9 feet long, which had formed 11 turns of a spiral, and the screw thus formed was drawn out in the direction of its axis to $1\frac{1}{2}$ feet, so that each turn of the screw was free. When her hand was used to it, the author took the other end in his ten fingers, and she at once felt the influence in its full force. On examination, she found the influence strongest close to her hand, diminishing regularly till, at the sixth turn from her hand, or the middle turn of the screw, it reached a maximum. Beyond this, it again increased, till at the author's hand the amount was exactly equal to that at the other hand. This experiment was often repeated, with every precaution, and with all different substances, but invariably shewed a dualism, a polarity, in the arrangement of the influence derived from his hand. Substituting the large rock-crystal for the hand, precisely similar results were obtained.

86. Analogous facts may be observed in the animal kingdom. In man there is admitted a principal axis, from above downwards, and the brain and organs of generation are considered the opposite poles of this axis. If I may venture to draw a conclusion from the observations of animal magnetism, this is not the chief but a secondary axis. In the first place, it has been seen that the patients cannot bear to be laid in such a position that their long axis lies across the magnetic meridian; by that means the body is differentiated magnetically in its breadth, which appears to be intolerable. We observe something similar in chills; if they come from the side they are at once more active and more hurtful than when they come from before or behind. This was subsequently rendered more intelligible. When the author placed his right hand in the left hand of M^{lle}. Maix, she felt it exactly like a small magnet or a crystal placed with the N. pole perpendicularly on her hand. But if he gave the left hand, the feeling was very much more disagreeable. When he placed his right hand in her left, and his left hand at the same time in her right, she described the sensations as of a perpetual current of something up her right arm, across her breast and shoulders, down her left arm, and through him

continually. It was painful, and nearly caused her to faint. If he now crossed his hands, she could not endure it, and declared that there then arose so painful a sensation of a strange kind of struggle and contest in her arms and through her breast, an undulation up the arm and down again, that she found it absolutely unendurable. In fact, after she had released her hands, it was found impossible to persuade her to repeat the experiment, which was always done if possible, for the sake of a check on errors. If, then, it be established by these experiments, that in nervous cases it is anything but indifferent which hand is given or taken, it follows that both hands, in respect to the influence residing in them, are not in the same condition; and it would even appear from the last experiment that there is a current, after the fashion of an electric current, from his left hand to her right, and then from her left to his right, a motion which meets with obstacles, and strives, as it were, to break through them, as soon as like hands are joined. This difference between the hands can only be due to polarisation, as we see it artificially produced in the copper-wire, and as we have found it in magnets and in crystals. In this point of view, the chief axis in man is transverse, and the long axis is only secondary. In fact, it is only transversely that we are formed of two symmetric halves. Every thing, brain, organs of sense, organs of mastication and deglutition, arms, hands, and feet, are opposed to each other transversely; and it is especially transversely that we are polarised.

87. These interesting observations were afterwards confirmed by experiments with M^{lle}. Atzmannsdörfer, who experienced the same sensations, as of a current, even stronger than M^{lle}. Maix. When the hands of the author were crossed, she became sick within a minute. When one end of the metallic callipers was put into her hand, and the other end touched by the author's right hand, she felt it light and as it were buoyant; but when it was touched by his left hand, she felt it preternaturally heavy. This was also observed in M^{lle}. Maix. It is worthy of notice, as a mark of distinction, or rather opposition, between the right and left hands in the style of attraction and repulsion. The patient even experienced different sensations, according as substances were laid in her own right or left hand.

88. Very recently the author has carried through a series of experiments with M^{lle}. Reichel, and pushed them farther than in any other case. Not only the right hand, but the whole right side, was found by her opposed in its properties to the other side. Nay, the mere approach of the author's side,

whether right or left, affected her differently. This subject is to be investigated subsequently; here it is only necessary to say, that all the observations in regard to polarity, made with M^{lle}. Maix, have been fully confirmed by M^{lle}. Reichel.

89. It appears, therefore, from these researches, that all the symmetrically arranged organs of the body; and especially the hands, exhibit a difference, which is caused by a magnetic polar opposition; and that consequently there exists a dualism of the fundamental influence above alluded to, exactly as we have seen it to exist in crystals.

90. In § 40 and § 52, it has been shewn, that the earth's magnetism exerts no perceptible influence on crystals; and that crystals do not assume any special direction, as magnets do. The same is the case with the influence of the hands. It—terrestrial magnetism—has no action on healthy animals. The force exerted by the author is alike in all positions; and he cannot perceive that in any position he is passively affected differently from what he is in any other. Doubtless the perfectly healthy man, who probably is never sensitive, is in no way affected by the earth's magnetism, how strongly soever it may act on certain patients. The author has not been able in any animal, even in blind ones, such as larvæ, to discover any evidence of an action being exerted on them by terrestrial magnetism. In this indifference, therefore, to the influence of the earth's magnetism, the force of crystals and that of the human hand fully agree.

91. With regard to the remarkable attraction of the sensitive patient's hand effected by the magnet and by crystals, it has been already stated that the hands of M. von Eisenstein produced this effect, but only after he had been magnetised. Without this, he was never able to attract the patient's hand. But it appeared that he was weak in the peculiar influence. The author omitted at the proper time to try his own power in this respect on M^{lle}. Nowotny, when her state of health was fitted for the inquiry; but he has since that time often seen the phenomenon in question in M^{lles}. Reichel and Atzmannsdörfer in the higher stages of their disease. When cataleptic, their hands followed readily those of any vigorous young man, and indeed those of the author himself, insomuch that, while insensible, this attraction of the hand has often made them rise from their chair, and follow the hand for some distance. It was even possible to attract their hands through an intermediate substance, such as a lump of chalk held in the hand of the experimenter. The attraction and adhesion of the hand was also seen in M^{lle}. Sturmman, but not by the author, although he has entire confidence in the

testimony of those who did see it in his absence. All these observations prove, that the hands and fingers of vigorous healthy men, like the poles of crystals, possess an attractive power for the hands of cataleptic patients.

92. But, in this comparison, the luminous phenomena which are now to be described, constitute a really brilliant point. When the author, for the first time after her violent convulsions, saw M^{lle}. Reichel playing with the magnetic flame, he thrust his hand in the dark between her eyes and the magnet, when she began to play as before with the points of his fingers, and to speak of five little fires dancing about in the air. She did not see the hand, and she took the motion of his fingers, from the points of which flames came forth, for a spontaneous motion of the flames. She saw, in like manner, in the dark, flame from the points of all men's fingers, but from no women's, except in some cases a feeble light, neither bright nor flaming. As long as her illness continued she amused herself and her friends by her observations on these lights. But after she had recovered, it came out, that, not only during her illness, but also when quite well, she saw the magnetic flame, the crystal lights, and the light from men's hands, provided it was dark enough. Indeed she had possessed this power from her early youth; for while an infant, her mother had often to lift her up, to convince her that nails and hooks in the wall were not on fire, as she declared them to be. She had even brothers and sisters who in like manner saw luminous appearances everywhere, where others saw nothing. At this time, the author makes use of her power daily in researches on Electricity and Magnetism, which will soon be made public, and which have, by her means, led to important results. The author has had, for a long time, every opportunity of studying, soberly and comprehensively, the luminous appearances in the human hand, and he daily continues to study these phenomena.

93. With M^{lle}. Atzmannsdörfer the same results, essentially, were obtained. But she saw all the flames larger. While M^{lle}. Reichel saw the flames from the author's fingers from 2 to 3 centimetres long (0.7 inch to 1 inch) M^{lle}. A. saw them 5 to 6 centimetres long (1.75 inch to 2 inches.) The author promises to give drawings of these beautiful appearances, as obtained from M^{lle}. Reichel, with a future memoir. Here it is enough to state, that from the finger-points of healthy men fiery bundles of light stream forth, exactly as from the poles of crystals, visible to the sensitive.

94. The properties of the force existing in crystals, as de-

scribed in Section II., have now been compared with those of the force exerted by the human hand, throughout, without any exception ; and the parallelism between them is, as may be seen, complete, and the agreement of both forces in their entire manifestations so perfect, that the two obviously fall together into one. We have seen—

§ 78. That the hand, passed over sensitive patients, acts on them like the poles of crystals.

§ 79. That the power which here acts, is conductible through all bodies like the force of crystals.

§ 80. It is capable of being collected in other bodies, like the force of crystals.

§ 81. That it disappears from the bodies thus charged in a short time, like the force of crystals.

§ 82. That bodies can retain it, or have a coercitive power in reference to, as in reference to the force of crystals.

§ 82. That the capacity of being charged is the same for both forces in all bodies.

§ 88. That this force is polarised in the human body as the other is in crystals.

§ 89. That both are alike uninfluenced by the earth's magnetism.

§ 90. That this force exercises a mechanical attraction on the hands of cataleptics, as does the force of crystals.

§ 92. That this force exhibits beautiful luminous phenomena, visible to the sensitive, of the same kind and strength as those exhibited by the force of crystals.

And then we are brought back to the proposition of § 78, namely, that the same force exists in the human hand, which is found in crystals : that, consequently, the force of crystals and the so-called animal magnetism are absolutely one and the same ; and therefore the laws which regulate the former, admit of being fully applied to the latter.

[It appears to me that the author, by the above series of researches, has established, in a purely inductive way, the all-important fact or principle, That there exists in nature a force, different from magnetism (although forming part of the total force of magnets), and capable of acting from one individual to another, even without contact. Also, that this force may be communicated to different portions of matter. Already these discoveries place beyond doubt some of the most important statements and assertions of Mesmer and his followers, and afford the means of investigating, experimentally, these very interesting phenomena. I may add, that I have already been enabled to confirm some of his statements

in regard to the action, on a sensitive person, of magnets, of crystals, and of the hand. Nearly two years ago, moreover, I often saw a lad, who, in the mesmeric state, saw flames issuing from the points of my fingers, which I first noticed from seeing him playing with them. In that case, as I had never heard of the phenomenon, suggestion was out of the question.—W. G.]

SECTION IV.

FURTHER SOURCES OF THE FORCE WHICH RESIDES IN THE MAGNET, IN CRYSTALS, AND IN THE HUMAN HAND.

95. As before; the author resumes the last section.

a. Not only do crystals act on healthy and diseased sensitive persons, but the earth's magnetism does so likewise. The action of the latter is so powerful, that very sensitive patients can only lie in one position, that with the head to the north and the feet to the south. Every other line is disagreeable to them, and in many cases, that from west to east is quite intolerable, nay, even dangerous to life.

b. All the reactions of magnets, crystals, &c. on such patients are essentially altered when any change is made in their direction with respect to the earth's magnetism.

c. Pure iron, when magnetised by contact with a magnet, does not retain any permanent magnetism when separated from the magnet. But it has, notwithstanding, acquired a peculiar power, by which it is capable of producing decided and strong effects on sensitive persons.

d. The magnet yields this unknown something, not to iron alone, but to all solid matter without exception, including the living body.

e. This something, in all bodies either directly charged with it, or rendered active by its distribution, acts on sensitive patients exactly as the magnet on crystals, and must therefore be identical with the peculiar agent residing in them.

f. In like manner, living persons, especially with their hands and fingers, are capable of acting on sensitive patients and healthy individuals, if sensitive.

g. This force, which has been called Animal Magnetism, has the following properties; it is, namely, conductible through other bodies; it may be communicated to other bodies either by directly charging them or by its dispersion. It soon disappears, but not immediately, from bodies charged

with it. It assumes a polar arrangement in the animal body, by virtue of its apparent dualism. It has no marked relation to the Earth's magnetism. It attracts mechanically the hands of cataleptic patients, and its presence is associated with luminous phenomena. In all these points it agrees with the force of crystals, with which it coincides, and in all particulars obeys the same physical laws as that force.

h. One part of the complex force inherent in magnets,—the force residing in crystals,—and this last force,—these three, in their essence, make, in one point of view, but one force.

96. But these are not all the sources of this force; nay, they are not even the chief sources of it. Pursuing the investigation, the author has met with further important sources. It has long been a question, whether the sun's rays can render a needle magnetic. Morichini, Mrs Somerville, and Baumgartner have chiefly investigated the matter. It occurred to the author that the sun's rays might play a part in the present investigation; and this idea acquired some probability when the influence exerted by the moon on certain nervous disorders, an influence well known and undeniable, was taken into consideration.

97. He employed the first sunny day to try the experiment with M^{le}. Maix. He put into her hand the end of a copper-wire nearly 30 feet long, and when her hand was accustomed to the sensation, the other end was put out of the window in the rays of the sun. Immediately the sensations caused by the force of crystals were perceived, not powerful, but quite distinct. The end of the wire was now connected with a plate of copper 9 inches square in the dark, and when the patient was accustomed to the feel of the wire, the plate was exposed to the sun. No sooner was this done than he was saluted with a cry of pleasure from the sick-bed. The moment the sun's rays fell on the plate a powerful manifestation of the well known force was felt, as a sensation of warmth in the hand, rising through the arm to the head. But this sensation was accompanied with one quite new and unexpected, namely, a peculiar, somewhat cooling, but astonishingly refreshing sensation, a pleasurable feeling, which the patient compared to the fresh air of a fine May morning. This sensation flowed from the end of the wire into the arm, and thence spread itself over the whole body, dispensing throughout her whole nature a feeling of strength and refreshment. All the bystanders were affected to sympathy, and the author allowed the unfortunate patient for a con-

siderable time the new enjoyment derived from this unknown cordial or restorative. It was something which flowed through her whole nervous system with a beneficial effect. The author did not know what it was, and as it did not immediately bear on the question, it was left, like many other things, for subsequent study. The explanation will be found at a later stage of the inquiry.

98. In another experiment, to avoid as much as possible the complication due to heat, the wire was hung with white linen. The room was warm, the air rather cool, but still the patient felt as before, only the sensation of crystal-force was weaker. The peculiar refreshing coolness was very decidedly felt.

99. Again, the wire was hung with moist linen. The effect was accompanied by a disagreeable sensation, such as moist air is said to produce on the patient. But in this case also, the peculiar effects first observed, namely, increasing sensation of heat in the wire, and the refreshing coolness flowing to every part of the body, were very distinctly observed.

100. In order to obtain confirmation and security for the accuracy of these observations, the experiment was now tried on M^{lle}. Nowotny, who was so far recovered as to have quitted her bed for several weeks. When the wire alone was used, she perceived coolness in the end of it in her hand, and this disappeared and reappeared as the other end was removed from the sunshine or restored to it. When several square feet of tinned iron were attached to the wire, and exposed to the sun, the sensation of coolness increased to that of icy coldness, which caused the hand to stiffen. It has been already stated that the force of crystals, in some persons, caused the sensation of heat, in others that of coolness; the special difference will be subsequently considered. In this case, where the coolness is derived from the sun, the great source of heat, it is peculiarly indicative of a specific influence. The influence was so decidedly marked, that a difference was perceived by the patient, according as the rays of the sun were allowed to fall perpendicularly or obliquely on the plate, or according to the time of day or of year, other things being the same.

101. The author had no opportunity of trying these experiments with M^{lle}. Atzmannsdörfer; but on inquiry, she stated, that at all times the sun's rays had exercised on her a most beneficent influence, not of a warming but of a cooling nature, and that she could not bear them to shine on her head, not on account of heat, but because they produced severe lancinating pains.

102. In like manner, he had often heard from M^{lle}. Sturmann, long before he had discovered the peculiar influence now under consideration, that the sun chilled her; a statement which was then quite an enigma to him.

103. But he was able to investigate this subject most accurately with the aid of M^{lle}. Reichel. Not only did she perceive the peculiar cooling sensation, when the wire was attached to sheet-iron, sheet-copper, sheet-zinc, tinfoil, lead-foil, silver-ribbon, gold-leaf, brass-plate, and German-silver, and these bodies exposed to the sun's light; but also when linen, woollen cloth, cotton, silk, &c., attached to the wire, were placed in the direct rays of the sun. Indeed, every substance tried, including porcelain, glass, stone, wood, water, lamp-oil, alcohol, sulphur, when tried in the same way, produced the remarkable sensation of increasing coolness, which all the sensitive patients uniformly and unanimately testified to, being as much astonished at the apparent contradiction (which, however, was afterwards very clearly explained) as the author himself.

104. If it were really the force residing in crystals, in magnets, and in the human hand, as already identified, which was here again met with in the sun's rays, this could only be proved, as in the preceding cases, by a comparison of its effects with those of the other forces. The first question was, Can the sun's rays bring other bodies into the same state as crystals, magnets, and the hand do? Can it enable these bodies to act on sensitive patients? If so, the light of the sun, so often analysed, must contain one more element, a powerful influence, which has hitherto escaped the researches of philosophers.

105. The author tried, with considerable curiosity and interest, the experiment of placing a glass of water for five minutes in the sun, and causing the nurse, whose hand was very weak in regard to the new force, to give it to M^{lle}. Maix without her having any idea of the object in view. Without a question being asked, she declared it to be magnetised water as soon it touched her lips. On the tongue, gums, throat, down the gullet, and in the stomach, at every point it acted with its peculiar pepper-like pungency, well-known to the sensitive, and exciting spasmodic attacks. Another glass of water, left in the sun's rays for 20 minutes, and handed to the patient by one of the weakest female hands, acted as strongly as if magnetised, as far as possible, by the large horse-shoe magnet of 9 bars, capable of supporting 80 lb.

106. It was possible that a considerable part of the

force might have adhered to the glass itself, rather than have belonged to the water. To ascertain this, as also to investigate the internal condition of the water, whether it acted as a tube full of steel-filings does towards a magnet, the water which had been exposed to the sun was poured into another glass, and again given to the patient. The result was, what had often occurred before with magnetised water in the cases of M^{lles}. Sturmman and Nowotny, namely, that the transferred water was almost as magnetic in the second glass as in the first; and that, consequently, the total revolution among the particles of the water caused by the pouring, had caused little or no change in that interior arrangement, in virtue of which it was termed magnetised. Even an hour later, when the residue was drunk by the patient, the magnetism had not disappeared, but was still powerful. In this, as in all other respects, the solarised water agreed perfectly with that which had been impregnated by means of magnets, of crystals, and of the human hand. Similar experiments were made on M^{lles}. Sturmman and Reichel, with the same results, which it is quite unnecessary to detail.

107. To carry on the parallel, the author now took the callipers of German-silver, and after the patient, M^{lie}. Maix, had become accustomed to its temperature when placed in her hand, he exposed it to the sun for some seconds and immediately gave it back to her. She found it as strongly charged with the force of crystals as when acted on by the magnet, by crystals, or by the human hand; but along with this she observed the peculiar agreeable coolness above mentioned, which was also collected in the callipers, and remained in it for some time. In fact, it was perceptible for 5 or 6 minutes; while the other force, that of crystals, lasted longer, indeed 20 minutes, which was exactly the time that it continued when the calliper was charged by the author's two hands. The solar ray, therefore, was equal in force to the ten fingers, and acted as long in the body charged by it as when the ten fingers were employed.

108. The author next gave one of his hands to M^{lie}. Reichel, that she might feel it accurately, and then went for 10 minutes into the sunshine, taking care to expose himself to the rays on all sides. On returning to the room, he gave her again the same hand. She was much surprised at the sudden change in it, and at the great addition of force which she perceived, without knowing any thing of its cause. The sun's rays had obviously impregnated the author's person, as the magnet had the person of M. von Eisenstein, and

also, in another experiment, the author himself. At an earlier period, M^{lle}. Maix had told the author, that she could not bear when any one, coming out of strong sunshine, came near her bed. A short time before, a whole company of her friends had come into her room from a walk in strong sunshine; and this was so painful to her, that she could not hold out, and was obliged to request her friends to leave the room. This was the effect of the sun, but the warming, not the cooling effect.

109. The young women who were about M^{lle}. Maix, for their amusement placed an iron key in the sunshine for a short time; and she found it as strongly magnetised as a bar-magnet which was in the house. It did not, of course, attract iron; but the patient declared that its action on her was precisely that of a magnet. The charge disappeared from the key after a time.

110. This experiment led the young women to another, the result of which was remarkable. They placed a horse-shoe magnet, which had become weak, in the sun's rays, instead of restoring its power by drawing another magnet along it; and their expectation was fulfilled. It was so strengthened and became so powerful in its action on the patient, that from that time, whenever a magnet had become weak, it was laid in the sun, to restore its power of acting on the patient.

111. The author next found that a rock-crystal and a crystal of gypsum, after five minutes' exposure to the sun's rays, were much more powerful in their peculiar action on the sensitive patient.

112. All these facts unite to form this law: The force derived from the sun, and corresponding to the force of crystals, is capable of being collected in other bodies: and since these bodies can be charged with it and retain it for some time, they possess a certain degree of coercive power in reference to it.

113. The conductivity of the force, derived from the sun, is proved by its passage along the wires to the hand of the patient. But other experiments were made, and it was found that when one end of a bit of linen was put into the hand of M^{lle}. Reichel, while the other end was placed in the sun's rays, the sensation of the force of crystals was perceived in her hand, where it appeared in the shape of coolness. The same thing happened with woollen, cotton, and silk. Silk was the best conductor, then linen; woollen stuff conducted more slowly, cotton slowest of all. A bar of wood $1\frac{1}{2}$ foot long, required upwards of $\frac{1}{2}$ minute before the effect was

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conducted from one end to the other. A glass-tube, exposed at one end to the sun's rays, quickly conducted the influence to the other end. Bodies of all sorts, therefore, whether conductors, semi-conductors, or non-conductors of electricity, are capable of conducting the force under consideration; quickly, if in one piece, more slowly if made up of many parts attached together, as woollen and cotton stuffs.

114. To test its polarisation in bodies charged with it, a copper-wire, 6 feet long, and about $\frac{1}{8}$ of an inch thick, was exposed to the sun for some minutes. M^{lle}. Reichel found it cold at one end, cool at the other: these sensations diminished as she proceeded towards the middle, and at about $\frac{3}{4}$ of the length of the wire from the cold end, she found, for a certain distance, a marked maximum. The solar force, therefore, assumes a polar arrangement in bodies, as the force of crystals, &c., does.

115. The description of the numerous and concurring experiments made for confirmation and control is omitted, in order to save space, by the author, and he proceeds to the question, whether luminous phenomena are connected with the new solar force? It is well known that many, if not all substances, when exposed to the sun, and then taken into the dark, phosphoresce; and this rendered it impossible to draw any sure conclusion from experiments made in that manner. The following arrangement was adopted: A private stair in the wall, leads from the author's study to the under story, in which his collections and instruments stand. The window being tightly closed, when both doors of the stair were shut, the darkness on the stair was complete. He could easily communicate with this retreat, and hear and understand what was spoken, both there and in the rooms both above and below, with which the stair communicated. M^{lle}. Reichel allowed herself to be shut up in this stair, and in this way many very interesting experiments in reference to luminous phenomena were conducted. This arrangement furnished the best security for the accuracy of the sensitive observer, who, in her prison, could never know what changes were made in the experiments above or below: she could only perceive the effects, and describe them to the author and his assistants, as often as she had anything to describe. In the rooms above there were several plates of copper, iron, zinc, gilt-metals, lead-foil, linen dipped in melted sulphur, &c., $\frac{1}{2}$ a square yard in size, kept ready. These were successively connected with an iron-wire, 30 feet long, and $\frac{1}{8}$ of an inch thick, which was carried through the key-hole, the rest of the aperture being closed,

and the end placed in M^{lle}. R.'s hand. After 10 minutes, when she had become quite accustomed to the wire and to the darkness, the plates were, one after another, attached to the wire and pushed into the rays of the sun, and in less than a minute there rose before her eyes from the end of the wire a slender column of flame, from 9 inches to 1 foot high, and only about $\frac{3}{4}$ of an inch thick. It was gradually pointed, and at the end almost as narrow as a knitting needle, and it diffused round it the most delicious coolness. When the air was agitated in any way, it flickered like any other flame, as was observed with the magnetic flame. According as the plate was moved in and out of the sunshine above stairs, the flame rose and sank in the dark, an interval of more than $\frac{1}{2}$ a minute always occurring between the charge and its effect. The author, one time, instead of using a plate, caused his daughter to take the upper end of the wire in her left hand, and to stand in the sun. This young lady, alone, in the dark, caused a small flame to rise from the wire, which diffused warmth, as has been formerly noticed. But now, as soon as she went into the sun's rays, the flame at the end of the wire rose to 8 inches, and diffused a most agreeable solar coolness. As often as she removed out of the sun's rays, the flame sank to its original size, and again diffused warmth. Many of the metallic plates and other objects were now, after exposure to the sun, brought into the dark to the patient. Not to speak of mere phosphorescence, which was to be expected, or of flames over the surface, which, if not caused by the phosphorescence, were probably influenced by it, it is proper to state that the plates at their sharp corners, especially the upper ones, sent forth bundles of flames like the magnets and the crystals, those from copper being green and blue, of gold and silver, bright white; of tin, dull white; of lead, dingy blue; of zinc, reddish-white; of mercury, white; and those of a group of crystals of sulphate of potash, blue with white points. A glass-tube, 3 feet long and $1\frac{1}{4}$ inch wide, when brought from the sunshine into the darkness, and held perpendicularly, was seen to be surrounded, in its upper half, by a fine white feathery or downy-like flame, which passed into bundles of flame $2\frac{1}{2}$ inches high, playing about the upper end. No difference could be detected between the effects produced by the direct rays of the sun, and those caused by the rays polarised by passing through the window-glass. All these experiments prove, that the force which, in the sun's rays, flows over bodies, produces the same beautiful luminous phenomena as the force of the magnet, of crystals, and of the human hand.

116. In every point hitherto investigated, therefore, the action of the sun on sensitive patients agrees with that of magnets, of crystals, and of the human hand; and consequently our own sun must be considered as the fourth source of the crystalline force, or rather of the new force, whatever name be given to it.

117 This observation obviously leads to many interesting considerations. The author, however, refrains from tracing out its connections for the present, his chief object being in the mean time to point out and establish the different sources of the force in question which have become known to him. He proposes subsequently to describe each source individually, as far as he has been able to investigate their peculiarities. Meantime, he thinks it advisable to direct attention to at least one special subject, because it is that one which establishes the mode of action of the sun even more accurately. This is the *spectrum*. If the sun's rays exert the force so often mentioned, it is natural to inquire whether all the rays of the spectrum, or only some of them, possess this power, and whether some may not possess more of it than others. The following experiment was made. A spectrum was thrown on a wall, and M^{lle}. Maix holding in her hand one end of a copper wire, the other end was moved along the spectrum from tint to tint, without her knowing what was done. Many repeated experiments, which gave uniform results, shewed that green, and still more yellow, were especially the seat of the delightful sunny feeling of refreshing coolness: this was, therefore, where the light of the spectrum was the most intense. This property diminished towards both sides, and disappeared at the ends. But the sensation of apparent warmth, or even heat in the wire, although 15 feet long, derived from the crystalline force, increased as the wire was moved from the middle of the spectrum towards one end, and was most intense beyond the red: this, again, is the seat of the maximum of calorific rays: the true heat of which could not, however, possibly reach the patient. In the violet ray and beyond it, this patient found the seat of a peculiar disagreeable sensation which she was familiar with as accompanying the new force in magnets also, and which was likewise perceived by other highly sensitive patients. But here is the very part of the spectrum where Morichini and Mrs Sommerville succeeded in magnetising steel. This observation adds some weight to the researches of these experimenters, which are not yet generally admitted.

118. The maximum of light, the maximum of heat, and the maximum of magnetic power in the spectrum, have,

therefore, each their peculiar and well-marked action in the excitable nervous system of sensitive persons; and the more minute investigation of these relations cannot fail to yield further interesting results, and to clear up many obscure points.

119. From the sun it was natural to turn to the Moon, and the inquiry here was the more indispensable, that, as is well known, numberless terrestrial phenomena, both in healthy and diseased persons, appear to be more or less under the influence of our satellite, while we cannot yet trace the relation between the cause and its supposed effects. The first experiment was made with M^{lle}. Maix. It was not easy, as her windows looked north, and it was impossible to reach the moon's rays directly. The author, in this emergency, carried an iron wire, $\frac{1}{8}$ of an inch thick, through two rooms, then across a court, and from thence through three more rooms, in all, to the distance of nearly 100 feet, to a place where it was possible to obtain the moon's rays. One end of the wire was placed in the patient's hand, the other was attached to a large sheet of copper, which was then, with the usual precautions, exposed to the moonlight. After a short pause, the sensation in the hand began to change from the normal one. Iron and copper wire, by themselves, had always occasioned a sensation of warmth; but this, instead of being strengthened by the moonlight, as it was by the sun's, especially beyond the red ray of the spectrum, was rather overpowered by the sensation which followed it. There flowed from the wire so powerful a current of the cool sunny pleasurable feeling formerly noticed into the hand and over the whole person of the patient, that she considered it six or eight times as strong as she had experienced from the sun's rays. This refreshing coolness increased during several minutes, and then remained stationary during half an hour, as long, that is, as the experiment was continued. The sensation caused by the sun's rays was to that caused by the moon's, as a cool aura or breath to a cool wind, as she expressed it; and hence the sun was more beneficial to her than the moon, which acted too violently. With the wire in the right hand, the sensation was infinitely more pleasant than when it was in the left. But that which occurred in the case of the moon only, and not with the sun, was a kind of decided attraction in the whole arm towards the wire, so that she felt a tendency to follow the course of the wire with the hand. On feeling this, she carried her finger slowly along the wire, and, had she not been in bed, would have followed it through its whole length, according to the peculiar attraction she felt. Here we meet with something like the strange attraction

exerted by the magnet on cataleptic patients, and of which we can hardly doubt, that it is that irresistible attraction which so powerfully affects lunatics, and which thus would appear to be conductible through metals. This patient considered the force as purely magnetic, only much stronger: but it must be remembered that her hand was never attracted by the magnet. The difficulties of the locality prevented further experiments with M^{lle}. Maix on this very interesting subject; and the author had recourse to other sensitive patients.

120. The next was M^{lle}. Reichel, who assisted in many and variously contrived experiments. When any object was put into her hand, and she was asked, after becoming accustomed to it, to expose one end to the moonlight, she indicated without delay the commencement of the sensations which she always perceived when the object in her hand was touched by the poles of magnets or crystals, or by the hand, or exposed to sunshine. All substances tried were found capable of receiving and transmitting the influence. In this case, the sensation was not cool, but lukewarm; and it will hereafter be seen that this patient distinguished the sensations of warmth and coolness, between which the sensitive patients constantly oscillated in their feelings, most distinctly of all, and likewise most consistently. When she took into her hand the callipers of german silver, laid them down, pushed them into the moonshine, returned them into the shade, and after an interval again took them into her hand, she found them charged with the influence derived from the moon. Thus the capacity of charge, passive and active, in the force and the object, was established. An iron-wire and a glass-tube, after being exposed to the moon for $\frac{1}{4}$ hour, were found by her most strongly charged at the ends, the force of charge diminishing towards the middle, where it reached a minimum. It was consequently polarised. Sheets of copper and zinc, lead and tinfoil, silver and gold-leaf, exposed to the moon and then carried into the darkened stair, where M^{lle}. R. was, appeared to her with bundles of flame at their corners, white, red, green, and blue. A large plate of metal was attached to a long wire, the end of which was put in her hand in the dark, and when the plate was moved alternately into and out of the moon's rays, she saw, as often as it was exposed to the moonlight, a narrow flame, hardly as broad as the finger, rise straight up from the end of the wire to 9 or 10 inches; and it always disappeared after a short interval, when the plate was removed from the moonlight. She found this flame warm. These experiments were repeated during three different full moons, and always with the same results.

121. From all this it follows that the moonlight is not mere moonlight; that, although it conveys no heat, it yet possesses, along with it, light, a powerful hidden influence which, in all respects, agrees with that residing in magnets, crystals, the human hand, and the sun's rays. The moon is therefore the fifth source of this influence.

122. As the calorific rays of the spectrum had so very much augmented the effects of the force under investigation, the author pursued the subject. In the sun and moon the force appeared to be in a state of motion, and to be sent forth from these luminaries, just as light and heat are on the radiation hypothesis. It occurred to him to try whether Heat alone would have any similar effect. A large sheet of copper was placed on a broad vessel of earthenware, and the usual connection made by means of a long copper-wire with the hand of M^{lle}. Maix. A cold brass-box, such as is used in ironing linen, with a cold iron inside, was then placed on the copper, and the author's hand above all. When the patient was accustomed to this the cold iron in the box was replaced by one at a low red heat, the box was shut, and the author held it a little above the copper, not touching the latter. Immediately there passed from the wire into the patient's hand a very strong current of the known sensation of warmth caused by crystals, &c. The hot box was now laid on the copper plate, and moved about so as to heat a large surface: the sensation rapidly increased in proportion as the heat spread. At the same time the patient complained of a striking sense of weight in the hand. The removal of the box was followed by a diminution of effect, and its return by a return of the sensations.

123. In another experiment one end of an iron-wire was given to the patient; the author took hold of it near the other end, and allowed her to become used to this arrangement. He then applied a candle to the end near his own hand, which was heated till it acquired the blue tarnish. The heating by conduction did not extend to his hand, and from his hand to that of the patient the wire was 3 feet long; a passage of heat to her by ordinary conduction was therefore out of the question. The usual sensation instantly commenced, increased with the heat applied, and soon reached a point at which it affected the patient's arm, and even as far as the head. It disappeared and returned as the candle was removed and again applied to the end of the wire. The experiment was repeated with a copper-wire twisted tenfold, and heated by two wax candles. Qualitatively the result was the same; quantitatively it was much greater; and this happened every

time it was tried. A wooden vessel was filled with cold water, the free end of the wire placed in it, and after the patient was accustomed to this, the cold water was poured out, and boiling water substituted for it. She instantly perceived a strong current of crystalline force.

124. The experiment was now reversed, by the introduction of a mass of ice into the hot water. Immediately the phenomena altered their form. The sensation of warmth and its accompanying symptoms decreased; a long traction through hand and arm was felt; the disagreeableness of the warm sensation gave place to the delightful coolness caused by the sun's rays, and this refreshing sensation gradually spread over the breast, the back, and the whole person. Ice, when placed directly in the patient's hand, caused spasms, and prevented further experiments.

125. Experiments were made with M^{lle}. Reichel to control the preceding; when an iron-wire, 6 feet long, was heated by a candle for a minute or two at one end, the other being in her hand, she experienced so much heat that she wondered the author could hold the wire in his hand not far from the source of heat, where, however, he felt not the slightest rise of temperature. At the same time she felt a cool wind flowing from the end of the wire. The same results, only after a perceptibly longer interval, were obtained with a wire 45 feet long.

126. To ascertain whether in this case also luminous phenomena occurred, M^{lle}. R. was placed in the dark stair, and in her hand one end of a thick copper-wire; the other end was heated by an argand lamp in the room outside. A red and green flame, $3\frac{1}{2}$ inches high, appeared when the heat was strongest, and fell and rose as the lamp was removed or restored to contact with the wire. An iron wire, thick, and $4\frac{1}{2}$ feet long, the end of which was heated to redness, gave at the other end a flame $5\frac{1}{4}$ inches high; and an iron wire 45 feet long, also heated to redness at one end, yielded to her a flame as long as the finger. The production of luminous appearances by means of heat, at points where no rise of temperature can occur, is therefore beyond all doubt.

127. The above experiments sufficiently prove that different observers have felt and seen effects, caused by heat, both by radiation and through contact, which entirely agree with those effects which characterise and indicate the presence of the peculiar force or influence residing in magnets, crystals, the human hand, the sun's rays, and the moon's rays. Heat is therefore the sixth source of that influence.

128. Friction is complex in its action; heat, electricity, galvanism, &c. are related to it. The author, therefore, thought it right to ascertain how far it might be connected with the subject under consideration. He laid a plate of copper on a deal floor, connected it by means of a long wire with the hand of M^{lle}. Maix, and then rubbed it gently with a board. The patient immediately perceived the usual sensation of warmth in the wire, increasing to apparent heat as the friction was increased in force and rapidity; and the sensation varied exactly as the friction, without her knowledge, was made to do. When woollen cloth was used instead of the board, the sensation was still stronger, and, with silk, stronger still.

129. The same experiments, made with M^{lle}. Reichel, gave the same results, both with a copper plate and one of zinc; the latter causing a weaker current of force. Both gave a flame at the end of the wire, visible to M^{lle}. R. in the dark. The author sawed through a bar of wood with a fine saw in her presence in the dark. She saw nothing peculiar about the saw-dust, but the blade of the saw, where used, soon appeared as if red-hot, while each tooth gave out a flame. Copper and zinc plates, rubbed together in the hands, shewed only here and there a spark. Zinc rubbed on zinc, and copper on copper, gave likewise slight flashes of light. Gypsum, rubbed on gypsum, gave no light. Masses of charcoal rubbed together appeared, on the rubbing surfaces, red-hot to the depth of a finger-breadth. Sugar with sugar gave the usual light visible to all, but M^{lle}. R. saw this enveloped in a flame $1\frac{1}{2}$ inch high. When two glass-bottles were rubbed together in the dark, the author himself saw them become fiery at their point of contact: but M^{lle}. R. saw the points of contact enveloped in flames as large as the fist. Unglazed porcelain crucibles, when rubbed together, gave a brilliant light visible to the author; the patient saw, in this case, flames as large as the open hand. At this time she was so well as to be able to walk daily without difficulty through the streets of Vienna.

130. The author rubbed two glass-tubes, a yard long, cross-wise, and saw on the line of friction, in the dark, a long streak of fire. M^{lle}. R., besides this, saw round the tubes where rubbed, delicate flame-like lights of a finger's-breadth floating, which were so extended in breadth as to appear to her in the form of ribbons of fire. She felt the tubes, $1\frac{1}{2}$ foot from the part rubbed, apparently very hot, and this heat instantly disappeared when the rubbing was stopped. At the edge she saw little flames, $2\frac{1}{2}$ to 3 inches long, streaming out, which sent forth to some distance a tepid aura. Ex-

actly similar results were obtained by rubbing two iron rods together, only here the author could see no part of the light.

131. In all these experiments, the bodies rubbed were not isolated, so that the electricity produced had a ready escape. The heat caused by the friction, however, could not possibly disappear so rapidly as the flames did, when the rubbing was stopped. The electricity caused by contact, and, in most of these cases, contact of like bodies, must have been so trifling that we are entitled to neglect it. In fact, where copper was rubbed on zinc the results were very insignificant; consequently, neither friction-electricity nor galvanism can have had much share in the phenomena. For similar reasons, the author considers the influence of thermo-electricity as being here too weak to allow him to ascribe the phenomena to it; and he is of opinion, that, besides the partial influence which the above named agents may have exerted, the greater part of the peculiar luminous phenomena seen by the sensitive may be attributed to friction alone. Hence he believes, but with somewhat less certainty than in the preceding cases, that friction must be viewed as the seventh source of the influence residing in magnets, crystals, &c.

132. The action of the sun's rays as well as those of the moon, sufficiently shew that Light has an important relation to the influence which we are investigating. But whether this power belongs to light *per se*, or is merely associated with it, or arises from some radiant force occurring simultaneously with light, are questions, of great importance, no doubt, but which at present, when our object is to discover the sources of this influence generally, would be premature. The investigation of the peculiar qualities of each source must remain for subsequent researches. The author next enquires, whether artificial light is to be reckoned, like that of the sun and moon, one of those sources.

When, in bright daylight, he brought a burning waxlight near to M^{lle}. Maix, she felt a peculiar coolness proceeding from it. Several such lights increased this cold sensation, which now attacked the whole body. When the lights were gradually removed from her, it was found that at the further end of a room adjoining hers, about 21 feet off, the effect, although much diminished, was still perceptible to her. The coolness was markedly similar to that proceeding from a wire exposed to sunshine. She now remembered that she had never been able to support those religious ceremonies in which great numbers of wax torches are burned; for that she had always found that the lights so chilled her to the

very marrow of her bones that she was compelled to withdraw. But she has had in some degree her present disease since birth, and may be looked on as having been born sensitive, and as having thus, at all ages, experienced the sensations depending on this sensitiveness, even when she appeared externally healthy. This peculiar effect of light on her, from a distance at which radiant heat must have been utterly insignificant, an effect, besides, directly opposed to that of radiant heat, was distinctly marked in her at a time when no one thought of ascribing it to disease, and long before the author commenced his experiments.

133. Experiments with M^{lle}. Reichel gave similar results. She felt one light, at considerable distances, to be a source of coolness: two lights acted twice as powerfully, and an argand lamp more powerfully still, and most of all when covered with a ground glass shade.

134. To ascertain whether the cause of these effects was transferable or conductible, a copper-plate was connected with M^{lle}. Maix's hand by a wire. Opposite the plate were placed two burning wax-lights, so that she could not see them, nor be affected by their radiation. She perceived at the same time warmth in the wire, and the sunny feeling of agreeable coolness formerly described, only much weaker than in the case of the sun. This was confirmed by multiplied trials. A similar experiment with 8 burning stearine candles was tried on M^{lle}. Reichel, who was in the next room, holding in her hand the wire attached to the copper-plate. She perceived the well-known effects very strongly, and felt the coolness flowing from the wire at a considerable distance. The interposition of a glass-plate between the lights and the copper-plate hardly diminished the effect, so that it does not appear to signify whether the light be ordinary light, or partially polarised, as by passing through glass.

135. These phenomena lead to the conclusion, that not only the light of the sun and of the moon, but light in general, is a source of the same power, force, or influence already recognised in so many different quarters, in the magnet, in crystals, and this may be considered the eighth source.

SECTION VI.

CHEMICAL ACTION. ELECTRICITY.

136. The chief results of the preceding section are,
a. The sun's rays possess a power of acting on sensitive

patients, which power entirely coincides with that residing in the magnet, in crystals, and in the human hand.

b. To this power adheres or is attached a peculiar sensation, described by all the sensitive as an ineffably pleasurable coolness, refreshing and strengthening the whole body.

c. In the spectrum, the maximum of effect in regard to the crystalline force, that is, of effect similar to that of magnets, crystals, &c., is at the outer edge of the red, that is, in the calorific rays.

d. The maximum of the intensely pleasurable sunny coolness is in the green and yellow rays, that is, in the maximum of light.

e. The maximum of the peculiar disagreeable traction, observed by the sensitive as a part of the effect of the magnet, but found also distinctly in the sun's rays, lies in the violet ray, that is, in the ray which magnetises steel.

f. The moon's light contains the new force in abundance, in some respects, indeed, as in regard to the pleasurable coolness, even in far larger proportion than the rays of the sun.

g. Besides this, the moonlight possesses a peculiar attraction; in virtue of which it acts on those affected with lunacy; nay, may possibly cause that malady.

h. Heat is a source of the new force;

i. It appears as a result of friction,

k. and also as an effect of artificial light.

137. If we look to the condition of chemistry in the times of Agricola, Kunkel, and Brandt, we may form some idea of the relation of that science to the object of our researches at the present time. Fragmentary observations lie scattered about, but in what a state!! For about 70 years, an instrument has been employed by some physicians, under the name of the magnetic baquet or tub: the description of which would cause any one accustomed to a scientific method of proceeding to shudder with disgust. A wooden tub is filled with a hotchpotch of the most absurd kind, and this is stirred up with magnetised water. An iron rod is stuck in the mixture, and from this woollen threads serve as conductors to patients of all kinds, who are to receive from it a current of salutary vital magnetism. This mixture consists of iron-slag, broken glass, smithy-scales or ashes, steel-filings, roots, iron-ore, grain, sulphur, sawdust, glass-plates, wool, old iron, aromatic herbs, quicksilver, &c., all magnetised and mystically stratified, the one above the other. What salutary influence, it may well be asked, can proceed from this hell-broth? But how such a mess can produce,

above all, a magnetising influence, no one can comprehend, and yet (on this point all who occupy themselves with magnetism as a means of cure are unanimous) it is said to be a continued and permanent source of magnetism, capable of being communicated to the sick by the conducting-threads.

138. That this apparatus cannot be either a galvanic or an electric one, and far less a magnetic one, is obvious to all who know the rudiments of these things; and yet it has an effect, observed for 70 years, in some points analogous to the effects of these powers; and at the root of which must lie something concealed, no matter what, which has a real existence, or the baquet could never have prolonged its existence as a curative agent till this day. On reflection, it appeared to the author, that only one thing was obvious in regard to the baquet, namely, that it must be a scene of chemical action. Free scope was given to all the affinities of the substances employed, and combinations and decompositions must go on slowly in it at all times. Since, according to the physicians, an influence did proceed from it, analogous to that which he had already traced to 8 different sources, he was led to enquire, whether chemical action, by itself, was capable of producing and exciting the same influence; whether, in short, Chemical Attraction might not be a new source of the force so often mentioned.

139. To investigate this, he took a glass of water, dissolved in it bicarbonate of soda, introduced the end of a copper-wire $4\frac{1}{2}$ feet long into the solution, and gave the other end to M^{lle}. Maix. When she was quite accustomed to the feeling, he added a pinch of tartaric acid to the solution. As soon as the action began, the patient experienced a very strong sensation of warmth rising to heat, so strong as to cause her to flush; and this lasted as long as the action continued, but no longer. It was as strong as when the author applied 10 fingers to the wire, or touched it with the large crystal or a bar-magnet.

140. It was possible that electricity, disengaged in the process, as some chemists affirm, might be the agent here. But the most delicate electroscope, aided by a condenser, could not detect the slightest evidence of free electricity in the wire; so that, if electricity takes a share in the chemical process, it is, at the moment of its liberation, neutralised, and no electrical current is formed. What the patient felt was therefore certainly not caused by an electric current.

141. A glass of dilute sulphuric acid and an iron-wire were put into the hand of M^{lle}. Maix. When the wire was placed in the acid, and the action began, she felt the wire

become warm, and even apparently hot, but a cool air made itself felt in the neighbourhood of the glass.

142. A glass of water, and a little salt in paper, were given to her, and after a pause, the salt was thrown into the water, which was gently agitated. During the solution of the salt, she felt the glass for a time increase in warmth, and at last it became stationary. The warm sensation flowed up the arm.

143. The same three experiments were repeated with M^{lle}. Reichel, and with the same results. Further experiments were made on this patient with sulphuric acid and soda, iron filings, and excess of the following acids successively; acetic, tartaric, fumaric, citric, hippuric acids: carbonate of soda with sulphuric acid in excess, &c. Fresh grape juice, in active fermentation, was also tried. All gave abundant currents of magneto-crystalline force. One end of a copper-wire, 240 feet long, was placed in her hand, and the other dipped in diluted sulphuric acid; and even at that distance, she felt the end of the wire become warm in her hand, and the sensation rose or fell as the wire was dipped in or removed from the acid.

144. Sugar, alcohol, borax, and carbonate of soda in crystals, potash, effloresced borax, effloresced carbonate of soda, sulphurets of calcium and potassium, quicklime; all these substances, when put into water, caused either a cool or a warm sensation in the wire, lasting till the action was complete, when in all cases this peculiar effect disappeared. Chemical action, therefore, however feeble, as solution, and the recombination of water of crystallisation, produced in all cases a free manifestation of magneto-crystalline force.

145. The author was curious to see whether water could be magnetised by chemical action. He placed a glass of water in another glass, containing bicarbonate of soda. Into the latter tartaric acid was now introduced, and when all action was over, the inner glass was handed by a female to M^{lle}. Maix. She found it as strongly magnetised as by 5 minutes sunshine; but not so strongly as by 20 minutes sunshine. A repetition of the experiment on the same water as soon as she had tasted it, appeared to double the charge. A similar experiment was tried on M^{lle}. Reichel with carbonate of potash and sulphuric acid; and the result was the same. By means of chemical action, therefore, we are able to magnetise water, as well as with the magnet itself.

146. During all these experiments, the force in the conducting wires was found by the patients to be polarised as in all the preceding investigations.

147. There remained only the luminous phenomena. These were tried with M^{lle}. Reichel. All kinds of solutions and dissolutions were tried both directly before her, and by leading a wire from the vessel to her hand in the dark. Sugar, carbonate of soda, borax, &c., were dissolved each in a separate glass, in the dark. A glass-rod was used for stirring. Even before it was used, the contents of the glass gave out a red light; a fine small flame began to float on the liquid and streamed upwards. When lumps of sugar were thrown into water, they became, according to M^{lle}. R., at once red, and fell through the water like red-hot fragments. When the author stirred the sugar and water about in the dark, he saw himself at each gentle friction of the rod on the sugar, flashes of light, which, as the whole surface of the sugar was in the act of solution, could not be electric, as some consider the light given out by lumps of sugar rubbed together when dry, or by chalk, &c., although even in these cases there is no evidence of its electric nature. Quicklime was moistened with water, and as soon as the inner motion which attends the slaking began, and vapour appeared, the patient saw the whole lime as if white hot, and a dull blue flame rose to the height of the hand. The dead or dull appearance she attributed to the vapour. These flames lasted $\frac{1}{4}$ of an hour undiminished, and in $\frac{1}{2}$ an hour longer gradually disappeared. Sulphuric acid, poured into water, formed at once red flames in the glass, which floated above the liquid. On stirring, they increased so as to rise a span above the glass. No doubt the effect of heat here added itself to the effect of chemical action. Even the glass-rod exhibited bundles of fire at its upper end. These fiery exhalations lasted almost an hour. Fermenting must of wine gave a continued yellowish flame.

148. An iron-wire 90 feet long was placed, one end in the hand of M^{lle}. Reichel in the darkened stair, the other, outside, in dilute sulphuric acid. At the end of half a minute she saw a narrow column of fire, a span and a-half high, rise up from the end of the wire; and this flame rose and fell as the wire was more or less deeply immersed. When the further end of the wire was in contact with water in which sugar was dissolving, the column of flame was even larger. In another experiment, a brass-wire 12 feet long was used, and gave the same results, but with this difference, that while the flame of the iron-wire appeared white and reddish-blue, that from the brass was white and green. Dry quicklime, stirred with water in excess, gave a flame a span high. Wherever, therefore, chemical attraction was active, there light and flame appeared in the dark to the sensitive.

149. In considering the chemical relations of this force, it is impossible to overlook flame, which is a highly chemical phenomenon. But being accompanied with light and heat, it is not easy to separate the results of these different agencies. Glowing coals were felt at 3 feet distance, and from that, as far as to the end of the room, cold by M^{lle}. Reichel. Spirits and alcohol, burned near her, were also cold at a small distance. Different bodies, such as resin, sulphur, potassium, were burned in her presence, and their flames, especially those of the two last, were found quite cold. It is not so easy, however, to say here which emanations cause the sensation of coolness. Light appears to have comparatively a small share in these cases, because the effect of the flames of sulphur and alcohol, both little luminous, was not weaker than that of stearine candles. Heat, again, has almost always yielded apparent warmth (see Section IV.) Since then, in these flames, the predominant result was a sensation of cold, this must have been owing, either to the products, or, as is more likely, to the chemical act itself.

150. Immediately after the present investigation on chemical action, we shall come to one on the voltaic battery. As the hydro-electric circuit is one of the most important sources of chemical activity, the author here anticipates so far as to mention that in that case also, the chemical changes produce an abundant supply of the new magneto-crystalline force, with all its usual characters. It is necessary thus to anticipate, because all kinds of chemical processes must be included in the following concluding proposition.

151. The parallelism of the so-called magnetic phenomena accompanying chemical action, with those which we have seen in magnets, in crystals, in the human hand, in heat, in light, &c. is perfect; and chemical action is consequently the *ninth* source of the new influence.

152. Here, now, the field of investigation opens up to an incalculable extent. This need not surprise us: we ought rather to have anticipated such a result from the first observations with crystals. Chemical action, in its various forms, is so closely allied to the construction and destruction of crystalline structure, that as soon as such a force was found in crystals, it was to be supposed that it would be related to the force which regulates the combination and separation of the molecules of bodies.

[Let me here refer to the experiments of Mr Hunt (Phil. Mag. Jan. 1846), on the action of magnets in promoting crystallisation. It appears highly probable, that, in these experiments, the active force is not the magnetism which attracts iron; but the new magnetic, or magneto-crystalline force of

Reichenbach. I have already obtained pretty decisive evidence, that the approach of the pole of a crystal acts on crystallising solutions just as Mr Hunt describes the pole of a magnet to do. Should my results be confirmed, they will furnish physical evidence, independent of sensitive persons, of the existence of a force in crystals. I am continuing these researches, and will make known the results as soon as I am fully satisfied of their accuracy.—W. G.]

It was thus easy to calculate that chemical action must have a powerful reaction in producing the new force. The author hopes, that it will supply a means of concentrating that force, and rendering it better adapted for further researches than hitherto, he having been as yet confined to the sensibility of sensitive persons : and, above all, that it may furnish a more convenient reagent for detecting it, and a measure of its relative power in different cases.

153. Let us now cast a glance back to the magnetic baquet : this strange contrivance now loses its enigmatic character, no doubt, at the cost of becoming more ridiculous. It is nothing but an accidentally thrown together slow and long continued source of chemical action ; from which flows the desired force, just as a slow fire gives out heat. It is a slow current, derived from chemical action, of the influence residing in magnets, in crystals, in the human hand, &c., and in this case is called Animal Magnetism. Now, we see why the baquet, when stirred up after a long interval, when it has become dull, again acquires new vigour ; because new surfaces for solution are produced ; also, why every new physician makes his own hotchpotch, and yet obtains the same results ; because it is indifferent what substances are present, provided they can act chemically on each other ; and, finally, how one, who used a baquet of water and glass obtained little, and others who followed him, obtained no results : because glass and water, although a magnetic incantation may have been pronounced over them, do not act together. The whole scaffolding of the baquet, which, since the time of Mesmer, has not a little contributed to render animal magnetism ridiculous, will now fall to pieces ; and any slow chemical action (perhaps an open voltaic circuit may prove the best), manageable as to power, and convenient in form and size, will replace it.

154. But the considerations, which present themselves in connection with chemical action, lead us to another, perhaps a more interesting, path of inquiry. They point to the source from which, in all probability, the organism draws its so-called magnetic force : to the hearth, where the flaming

forces are kindled, which flow from our finger points, and, as we shall see, from other nobler parts of our wonderful structure. This is *Digestion*. Since every chemical action, however slight as we have seen, gives rise to this force, and since digestion is nothing but a continued chemical action, lasting all our lives under the influence of vitality, it follows, necessarily, that in our intestinal canal the new force must be continually set free, and placed at the disposal of the whole organism. But this is not all. The digested matters enter the circulation, and never cease to be engaged in an endless series of chemical decompositions and recompositions throughout the body, thus continually giving rise to the same force till they leave the body.

155. All that has been here said of Digestion is true, *mutatis mutandis*, of Respiration. This function supplies us with oxygen, which is carried by the blood to every part of the body, there to take part in the chemical changes above alluded to, and to cause the change of matter. One of its chief results is animal heat; and the true animal magnetism accompanies this in all circumstances. That which, in the body, causes heat, causes also the magnetic force, whatever name may be given to it. These imponderables, which constitute the innermost life, whether material or not, mutually regulate each other, nay, are, perhaps, essentially one and the same: and that we find them associated, is only an additional security that we are on the right trace in following them up. We now can explain whence the force comes, which flows, polarised, from our hands and fingers, as from a magnet; and where that which is always escaping from us in flames is always renewed. Chemical action, at work in the whole of our structure, produces and disengages it; and where we meet with it, we find it arranged according to its innate dualism or polarity.

156. By one of the most profound combinations of thought, to which our age can point, Liebig has led us to the idea that all the motive force in our bodies is produced by digestion, and all the heat by respiration: that is, that both,—force and heat,—were the result of chemical action. Although this cannot yet be brought into an algebraic formula or a chemical equation, and disputes may occur here and there about the expression of this truly great idea, yet the conception addresses itself so powerfully to our comprehension, and finds so powerful an echo in the general knowledge we possess of nature, that its ultimate triumph is secure. And, indeed, as Nature gives nothing for our support but air and food, we can hardly doubt that she has intended us to obtain from air and food all that is necessary to our existence. If,



then, we find, for example, that we daily appropriate 14 oz. of carbon from our food, and daily give it off by respiration: if we find, further, that we daily take up 47 oz. of oxygen, and daily give out as much: if we find, lastly, that this carbon and this oxygen are given out combined, but that this combination corresponds exactly to the development of as much heat as we daily require; there is, in this deduction, so much striking evidence, that hesitation must ultimately give way to conviction.

158. The author considers it as no small security for the truth to nature of his researches, that he has been brought, by a different route, to the same new field of inquiry as Liebig had already opened up. Chemical action yields abundantly the active principle of the crystalline force: the human body overflows with this influence; man digests, respire, the change of matter goes on within him, as do combination and decomposition, so that chemical action goes on at every moment. It is, consequently, certain, that from the play of affinities, or, in a word, from the chemical action of the human body, the still mysterious force whose existence is established by these researches, must proceed. We may indeed doubt, whether the sun shines; because it is often day when no sun is visible: this the author knows, and against such doubts he does not contend.

158. The author closes this section with a useful application of the results, which is, says he, so much the more welcome, as it utterly eradicates one of the chief foundations of superstition, that worst enemy to the development of human enlightenment and liberty. A singular occurrence, which took place at Colmar, in the garden of the poet Pfeffel, has been made generally known by various writings. The following are the essential facts. The poet, being blind, had employed a young clergyman, of the evangelical church, as amanuensis. Pfeffel when he walked out, was supported and led by this young man, whose name was Billing. As they walked in the garden, at some distance from the town, Pfeffel observed, that, as often as they passed over a particular spot, the arm of Billing trembled, and he betrayed uneasiness. On being asked, the young man reluctantly confessed that, as often as he passed over that spot, certain feelings attacked him, which he could not control, and which he knew well, as he always experienced the same, in passing over any place where human corpses lay buried. He added, that, at night, when he came near such places, he saw supernatural appearances. Pfeffel, with the view of curing the youth of

what he looked on as a fancy, went that night with him to the garden. As they approached the spot in the dark, Billing perceived a feeble light, and when still nearer, he saw a luminous ghost-like form floating over the spot. This he described as a female form, with one arm laid across the body, the other hanging down, floating in the upright posture, but tranquil, the feet only a hand-breadth or two above the soil. Pfeffel went alone, as the young man declined to follow him, up to the place where the figure was said to be, and struck about in all directions with his stick, besides running through the place of the figure; but the ghost was not more affected than a flame would have been: the luminous form, according to Billing, always returned to its original position after these experiments. Many things were tried during several months, and numerous companies of people were brought to the spot, but the matter remained the same, and the ghost seer adhered to his serious assertion, and to the opinion founded on it, that some individual lay buried there. At last, Pfeffel had the place dug up. At a considerable depth was found a firm layer of white lime, of the length and breadth of a grave, of considerable thickness, and when this had been broken into, there were found the bones of a human being. It was evident that some one had been buried in the place, and covered with a thick layer of lime (quicklime), as is generally done in times of pestilence, of earthquakes, and other similar events. The bones were removed, the pit filled up, the lime mixed and scattered abroad, and the surface again made smooth. When Billing was now brought back to the place, the phenomena did not return, and the nocturnal spirit had for ever disappeared.

159. It is hardly necessary to point out to the reader what view the author takes of this story, which excited much attention in Germany, because it came from the most truthful man alive, and theologians and psychologists gave to it sundry terrific meanings. It obviously falls into the province of chemical action, and thus meets with a simple and clear explanation from natural and physical causes. A corpse is a field for abundant chemical changes, decompositions, fermentation, putrefaction, gasification, and general play of affinities. A stratum of quicklime, in a narrow pit, unites its powerful affinities to those of the organic matters, and gives rise to a long continued working of the whole. Rain-water filters through and contributes to the action: the lime on the outside of the mass first falls to a fine powder, and afterwards, with more water, forms lumps which are very slowly

penetrated by the air. Slaked lime prepared for building, but not used, on account of some cause connected with a war-like state of society some centuries since, has been found in subterraneous holes or pits, in the ruins of old castles; and the mass, except on the outside, was so unaltered that it has been used for modern buildings. It is evident, therefore, that in such circumstances there must be a very slow and long continued chemical action, partly owing to the slow penetration of the mass of lime by the external carbonic acid, partly to the changes going on in the remains of animal matter, at all events as long as any is left. In the above case, this must have gone on in Pfeffel's garden, and as we know that chemical action is invariably associated with light, visible to the sensitive, this must have been the origin of the luminous appearance, which again must have continued until the mutual affinities of the organic remains, the lime, the air, and water, had finally come to a state of chemical rest or equilibrium. As soon, therefore, as a sensitive person, although otherwise quite healthy, came that way, and entered within the sphere of the force in action, he must feel, by day, like M^{lle}. Maix, the sensations so often described, and see by night, like M^{lle}. Reichel, the luminous appearance. Ignorance, fear, and superstition, would now dress up the feebly shining vaporous light into a human form, and furnish it with human limbs and members; just as we can at pleasure fancy every cloud in the sky to represent a man or a demon.

160. The wish to strike a fatal blow at the monster of superstition, which, at no distant period, poured out on European society from a similar source, such inexpressible misery, when, in trials for witchcraft, not hundreds, not thousands, but hundreds of thousands of innocent human beings perished miserably, either on the scaffold, at the stake, or by the effects of torture,—this desire induced the author to try the experiment of bringing, if possible, a highly sensitive patient, by night, to a churchyard. It appeared possible that such a person might see, over graves, in which mouldering bodies lie, something similar to that which Billing had seen. M^{lle}. Reichel had the courage, rare in her sex, to gratify this wish of the author. On two very dark nights she allowed herself to be taken from the castle of Reisenberg, where she was living, with the author's family, to the neighbouring churchyard of Grünzing. The result justified his anticipation in the most beautiful manner. She very soon saw a light, and observed on one of the graves, along its length, a delicate, breathing flame: she also saw

the same thing, only weaker, on a second grave. But she saw neither witches nor ghosts: she described the fiery appearance as a shining vapour, one to two spans high, extending as far as the grave, and floating near its surface. Some time afterwards she was taken to two large cemeteries near Vienna, where several burials occur daily, and graves lie about by thousands. Here she saw numerous graves provided with similar lights. Wherever she looked, she saw luminous masses scattered about. But this appearance was most vivid over the newest graves, while in the oldest it could not be perceived. She described the appearance less as a clear flame, than as a dense vaporous mass of fire, intermediate between fog and flame. On many graves the flame was 4 feet high, so that when she stood on them, it surrounded her up to the neck. If she thrust her hand into it, it was like putting it into a dense fiery cloud. She betrayed no uneasiness, because she had all her life been accustomed to such emanations, and had seen the same, in the author's experiments, often produced by natural causes. Many ghost stories will now find their natural explanation. We can also see, that it was not altogether erroneous when old women declared that all had not the gift to see the departed wandering about their graves: for it must have always been the sensitive alone who were able to perceive the light given out by the chemical action going on in the corpse. The author has thus, he hopes, succeeded in tearing down one of the most impenetrable barriers erected by dark ignorance and superstitious folly against the progress of natural truth.

[The reader will at once apply the above most remarkable experiments to the explanation of corpse-lights in church yards, which were often visible to the gifted alone, to those who had the second sight, for example. Many nervous or hysterical females must often have been alarmed by white, faintly luminous objects in dark churchyards, to which objects fear has given a defined form. In this, as well as in numerous other points, which will force themselves on the attention of the careful reader of both works, Baron Reichenbach's experiments illustrate the experiences of the Seeress of Prevorst.—W. G.]

161. We now come to the province of Electricity. It might be supposed that, in the foregoing experiments, electricity played an important part, or was even the principal cause of the whole phenomena. The author carefully examined this point, and the results will shew the true position of electricity in this matter.

162. Very careful experiments were made with a small galvanic pair of wire and copper, of nearly 40 square inches surface, between the elements of which cloth moistened with solution of salt was placed, and with a soldered pair of zinc and copper of 13 square inches surface. The sensitive patients either held a metallic rod in each hand, and brought these in contact with the poles of the first arrangement, or held the second in their moistened fingers. But although both arrangements affected the multiplier strongly, the following patients, M^{lle}. Nowotny, Sturmman, Atzmanusdörfer, Reichel, and Maix, perceived nothing more than healthy people did. No doubt the current from a single pair is weak, but it is sufficient to cause contractions in the frog's limbs, to act on the needle, and even to decompose iodide of potassium. It was, therefore, probable, that, if any high degree of sensitiveness for galvanic electricity existed, some marked effect would have been produced by it in these individuals.

163. It follows, then, from very varied and multiplied experiments, made with all the most sensitive patients, and the results of which were uniform, that a weak hydroelectric current does not act more strongly on patients who are singularly sensitive to the action of magnets, &c., than on healthy persons. And this, again, implies, that galvanic electricity is not the influence for which they possess that high degree of sensitiveness which we have seen.

164. Stronger currents could not fail to act strongly on these patients. M^{lle}. Nowotny, when tried with 15 or 20 pairs of 13 square inches, excited as before, was found rather more sensitive than any of the bystanders, but not at all to any uncommon extent. The same thing occurred with M^{lle}. Maix; and M^{lle}. Reichel amused herself by taking the shock of 50 such pairs, when others declined doing so.

165. If M^{lle}. Reichel allowed the current from 50 pairs to pass for a long time through her person, she felt after a time sensations analogous to those produced by a magnet, probably because the current produces a current of magnetism, or, rather, of the new force allied to it.

166. The electricity of the friction machine, did not affect M^{lle}. R. otherwise than healthy persons, and she even willingly took shocks from it which to many others were very disagreeable.

167. The conclusion drawn by the author is, that an electrical discharge passed through the body, whether from the galvanic pile or the friction machine, passes too rapidly to be able to bring into activity the force which we have found to exist in crystals as well as in the human body.

168. But this by no means proves that all kinds of electrical treatment are equally ineffectual. For when a thick wire was first placed in the hands of M^{lle}. Reichel, and then made to close the galvanic circuit, she then felt the wire decidedly becoming apparently warm, as in the former experiments made with magnets, light, &c., &c. But as the galvanic battery is a complication of chemical, magnetic, and electrical activity, and cannot, therefore, give unmixed results, the author tried friction-electricity, and made the patient hold in her hand, but without actually touching the metal, a wire leading from the conductor of the machine. As soon as the plate was made to rotate, she felt a warm atmosphere round the wire, which she easily distinguished from the usual cobweb sensation.

169. The author passes over the experiments made on conduction, charging, polarisation, &c., which are besides involved in the experiment just mentioned; and proceeds to the luminous appearances. The patient was placed on the darkened stair, with a wire 18 feet long in her hand, the point free. The wire lay on the floor, and ended, outside, in contact with the conductor. The machine acted feebly, so as to give sparks, only about the fifth part of an inch long. Very soon after the plate was set in motion, a slender flame rose from the end of the wire, exactly like those so often described. It was 9 inches high, below as broad as the thumb, above very pointed. When the plate was more quickly turned, without the knowledge of the patient, the flame rose higher, and fell again, when the quicker motion was stopped. The wire being in contact with the floor, did not, and could not, exhibit any of the usual electrical bundles of light at the point visible to ordinary observers. When the machine was stopped, the flame always lasted two minutes longer, and then began slowly to diminish in size. Something, then, evidently took place here, quite distinct from the usual appearances of an electrified wire. Numerous repetitions of the experiment at different times and with different wires, gave the very same results.

170. The wire was attached to a hollow brass ball of 2 inches diameter, and this brought within 2 inches sideways of the conductor, the sparks of which reached only to $\frac{1}{10}$ th of this distance, the ball being thus within the electrical atmosphere of the conductor, when excited. Two minutes elapsed after the plate was set in motion, before the patient saw any change in the wire; then the flame slowly rose to a span in height, and reached its maximum in four minutes more. It then remained stationary. When the ball was removed from the

machine, the flame lasted two minutes unchanged, and then began slowly to disappear.

171. Similar results were obtained when the ball was placed at the distance of 7 inches. But at 3 feet distance, the flame was smaller by $\frac{1}{4}$ th; and at 6 feet the flame was only half its original size. In these experiments the time required for the appearance of the flame remained unaffected.

172. The ball was now made to touch the conductor, so as to receive, immediately, positive electricity from it. The same appearances followed, but in less than half a minute. But when the ball was so placed as to receive a succession of sparks, the above effects did not occur. The patient felt every spark as a shock in her hand, but saw no flame. The rapidity of the electrical action appeared to be too great; so that the flaming principle, less mobile perhaps by nature, was not set in motion. All these experiments were repeated with negative electricity, but no difference could be detected. In all these experiments, the patient, sitting in the dark stair, knew nothing of what was done outside. Nothing was said to her; and she only described, speaking so as to be heard in the room to which the stair led, the phenomena that occurred, just as she felt or saw them. Deception of any kind was here quite out of the question; but the perfect uniformity of the results, and the accurate coincidence of the phenomena perceived by her with the experiments made out of her sight, and without her knowledge, as well as their agreement with theory, furnish striking proofs of the exactness of all the observations.

173. The author here omits numerous experiments, made to control the above, and leading to the same conclusions. He adds that these flames gave out a sensation of coolness. When the patient was near the machine, she experienced warmth from the positive charge of the conductor; but at some paces from it, she decidedly experienced coolness. This difference can only, he says, be explained in a future section. A tin electrophorus plate, 1 foot in diameter, with a wooden handle, held for a minute in the atmosphere of the excited conductor, and then touched with a moist finger, caused a strong and continued sensation of a current of cool air, when brought near to the face of the patient. An isolated body acted in the same way; there is not, as yet, any means of isolating the magneto-crystalline force.

174. An open voltaic arrangement of 50 freshly cleaned zinc and copper pairs, with cloth between them moistened with salt and water, appeared to the patient, when she

brought her hand near to it, warm at the positive, and cool at the negative pole. The warmth extended to $\frac{1}{4}$ th of the length, the coolness only to $\frac{1}{3}$ th: the latter was comparatively feeble, the former very marked, so as to be perceived by several healthy persons, and even by the author himself. The patient also felt warmth when her hand was brought over the positive pole in the line of the axis of the pile, and coolness at the opposite pole. When the wires attached to each pole for experiment were not joined, the positive wire gave a current of warm air, the negative wire a current of cold air, as the patient described it. This warmth and coolness increased exactly in proportion to the number of elements of the pile.

175. Wherever, then, electricity is for some time active, the peculiar force appears which has been so often described in this treatise, and electricity is consequently the tenth source of it.

SECTION VI.

THE MATERIAL WORLD, COLLECTIVELY.

176. A retrospect of the last section gives the following as the chief points in it:—

a. Chemical action, as well the ordinary kind as that connected with combustion and the galvanic pile, is a comprehensive source of the magneto-crystalline force.

b. The most insignificant chemical action is sufficient to develop it abundantly, to charge surrounding objects with it, to exhibit polarity, to produce light, &c.

c. The magnetic baquet is nothing but a source of chemical action.

d. Digestion and respiration, and, in general, the change of matter in the animal body, being chemical processes, are the sources of the magnetic influence which exists and acts in the human frame.

e. The ghost-like luminous appearances observed above graves, although unseen by most healthy persons, do really exist, are of purely physico-chemical nature, but can only be seen by the highly sensitive.

f. Electricity is also a source of the power which resides in crystals, &c.; this is true both of friction-electricity, positive and negative, and of contact-electricity.

g. Even the electric atmosphere is capable of setting this force in motion at considerable distances.

177. We have, thus far, found the force which we are investigating, proceeding from ten distinct sources. We shall now find it occurring more generally; we shall seek it in the collective material world, and endeavour to ascertain something of the important part which it plays in the universe.

178. It is well known that there are many persons on whom certain substances exert a peculiar, generally disagreeable influence, which often borders on the ludicrous. Not to speak of the strange fancies of pregnant females, there are people who cannot touch fur, others who cannot endure the sight of feathers, of butter, &c. ; and, if forced to do so, faint in consequence. Now, observation shews that such antipathies are found in individuals who, although outwardly healthy, are yet more or less sensitive, and that they increase in number and strength as these persons become more nervous, especially if subject to convulsive diseases. In the case of M^{lle} Sturmman, this goes so far that she often cannot touch a key or door-handle without her fingers being paralysed by spasms, although she appears otherwise well. In his researches with the sensitive patients, the author soon found that these antipathies were connected with certain sensations, common to many persons, and that when these sensations were compared, they might be reduced to a few; which few were found to follow certain rules. The sensations were, apparent heat or cold in substances of the same temperature; decided agreeableness or disagreeableness, the latter rising to the causing of spasms: pungent, knocking, or drawing sensations in the skin and limbs; and tonic spasms without pain.

In Section II. it was mentioned that the emanations from the poles of crystals caused such tonic spasms in M^{lle}. Nowotny, and that this was the case with all distinct crystals, of whatever substance. That effect need not be again noticed here: let us attend to the apparent differences of temperature, to the disagreeable or nauseous sensation, and to the apparent mechanical agitations of pricking, &c., felt by the patients. Some of these feelings extended to the healthy; but all were felt by the sensitive, more or less powerfully, according to the nature of their disease, and their amount of suffering. The author first observed that, in the case of M^{lle}. Nowotny, all amorphous bodies, although devoid of the peculiar action of crystals, gave rise to a nauseous sensation, which adhered pretty constantly to certain bodies, and appeared in different degrees of force.

179. To investigate this point, the author took the trouble

to try more than 600 bodies, in reference to this nauseous sensation. It appeared that the patient could easily give to every substance its proper place in the scale of force. This she could repeat without failure at a distance of several days.

180. It soon appeared that these bodies arranged themselves according to their electro-chemical value, and indeed in such wise that the highly electric stood at the top, the indifferent at the bottom of the scale, without regard to their polar opposition. For example, the highest were oxygen gas, sulphur, caffeine, sulphuric acid, potassium, phosphorus, sodium, selenium, iodine, cinnabar, lead, potash. Between the numbers 30 and 110 were bismuth, arsenic, mercury, morphia, zinc, iodide of potassium, tellurium, chloride of lime, chromium, lithium, purple of cassius, oxide of nickel, tin, iridium, nickel, alcohol, chlorine gas. Between 200 and 400 were paraffine, rhodium, acroleine, piperine, creosote, sea-salt, quinine, brucine, cantharidine, strychnine, crystallisable acetic acid. Between 500 and 600 were cinchonine, quartz, hippuric acid, mastic, chalk, gum, vegetable acids, sugar, milk-sugar, mannite. At the lower end were palladium, platinum, silver, copper, iron, gold, amber, water. These last had hardly any action on this patient. Some of the rarer metals, perhaps not pure, and iron with its magnetic properties, are exceptions; but in general the highly electric are associated, positive and negative being alike to her. Thus oxygen, sulphur, and phosphorus, were placed close to potassium, sodium, and lead.

181. When the same substances were tried on the patient in her cataleptic state, the results were in kind the same, but in degree much stronger. The substances at the top of the scale, laid in her hand, caused violent spasms, whereby they were thrown to a distance, and her hand then, as usual in catalepsy, retained the new position. She always, when restored to consciousness, complained of fatigue in the arm which had been used for the experiments, although she knew nothing of them. This proved that the spasms were accompanied with great exertion, leaving behind it a feeling of exhaustion.

182. It was soon also observed that many substances began to act before they touched the hand, and it was enough to place them near it. Such bodies were sulphur, lead-glance, fluor-spar, rock-salt, &c. &c. There was evidently an action from a distance of even amorphous bodies, if they were only high in the electro-chemical scale.

183. When tried in her usual state, the same substances

which had most strongly affected her by their approach, did not act until they were in contact. It is therefore evident, that, in catalepsy, the acuteness of the senses affected is enormously increased; and that bodies possess a latent power, in virtue of which they act on cataleptics from a certain distance, in a manner analogous to that in which they act by contact in the ordinary state.

184. These observations were confirmed and extended with the aid of M^{lle}. Maix. When different substances, sulphur for example, were placed in her hand, she felt them warm or cool; the sulphur she felt warm when it touched her hand: but it gave out besides a cool aura extending over the whole hand, to the arm, the face, the other arm, the breast, and at last through the bed-clothes, so that the abdomen and feet perceived the cool emanation from the sulphur.

185. When sulphur was put into an empty glass, and that placed on her hand, she felt the glass, as before, warm where she touched it: but a copious current of coolness flowed from the sulphur out of the glass and fell on her hand, from whence it spread to all the other parts. A crystal of gypsum produced the same effect. This coolness, as felt after passing through the glass, was much more agreeable than from the actual substances without the glass: it was, as the patient said, finer, more transparent, purer, more ethereal.

186. The sulphur, after this experiment, having been laid on a table near the bed, M^{lle}. Maix soon declared that she perceived its effect from thence. On removing it further, it was found that she was sensible of its action even at 6 feet distance, in the form of its cold aura. The sulphur was a piece not larger than a finger. A surface of 7 inches square of sulphur was now prepared, and this was strongly felt, even at 14 feet; the cool wind from it being very similar to that from the pole of a large rock-crystal, or a small open magnet.

187. As sulphur, both in immediate contact with the hand, and when enclosed in glass, produced a warm sensation at the points of contact in this patient, the author looked for a substance which gave her a cool sensation, and found one in sulphuric acid. She felt this, in glass, very cold; but when removed some paces, she also perceived a cool aura or wind from it. Nitric acid was equally cold at the point of contact; but its effect from a distance extended half as far again as that of an equal quantity of sulphuric acid.

188. It was now desirable to find bodies which, when laid in the hand, felt neither warm nor cold, but indifferent.

Such bodies are paraffine and cane sugar. But both gave out the cool aura, paraffine at 6 feet, sugar at nearly 3 feet.

189. A large number of bodies was now examined, in reference to this phenomenon. A bottle of oxygen gas felt particularly hot and pulsating, and made both hand and arm soon stiff with spasms; it was highly nauseous, and gave a cool aura to more than $1\frac{1}{2}$ feet. It is remarkable that so small a quantity of a substance in which we habitually live, had so very marked an effect on the system. A specimen of chromic acid, sealed in a tube $\frac{3}{4}$ inch wide, felt to the hand burning hot, but sent forth a cold aura to 18 feet. Phosphorus in water acted like sulphur, only weaker. Selenium, tellurium, and carbon, all acted like sulphur; but carbon was the weakest of all. An empty tumbler on the hand felt warm, without aura; but if covered by a watch-glass, a cool aura fell down on the hand, which ceased on removing the watch-glass. It was, therefore, the confined air which caused the cool aura, obviously the warmth of the hand exalted the power of the contained oxygen so as to overpower that of the external cold air; and since oxygen would seem to be the most energetic of all bodies, this small rise of temperature was sufficient to cause a sensible manifestation of the power.

190. All metals felt warm to the hand, but they all gave out what the patient called cool air. They followed each other in this order, beginning with the strongest: Chromium, osmium, nickel, iridium, lead, tin, cadmium, zinc, titanium, mercury, palladium, copper, silver, gold, iron, platinum. A copper-plate of half a square yard surface, placed opposite her bed, gave her a decided cool fresh wind, which by degrees flowed, causing an agreeable sensation, through the whole bed. A similar zinc-plate acted in the same way, not so strongly. An iron and a lead plate were both found weaker. On the other hand, a mirror placed opposite to her, at first with the mercurial alloy next her, acted very strongly on the patient; with the glass surface next her, it acted more powerfully still. The radiation of this surface again caused that peculiar very agreeable coolness mentioned (185.) as proceeding from sulphur, &c., through glass. The patient felt herself from head to foot penetrated by the pleasurable sensation thus produced.

191. Less extensive experiments on this subject, made with M^{lle}. Sturmman, gave decided confirmation of the above results. She felt oxygen in the hand very hot; sulphur, selenium, iodine, bismuth, chloride of gold, iridium, purple of cassius, and morphia, were all, in the hand, warm. Anti-

mony, mercury, zinc, copper, tellurium, lunar caustic, bismuth, gold, lead, tin, and iron, were, in different degrees, cold. Potash gave uncertain results. Crystals of calcareous spar, arragonite, tourmaline, and rock-crystal, she found polar, at one end warm, at the other cool. Sulphur, lead, zinc, iron, tin, copper, silver and gold, in plates of half a foot square, and at the distance of 3 feet and upwards, sent forth radiations, sometimes hot, sometimes warm, tepid and cool. Palladium gave out on all sides, a slender current of cool wind. In her cataleptic fits, if sulphur, &c., were laid in her hand, she threw her hand up with force, as M^{lle}. Nowotny did; if these bodies were only laid near her hand, it began to quiver, shuddering took place, the hand slowly drew itself away, and was affected with spasms.

192. Similar results were obtained with M^{lle}. Atzmannsdörfer, who found sulphur, selenium, pyrites, antimony, zinc, lead, Egyptian jasper, rock-salt, alum, potash, and brucine, cold in the hand; but platinum, silver, bar-iron, copper, gold, and mercury, warm. Gypsum, fluor-spar, pyrites, alum, tellurium, lead, common garnet, and gallic acid caused, at some distance, a cold aura, flowing, apparently, in all directions.

193. M. Schuh felt, on contact, sulphur, in lumps as well as powder, warm. Oxygen, iodine, bromine, copper-nickel, cyanide of gold, cyanide of potassium, he felt warm and soon productive of headach, which gradually became intolerable. He arranged a small series of minerals by feeling them, as follows, beginning with cold and proceeding to warm: pyrites, fluor-spar, calcareous spar, iron-glance, staurolite, rock-crystal, tungsten, schorl, sandy calcareous-spar from Fontainebleau, heavy-spar, topaz, sea-salt, analcime, felspar. Blue vitriol and carbonate of soda had to him points which sent forth cold. He could even accurately find the cold points or poles by feeling these salts wrapped up in paper. He felt cold at the distance of 9 inches from fragments of sulphur, and from a small layer of oxalic acid; but surfaces of half a foot square of tin, lead, copper, silver and gold, sent forth heat at the same distance. Silver and gold coins, and steel tools, he also felt warm when he held the hand above them, at some distance. He could not long bear the effect of a large cheval glass, which caused headach, stupefaction and gastric pains. If he turned his back to the mirror the effect was only accelerated. He also tried a large mirror on the wall, but here the effect was more rapid and stronger.

194. M. Studer placed his hand round many substances, or brought them near his eyes, which were highly sensitive, and found sulphur, pyrites, tellurium, chloride of lime, per-sulphate of iron, sulphuret of potassium, binoxalate of potash, seignette salt, rock-crystal, sugar, to give coolness from a distance; while warmth proceeded from gold, silver, copper, tin, lead, zinc, potassium, and aqua potassæ. The same results were obtained with the carpenter Klaiber.

Many experiments were made with many different persons, and at last two substances were found to serve as representatives of the two series, namely, sulphur for those which give cold from a distance, gold for those which give warmth. Of each the author had a surface of $\frac{1}{4}$ a foot square lying ready. Almost every one, whose hand was made to pass over these at a small distance, declared the sulphur to be productive of cold, the gold of warmth. Among these may be named the following: M. Kotschy the African traveller, who felt vividly these sensations and complained, without having heard of any such thing, of the peculiar pricking as with needles, which the sulphur also caused in his hand, without contact. Dr Fenzl, the well-known botanist, distinguished the sensations of heat and cold perfectly. Mr Incedon, an English resident in Vienna, not only felt the heat and cold, but described the pricking caused by the sulphur, as very similar to the sensation experienced when the hand has been asleep, as it is called, and has nearly recovered the normal state. The author himself was able to distinguish the heat and cold sufficiently well to be quite sure about them, provided the temperature of the air were about 64° F.

195. Amidst these varying phenomena, some points appear pretty constant. The same substance, with different observers, is not constant in the sensations produced, and this part of the subject requires a separate investigation. But all the bodies tried, acted on the sensitive patients with perceptible differences in the apparent temperature, no matter whether heat or cold were felt. The author was enabled, by the kindness of M^lc. Reichel, who submitted to extensive series of experiments, to bring the phenomena into some order, and indeed he might have dispensed here with all the other patients, had it not been desirable to have as much evidence as possible.

196. The castle of Reisenberg, the residence of the author, where these experiments were made, is so built, that, in the chief front, two suites of nine rooms each are connected by folding doors, all in one line. Each line is 144 feet long,

with a balcony at each end, 9 feet broad; in all, therefore, the author could command a straight line of 162 feet in still air. When working with wires, the distance can be doubled by adding the one suite to the other, thus commanding nearly 330 feet. M^{lle}. R. was placed at one end, and experiments were made on the distance to which the effects of substances would reach. To obtain a measure, magnets were first tried. With a small horse-shoe magnet, the limbs of which were $2\frac{1}{2}$ inches long, it was necessary to go to $7\frac{1}{2}$ feet from the patient before the effect disappeared. With another, the limbs of which were 7 inches long and 2 broad, it was necessary to go as far as 54 feet. A heavy horse-shoe magnet, of 9 elements, and carrying at that time 40 lb., only ceased to act at 90 feet, or at the further end of 6 rooms. Experiments with a bar-magnet of about $1\frac{1}{2}$ foot long, gave, for the distance at which the patient ceased to perceive the effect, for the south or positive pole, about 69 feet, and for the north or negative pole, about 54 feet.

197. The iron-bars which had been used to form a parallelogram, as the armature to the last named magnet, of which one was exactly equal in size to the magnet, the others only $\frac{1}{2}$ of its length, were tried separately. They attracted no iron-filings, and were quite unmagnetic in regard to the needle; but the patient felt them at the following distances:

	One end of the long bar	at	69 feet
	The other end . . .	...	60 ...
Of the two cross bars :			
	One end . . . . .	...	24 ...
	Both together . . . . .	...	45 ...
	The other end . . . . .	...	33 ...
	Both together . . . . .	...	63 ...

Thus the pieces of the armature alone acted on the patient as strongly as the magnet itself: and must, therefore, in regard to the crystalline force, have come into equilibrium with it. In this very remarkable result, deception is out of the question, because it was quite impossible for the patient, several rooms off, to know the precise position of the bars, and all her observations were perfectly consistent among themselves, and thus mutually controlled each other.

198. Three days later, menstruation having come on, her sensitiveness was much increased, and she felt the large magnet of 9 elements at the entire distance of 162 feet so strongly, that she thought it would still be perceptible at twice the distance. The surface ($\frac{1}{2}$ a square foot) of sulphur

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was now tried, and found to produce the cool aura sensibly at 108 feet. A plate of copper, of more than 4 square feet surface, was tried, and produced heat at 84 feet. An iron plate, of 6 square feet, produced warmth at 132 feet; lead-foil, 6 square feet, at 67 feet; tinfoil, 6 square feet, at 63 feet; zinc plate, 6 square feet, at 60 feet; silver paper (pure), 1 square foot, at 21 feet; gold paper (pure), 3 square feet, at 60 square feet; an electrophorous plate (of wax or resin) 14 inches diameter, at 90 feet; a mirror, of 9 square feet, at 96 feet; and a small bottle of oxygen gas at 15 or 16 feet.

Many other objects, of brass, porcelain, glass, stone, paper, wood, linen, open or shut doors, trees, people, horses, dogs, cats, ponds of water, &c. &c. &c., especially if they had been shortly before exposed to the rays of the sun, in short, every thing material, acted on the patient, causing sometimes a cool, sometimes a warm, current to flow towards her, and many of these so strongly as to attract her attention and annoy her severely; many, again, so feebly that she, being used to the thing, paid no attention to it.

199. This astonishing result, namely, that a person, a plate of metal, some sheets of gold paper, &c., acted sensibly on the patient, without her seeing them, at perhaps 100 paces, was so unexpected by the author that he could not suppress his surprise. This, however, only caused M^{lle}. Reichel to smile, she having been all her life familiar with this influence. All the sensitive persons tried, both healthy and diseased, including the author himself, had, under proper circumstances, experienced the same sensations and perceptions, stronger or weaker, more or less extensively, according to the subjective excitability of each. It seemed obvious that all this was nothing else than a manifestation of the force, already so often mentioned, in a more general, perhaps a modified, form; and it was now necessary to look for the remaining characters of the new form of the influence, in order to attain a sure judgment as to the identity of it with the former.

200. Is this force, thus universally disseminated, transferable from one body to another, as the crystalline force is? A curious occurrence here assists us to the answer. M^{lle}. Maix was visited by her sister M^{lle}. Barbara Maix, a young woman, apparently healthy, but subject to nervous disorders. She had hardly taken the hand of the patient into her own, when she let it go in terror, calling out, "What on earth have you in your hand that pricks me so?" Now there was nothing in the patient's hand; but she had, shortly before,

held for some time a piece of sulphur in her hand. This effect, after a time, disappeared; but it was easily reproduced when she again held sulphur in her hand. Something was evidently transferred to the hand from the sulphur. When the author held sulphur in his hand, and then took the hand of M^{lle}. Maix, she perceived the pricking sensation, and discovered by it what he had handled.

201. When the callipers, after being placed in the patient's hand for some time, that she might become accustomed to the sensation caused by them, were laid down and a mass of sulphur placed on them for a few minutes, the patient, on again taking the callipers, felt very strongly the pricking due to the sulphur, and consequently something had been transferred to the metal.

202. Experiments with M^{lle}. Reichel gave similar results. After holding a roll of sulphur for 5 minutes in his hand, the author laid it down and took hold of her hand. Very soon she complained (although she had no knowledge of the former experiments) that his hand was full of needles. This was a complete confirmation of the first experiment with the hands of two distinct persons, and a proof how much objective reality there is in these phenomena. The hand was found after $\frac{1}{4}$ of an hour not yet free from the charge it had received from the sulphur; and indeed the charge disappeared very slowly.

A pair of steel scissors, which, alone, felt warm to M^{lle}. R., after being laid on sulphur, felt cold and caused the pricking sensation.

A glass-tube, 3 feet long, which, alone, felt slightly warm, was placed for a minute with one end in sulphur, and the other end given to the patient. It now felt very cold, and it was half-an-hour before it had recovered its original power of causing-light warmth. Sulphuric acid, in a bottle, placed in contact with the tube, had the same effect.

Caffeine, to the amount of a few milligrammes (possibly $\frac{1}{10}$ th of a grain) was placed in a thin glass-tube, and this laid for a time in the large tube. The latter now felt (after the caffeine was removed) decidedly warm.

The hand of the author's youngest daughter, after she had laid it for a short time on several folds of gold paper, was felt much warmer than before; and this increased warmth lasted about 7 minutes.

A glass full of powdered gum, which, alone, feels cool, being placed for some minutes close beside a bottle of potassium in naphtha, which, by itself, feels warm, had acquired a varying sensation, sometimes warm, sometimes cold, as if

the potassium had overpowered in part the force of the gum, while another, perhaps more inward or intimately associated part, was not, in the given time, overcome.

Pure gold leaf, by itself warm, gave to an empty glass bottle, of itself cool, by contact, the power of causing a strong sensation of warmth.

Gypsum and oxide of copper, both of themselves cold, became warm to the patient when held in the author's left hand, but not in the right.

Potassium in naphtha, of itself warm, after being laid (in its bottle) among fragments of sulphur, became as cold as it had at first been warm. The sulphur had neutralised the warmth of the metal, and had, besides, charged it with its own coolness.

The callipers of packfong, of itself warm, became cold when placed in salt; colder in contact with fluor-spar, and still colder with sulphur.

A stick of sulphur, placed for a short time in contact with the potassium bottle became less cold. After a longer contact it was found cold in some parts, warm in others; after being held for some time in the author's left hand, it lost all coolness; and, finally, when laid on the gold leaves, it even became warm.

203. It was therefore established that the force now under consideration could be transferred from one body to another by mere contact, so as to charge the latter, exactly as the force residing in crystals.

204. Further experiments shewed, that a body might be charged with this force without contact. Thus the callipers were rendered cold by sulphur at $\frac{3}{4}$ of an inch; and blue vitriol wrapped in paper caused the long glass-tube to become cold at the distance of 9 inches. The hands of the author's daughters when held over a surface of sulphur, and then placed in those of M^{lle}. Reichel, produced coldness, accompanied by the sensation of pricking as of needles.

205. Hence this force may be transferred from one body to another without contact, by mere approximation.

206. Its conductivity is sufficiently obvious, but the author adds a few remarkable proofs. Thus, a copper-plate being connected with the patient's hand by an iron-wire 90 feet long, different substances, when laid on the plate, caused either warmth or coolness in about half a minute. Zinc, tin, lead, gold, mercury, potassium, potash, aqua potassæ and minium, produced warmth; and sulphur, carbon, oxalic acid, aqua regia, sulphate of iron, and sea-salt, coolness; and these effects slowly disappeared, beginning to diminish half a

minute after the removal of the substances. Sulphur, when only brought near the plate, caused coolness in the wire. In a wide glass-tube, 3 feet long, many different substances, contained in phials, were laid at one end, and all produced on the hand of the patient at the other end exactly the same sensations as they had done when laid in her hand. Another method, which was ultimately found the best, was for the patient to hold one end of a glass-rod, and to place the other end in contact with the substances to be examined. The results were quite uniform with those otherwise obtained. M^{lle}. Maix also perceived the action of substances placed on a copper-plate, connected with her hand by a wire.

The author's daughter gave one hand to M^{lle}. Reichel, and held the other over a surface of sulphur, without contact. The patient, in half a minute, felt the hand become cold, and after a minute she felt the usual pricking of sulphur. This experiment was also made with gold leaf, when the sensation of warmth was experienced.

207. All this proves that the force which emanates from all amorphous bodies is conducted through all substances, even through the living body; and that it may thus be propagated, even without contact.

208. It is unnecessary to speak of the capacity to be charged with this force, or of the power to retain it for some time, possessed by matter, for the preceding experiments have abundantly proved these things.

209. There only remain the luminous phenomena; and these are in truth surprising enough. When experiments were made on M^{lle}. Reichel in the dark with crystals, she always pointed out that all metallic objects were luminous to her. She saw a freshly scoured copper-vessel luminous all over, and a fine green flame floating over it, being larger and streaming forth from the edges. It appeared that all metals, indeed all elements, without any crystalline structure, in sufficiently dark rooms appeared luminous. Compounds were also luminous, but more feebly; and the more feebly the more complex their constitution. Many substances were examined. Most metals appeared red as if red hot, some yellow, some white. A fine flame floated over them, which had different colours with different metals, and could be moved, like ordinary flame, backwards and forwards by the breath, the hand, or the agitation of the air. Compound bodies only shewed flames at their points when crystallised. When the same and different substances were presented to M^{lle}. R. in the dark at different times, her accounts of them never varied, although she could not possibly know

which were at any time placed before her. In compound bodies the colour of the flame appeared to vary, apparently from trifling causes. She described as follows the substances here named:—

Copper-plate, a red light, with a green flame over the whole surface, overflowing at the edges, and these from 7 to 14 inches broad, undulating from the middle towards both sides.

Iron-plate; red light; the flame undulating towards the middle, with a play of red, blue, and white. Somewhat elevated in the middle; half a hand high.

Bismuth; red light; the flames bluish-red.

Zinc-plate; pale red light; the flame dingy white, at the points purplish, toothed at the edge, forming bundles at the corners.

Tin-foil; flame dirty bluish-white, at the edge feebly overflowing, without corner bundles.

Lead; blue light; flame dead blue, small at the edges; no bundles.

Cadmium; white, somewhat bluish flame.

Cobalt; pale blue.

Silver-paper, highly polished; white light; flame white, a fingerbreadth high, not undulating; no bundles.

Gold-paper, polished; white light; flame white; two fingerbreadths high, not undulating; behind the paper a white luminous vapour.

Palladium; strong blue light; pale-blue vapour.

Platinum; white light; bluish flame.

Antimony; white light; bluish flame.

Rhodium; red, with pale yellow.

Tellurium; red light; white edges; no flame.

Osmium; red light, with greyish-red vapour.

Mercury; red light; strong white flame; white vapour.

Chromium; green, verging to yellow.

Nickel; red, inclining to greenish-yellow.

Titanium; vivid red, inclined to violet.

Arsenic; bluish-red; pale red vapour.

Iridium; blue light; reddish-blue flame.

Sodium; red light; flame dirty white, inclining to lilac.

Potassium; red light; freshly cut, yellowish-red; flame large.

Carbon; red light; red flame at edges.

Diamond; flame white, blue in the middle, red at top.

Iodine; red light; when shaken, inclining to green.

Selenium; bluish-red; flame blue.

Sulphur ; flame blue, with turbid white vapours.

A glass-box, filled with silver-plate, appeared at night to the patient as if full of fire ; all the vessels being covered with white flames over their surface.

All these results were uniform, when the darkness was complete. If not, and especially with compound bodies, the colours were not so uniform. A good deal seems to depend on the purity or impurity of the specimens.

In general, these lights and flames have some resemblance to electrical light. They were very like the magnetic and crystalline lights, and appeared to M^{l^{ic}}. R. only a somewhat less vivid degree of the same light, to which she was accustomed from childhood ; although, by advice of her mother, she had concealed the circumstance, fearing to be taken for a supernatural person.

210. It follows, therefore, that all liquid and solid, that is, all denser bodies, give out luminous emanations, in the shape of flame, glowing appearance, and luminous vapour, in the same way as magnets and crystals do.

211. To complete this inquiry into the material world, let us look for a moment at the starry heavens. We have seen the powerful influence of the sun and moon ; and it was natural to try whether the stars might not also act on our earth in an inferior degree, corresponding to their distance.

212. From the author's windows, which commanded a free prospect towards east and south, in a clear night, M^{l^{ic}}. Reichel perceived a distinct influence of the kind suspected. On a neighbouring hill, in a clear, calm, moonless night, she felt that some parts of the sky sent forth a current of coolness, others one of warmth. This was tried soon after sunset, then about 9 P.M., twice at midnight, once at 4 A.M., and just before sunrise. In general it appeared, that soon after sunset the west, and before sunrise the east, were especially cool : at 9 P.M., north and north-west were the cooler, south and south-east the warmer : at 4 A.M., N. and N.E. were the cooler, S. and S.W. the warmer ; and, finally, at midnight, N. was cool, S. warm, and W. and E. so nearly in equilibrium, that little difference was perceptible. They were probably quite equal at 2 or 3 A.M.

213. These changes depend on the position of the sun, which we know causes coolness ; for the greatest coolness was always found in the region nearest the sun, and the presence of clouds made no difference. When the patient was asked to point out exactly the middle of the north cool region and the south warm one, she always pointed in the magnetic meridian, never in the astronomical meridian. She

declared that towards S. she felt a limited strip of the greatest warmth. Even at mid-day she found the line of the magnetic meridian the warmest towards the south, and the coolest towards north, of all points of the compass. This clearly indicates the theoretical value of these indications.

214. But these phenomena, partly solar, partly terrestrial, are not to be confounded with those derived from the stars, with which they are mixed up. M^lle. Reichel always found the milky-way cool; also the Pleiades, the Great Bear, and other constellations: indeed the starry firmament in general. On the other hand, certain single stars gave her a sensation of warmth: these were, Saturn with his ring, Jupiter with his satellites, Venus; in short, planets alone. It thus appeared that stars shining with reflected light were warm; those giving out their own light cool. This agrees beautifully with the former results in the case of the sun and moon.

215. The patient stated that all the stars acted on her as if united like a magnet, not only before, but also behind, so as to affect the spine and the head. A copper-plate, 1 foot square, was connected with a brass wire, the other end of which was given to the patient in the dark stair. By itself, the wire gave a small flame: but when the starlight was allowed to fall on the plate, a slender flame soon rose from the wire to the height of more than a span. Zinc produced the same effect, only weaker. The wire felt cool, especially when no planet could counteract the action of the fixed stars.

These observations are not surprising after what we have learned: but they furnish a beautiful proof of the exactness of what was stated in regard to the sun and moon; also of the action of the whole material world, even the heavenly bodies, on us, with the same force which we find in terrestrial matter: lastly, they prove that there actually does exist a mutual influence between us and the universe, an influence hitherto unsuspected; so that possibly the stars may not be altogether without some influence on our sublunary world, even in practical matters, or on the working of the human brain.

216. We thus come to the closing proposition of this Section, namely, that just as magnets, crystals, the human hand, the sun's rays, &c. &c. &c., all which we have recognised as special sources of the new force, exhibit the marks of a common influence, so does this force exist in all, even amorphous, bodies, including the heavenly bodies, and takes its place as a universally diffused natural force. In the first 10 sources it appears concentrated in isolated points of the

material world ; but here we find it as a universal property of all matter, in variable and unequal distribution.

217. Whether, now, this comprehensive power be an altogether new one, or a hitherto unobserved modification of a known one, or a new complication of several of the known ones, these, and many such questions, must be left for the present unanswered. The author has reached that point, where all the sources of it known to him have been collected and indicated. He will, in future memoirs, endeavour to compare them, and to develop them in many relations which could hitherto be only hinted at ; and perhaps higher authorities will then undertake to give judgment on the whole.

218. The author, having now established the existence of a force, or influence, distinct from all known forces, or at all events requiring to be investigated distinctly, finds it necessary to give it a name. That of Magnetism, which has long been given to it in some of its manifestations, although founded on analogy, conveys an erroneous impression ; since it forms only a part of what is usually called magnetism, and is found, besides, unmixed, in crystals, and in other sources of it. It is no doubt highly probable that all the imponderables are either essentially modifications of one force, or closely connected together : but this is not yet demonstrated ; and as long as, in reference to the force now under consideration, a bar of iron, incapable of attracting iron-filings or of affecting the needle, can produce as powerful an effect as a magnet of the same size, so long must we consider these forces as distinct, and to avoid confusion they must have different names. For reasons not further specified, the author has given to the new imponderable the name of *Od*, a name not possessing any meaning, but admitting of being compounded, according to the genius of the German language. Thus he calls the force, abstractly, *Od* ; as it is found in crystals, magnets, the living body, in heat, in light, &c., *Crytallod*, *Magnetod*, *Biod*, *Thermod*, *Photod*, &c. Although this may answer very well in German, it is not likely that these names will be adopted in this country.

SECTION VII.

DUALISM IN THE NEW FORCE.

219. Many of the previous experiments, as well as analogy, naturally led to the idea that the new force, like electri-

city and magnetism, might exhibit the character of dualism or opposition. The first phenomena that attract attention, in this point of view, are the opposite sensations of heat and cold. These were not in all cases uniform with the same substance in different patients; but with the same patient they were always consistent. The cause of the variation might lie in the substance or in the observers.

220. The first question was, what, in the mouth of the sensitive, is meant by the terms cold and warm? The objects thus called are all of one temperature; we must therefore take the words to signify an effect produced by some unknown cause on the nerves of touch, similar to heat or cold.

221. A bottle of oxygen gas and a piece of sulphur felt both hot to M^{lle}. Sturmman; both cold to M^{lle}. Reichel. M^{lle}. Maix found both hot in the hand, but sending out a cool aura. They all found a difference in temperature from the surrounding air, but they differed as to the degree of apparent temperature in the substances. Each was, however, uniformly consistent with herself.

222. This proved, not only that the supposed cause was present in different quantities in different substances, but also that the subjective sensibility varied in different observers and in different diseases.

223. To simplify the inquiry, the author took one substance, namely, a crystal of gypsum, 3·5 inches long, and found that its streak, when the natural point was drawn from the wrist to the point of the middle finger, without contact, in M^{lle}. Nowotny, while in the magnetic meridian, caused a cool aura; with the opposite end a nauseous warm aura. A rock-crystal, somewhat longer, produced the same effects. M^{lle}. Sturmman felt the streak of tourmaline warm with one pole, cool with the other.

224. M^{lle}. Atzmannsdörfer, tried with the same crystal of gypsum as M^{lle}. Nowotny, felt the same effects, with this addition, that the streak with either pole was felt much stronger in the left hand than in the right. Similar results were obtained with M^{lles}. Reichel and Maix.

225. Many healthy people felt the same. MM. Schuh, Prof. Endlicher, Kotschy, Dr Lenzl, Incedon, Studer, and the carpenter Klaiber, and the author himself did so, more or less. MM. Kotschy and Incedon could only endure for a very short time the cold streak of a large rock-crystal.

226. In general, the result was, that one pole of a crystal gives a cold, the opposite a warm streak. Occasionally

healthy persons were doubtful as to whether the streak was warm or cool; but the sensitive never hesitated.

227. We cannot say of what nature is the dualism thus established, any more than in heat, light, electricity, and magnetism. We can only trace the parallelism between these forces and the new one.

228. The new force, except in not attracting iron, and not being acted on by terrestrial magnetism, agrees with what is commonly called magnetism, more especially in its action on the sensitive. A magnetic needle produced exactly the same effects as a crystal. Now, the negative or north pole of the magnet, usually felt cold, the positive or south pole warm. This naturally leads to the conclusion that the causes are similar, and that where the new force agrees with + M it is positive, where with — M negative.

229. To investigate this, the action of a magnet was more closely studied. A small bar-magnet was placed in the hands of M^{lle}. Maix, so that she held both hands round it at the middle, the north pole being towards the left side. She felt a slight uneasiness. Her hands were now separated till each grasped a pole, when she felt much uneasiness in both arms, in the breast, and in the head. On letting go the magnet out of one hand, the sensation ceased. The whole sensation was that of a current, as formerly observed with the hands of the author. The experiment being repeated with a large horse-shoe magnet, the effect was very strong, and the patient felt, as it were, the current, which was interrupted whenever the hand was removed from the pole. In these experiments it was necessary to keep the north pole in the left hand, and the south pole in the right hand; for, if reversed, the patient experienced the painful conflict formerly mentioned, to such a degree that the experiment could not be continued. If a current, as in the galvanic circuit, be admitted, then it passes from the positive or south pole through the right arm, the body, the left arm, the left hand, and so to the negative or north pole. Consequently the left hand of the patient corresponds to the south or positive pole, the right to the north or negative pole, of the magnetic needle; or, in other words, her left hand is positive, her right negative, in relation to ordinary magnetism, which, as we know, includes the new force.

230. We have seen that when the author took her hands in his, her left in his right, &c., the circuit went on, and she could bear it; but that when he crossed his hands, so that her right was in his right, &c., the conflict began, and became

intolerable. This proves that men and women agree in their polarity in reference to the new force.

231. The bar-magnet was now laid in the left hand of M^{lle}. Maix, so that it reached from the point of the middle finger to the middle of the fore-arm, the north pole upwards. All was here in its natural order; but on reversing the poles disagreeable sensations were felt, and spasms began from the wrists to the points of the fingers. The magnet was now laid on the fore-arm altogether; but here, also, if the south pole were upwards, the sensations were intolerable. If her hands were joined, she felt nothing unusual beyond the current with the north pole of the bar upwards; but with the south pole upwards, she felt when her hands were joined a most painful sense of conflict within her. Under no circumstances could she long endure her hands to be joined. After a time she always tore them asunder when the sensation of the current ceased. All these experiments were made with the patient in the magnetic meridian.

232. As was to be expected, single crystals exhibited phenomena analogous to those observed with magnets. When a rhombohedron of gypsum was placed in the patient's hands, she found it polar in two axes, and of these the shorter was the stronger. When she held her left middle finger on the cold pole, and her right middle finger on the warm pole, the arrangement was not unpleasant; but on turning the crystal, the nausea so often mentioned came on. The cold pole, therefore, corresponded to the negative or N. pole, and the warm pole to the positive or S. pole, of the magnet. When the crystal was laid on her left hand, its direction was not indifferent; for if the cool pole were towards the point of the finger, the painful contest within was felt. Granite, staurolite, and heavy-spar, gave similar results.

233. The author would not have attached much importance to the preceding phenomena, had they occurred only in M^{lle}. Maix. But not only did she give perfectly uniform results at different times, and in different stages of her disease: M^{lle}. Nowotny, although far advanced in her recovery, could yet not long endure the placing together of her own hands. When the author placed his hands in hers, she felt exactly as M^{lle}. M. did; and in the position formerly described, experienced a sense of the motion of a current, which became intolerable. M^{lle}. Atzmannsdörfer found his right hand in her left hot, his left in her left still hotter. With both hands she felt the current in motion which affected her whole system, and stupefied her head. But with his hands

crossed, she became in a few seconds unconscious, and he was compelled to stop. M^{lle}. Reichel had no objection to hold his right hand in her left: but his right hand in her right was painfully disagreeable to her. She felt the effect in her arms, and even in her head, when both of his hands were placed in her opposite hands; but when his hands were crossed, the sensation was far stronger, and intolerably nauseous. She also could not bear to lay her own hands together. All this was complete confirmation of what had been observed in M^{lle}. Maix.

234. The following law is deducible from the phenomena: namely, that certain poles of crystals and of living organized structures correspond, in regard to the new force, to the poles of the magnet: that crystals in this sense have a clearly expressed north and south pole, the cooler being always the north, and the warmer the south pole: and, finally, that of the human hands the right agrees with the north, the left with the south pole, both in males and females.

235. For further confirmation the author now mentions the experience of certain healthy persons. M. Schuh, a vigorous healthy man not much above 30, of lively impressionable temperament, was unusually sensible to the new force, and in fact occupied a position midway between the sensitive and the non-sensitive. He was never ill, and only when overworked in his studies has he had occasionally headach. He perceives vividly the action of all crystals; and large magnets act on him at the distance of $1\frac{1}{2}$ feet. The author's right hand, placed in his left, caused soon an unpleasant feeling in the head. If, in addition, the author's left were placed in his right, this feeling rapidly increased: it rose from the temples to the forehead, and caused a pulsating headach, almost intolerable, which continued 7 or 8 minutes after the hands were separated, and then slowly disappeared: With the crossed hands all action was arrested, evidently because the author's force and his were equal, and neutralized each other; whereas with the sick and feeble sensitive patient the author's force was overwhelming, and established the current after the painful contest so often mentioned. Considering the right hand as negative, and the left as positive, the author requested him to try the effect of joining his own hands. To his astonishment his headach quickly came on, as strongly as when the author's hands were used. His negative right hand and positive left hand formed as it were a pair, and the circuit was closed by the body and arms; so that a current was established and acted on the brain. Several months later, M. Schuh declared that

he found it impossible to keep his hands joined; and that if he accidentally joined them, when asleep for example, the unpleasant sensation compelled him to separate them. M. Kotschy felt similar effects very strongly, and described them almost in the very words of M^{lle}. Maix. Mr Incedon experienced, when the author's crossed hands were placed in his, absolutely unendurable headach.

236. We are now able to throw some light on the fact formerly observed in the sensitive, namely, that they cannot endure the position from west to east: that is, with the head west, and the feet east. In that position the whole right side is towards the south, the left towards the north; or, in other words, their positive side is turned towards the positive pole of the earth. Like named, that is, hostile, poles are thus opposed, and as they repel each other, we can in some degree comprehend how this position is so annoying to persons who, in this point, are so peculiarly sensitive. M^{lle}. Nowotny, when able to walk out, found it absolutely impossible to bear, for more than a very short time, walking from west to east. No better proofs of the accuracy of the previous observations need be desired; and M. Schuh is no sickly bedridden patient, but a vigorous man, seen and known over half Berlin and half Vienna.

237. The author now undertook a minute and comprehensive control of the experiments from which the above case was deduced, with the aid of M^{lle}. Reichel. M^{lles}. Nowotny and Maix had previously given a series of elements and compound bodies, according to the degree of nausea produced (see 179); and although there was a regular gradation from the most highly electric to the least electric, no distinction had been made as to the precise place of the substances in the electrochemical series, namely, whether positive or negative; so that, in those series, positive and negative electrics were mixed, and only the quantity, not the kind, of the electric energy of the substances was noticed. If now, as seemed probable, the difference in the sensations of heat and cold in the sensitive depended on a distinction between positive and negative, as in the poles of magnets and crystals, then the above series must be capable of division into two, in reference to their causing heat or cold, by those who feel these sensations; and, in that case, one division would contain the positive, the other the negative substances. The series obtained by M^{lle}. Maix was now gone through by M^{lle}. Reichel, and divided into two, according to the sensations of heat and cold.

238. It is unnecessary here to give the list; it is sufficient to say, that among the warm bodies were found all the metals,

with two exceptions, tellurium and arsenic, the most negative of the metals: most organic compounds and organic bases; compounds of carbon rich in hydrogen, and hardly any acids. Among the cold were found sulphur, iodine, and other similar bodies; compounds of chlorine, oxides of metals, cyanides, and almost all acids. As far as we can judge, the former, the warm, are the electro-positive; the latter, the cold, electro-negative. It is truly astonishing to see a person, totally ignorant of such matters, capable of arranging all substances accurately according to one of their most obscure properties, their electro-chemical character, and that without even seeing them, by a kind of feeling.

239. As we have seen (234) that in crystals, magnets, and the human hand, all bodies causing warmth to the sensitive are positive, so we find, by M^{lle} Reichel's series, that all positive bodies cause warmth. The same is true, *mutatis mutandis*, of the negative bodies, and those which cause cold.

240. These last experiments were made with every possible precaution, and frequently repeated; and the author gives here minute directions for avoiding the various sources of error.

241. This last series is not to be considered a normal one, but only an example, because we cannot be sure of the purity of all the substances. Moreover, the same experiments ought to be tried with other sensitive patients. This would furnish the key to the differences in their sensations, compared with those of M^{lle} Reichel, who seems to have been in a condition of singular equilibrium, or, as it might be called, purity of the diseased state, so precisely did her sensations correspond with the general electric character of substances, as otherwise ascertained.

242. Let us now endeavour to make some application of the above law, namely, that bodies which cause warmth or cold in the sensitive, which, therefore, are positive or negative in regard to the new force, correspond to the electro-positive and electro-negative. In the first place, we have seen that the sun is strikingly cold, the moon as strikingly warm; while the fixed stars agree with the sun, the planets with the moon. The author knows of nothing done by astronomers on this subject, except the conclusions drawn by Kreil as to the nature of the moon, from the disturbances of declination in the needle due to its influence. It is, therefore, very interesting to know, that, by the human nerve, we can ascertain that all fixed stars come into the negative series, but the moon and planets into the positive series; so that bodies shining with their own light, and those shining with borrowed light, are

opposed to each other, like opposite poles. Perhaps we may thus ascertain that a comet is a reflecting body, and not one giving out its own light. No doubt the sensation in question, strictly speaking, only tells us the effect on the sensitive of the emanations of the comet or other body, and not directly its positive or negative condition; but all that we know of the heavenly bodies we have learned in the same way, namely, by the sensations caused by their emanations.

243. It has been already stated (149), that all fire affects the sensitive, when at a certain distance, with a sensation of cold. This is remarkable, since we know, from the researches of Pouillet, that the exterior of flames, proceeding from oxidation, is strongly electro-positive, and ought, therefore, to cause warmth. Not only does the open flame of substances, both positive and negative, exert this cooling influence on the sensitive, but it is also perceived, when the fire is enclosed, whether in positive or negative substances. Thus, when M^{lle}. Reichel approaches a stove with a fire burning within it, she certainly, when quite close to it, feels warmth; but at a few paces from it, it causes vivid cold, and that the stronger the more vigorously the fire burns in the stove. In severe frost, when she went towards the stove to warm herself, she was far more strongly chilled than before; was frozen, as she said, through and through: her fingers, previously somewhat stiff, became entirely so; and she was obliged to leave the stove and warm herself as she best could, by walking up and down and rubbing her hands. It did not appear to signify whether the stove were of iron or of porcelain. We must not forget that this phenomenon is very complex, inasmuch as we have the new force derived from heat, light, chemical action, the accompanying electricity, the substance of the fuel, and that of the oven. But the resultant of all these components was, in all cases, a high degree of cold, sensible at the distance of many paces, so that it expelled M^{lle}. Maix from lighted churches; and M^{lle}. Reichel, if she remained only a short time near a burning wood-fire, felt herself successively attacked with pain in the head, with numbness, and finally with pain in the stomach, so severe that, if she did not leave the spot, she soon fainted. Flame, therefore, is, in regard to the new force, negative in its action on the sensitive.

244. Here we may inquire, what is the apparent temperature of the flames seen by the sensitive, proceeding from the wires connected with the poles of all the sources of the new force? To try this, a glass-rod, of itself cold, and an iron-rod, of itself warm, were placed in contact, separately, with many substances, and the flames visible at their ends in the dark,

felt at about $1\frac{3}{4}$ inch from the rod. Both rods yielded the same results, and gave the following parallel series :—

COLD FLAMES.

Bichromate of Potash.
Cane Sugar.
Sugar of Milk.
Citric Acid.
Oxalic Acid.
Bleaching Powder.
Sulphur.
Bromine.
Graphite.
Carbon.
Arsenic.
Peroxide of Manganese.
Alcohol.
Persulphate of Iron.

WARM FLAMES.

Gold.
Platinum.
Potash.
Narcotine.
Minium.
Protoxide of Lead.
Cast Iron.
Paraffine.
Mercury.
Tin.
Cadmium.
Zinc.
Iridium.
Creosote.
Iron Filings.

The apparent temperature of the flames, therefore, agrees exactly with that of the substances themselves, as ascertained by contact, by means of a glass-tube, or by a glass-rod (see 237). Consequently, all those bodies which, in reference to the new force, are negative, give cold flames, and those which are positive give warm flames. So that the apparent temperature of the flame given by a body (visible only to the sensitive) furnishes a means of classifying it as negative or positive.

245. The same patient, M^{lle}. Reichel, further felt as cold all the emanations of electrified bodies, especially if positively excited. Even if warm by themselves, bodies positively electrified, so as to give sparks of $\frac{1}{8}$ of an inch, were found very cold at 10 to 15 paces. This cold sensation increased remarkably when the electricity was exalted, by turning the machine more rapidly, but the change was always some seconds behind its cause. A fox-skin, of itself warm, became very cold after an electrophorous cake had been struck with it several times. When the electricity was allowed to escape through points, the effect was also cold. On the other hand, bodies negatively electrified were felt warm by her. An electrophorus, warm by itself, became far warmer when struck with the fox-skin.

According to these experiments, it would appear that positively electrified bodies caused a cold, negatively electrified a warm sensation. As this is contrary to the usual theory, we may suppose that the air surrounding an electrified body becomes, by induction, oppositely electrified and then, as the

nearer body, acts on the patient. But the author has not hitherto been able to clear up this matter. A cake of sulphur, struck with the fur, not only did not become warm, but had its natural cold so increased as to cause cold at 78 feet. Another cake, of resin, shell-lac, and a very little sulphur, struck with fur, felt cold to from 3 to $4\frac{1}{2}$ feet; but from thence to 48 feet warm. An iron-plate of 6 square feet surface, naturally warm; but if positive electricity was made to flow on it, the apparent warmth increased very much; and at 162 feet, the utmost extent, in one line, of the disposable rooms, the effect was far from exhausted. Singularly enough, however, when she came to stand sideways near the plate, she felt a cold wind flowing from the edge of the plate, and rather sharp. At night the edge was surrounded with flames. When charged with negative electricity, the cold diminished, but did not pass into warmth.

The author suspends his judgment on what is thus obscure in regard to friction-electricity and the new force, until further and more extensive researches shall have been made.

246. The phenomena were more decided with the voltaic pile. A pile of 50 copper and zinc pairs, hardly the size of the hand, with felt steeped in salt water between them, the whole at about the temperature of the body, felt at $\frac{3}{4}$ of an inch from the zinc pole warm, at the opposite pole cold; and this was perceived not only by the diseased sensitive, but by the more sensitive among the healthy assistants. The wires, and the flames proceeding from them, were, at the positive pole warm, at the negative cold. At the negative pole she detected, mixed with the cold, something warm, which was the effect of the metallic copper, as formerly stated.

She also detected something cold at the warm end. This arose from the turned-up edges of the copper-plates, which were sharp, and at these sharp edges flames were visible in the dark. These flames, being negative, caused this unexpected coolness. These observations speak strongly in favour of the accuracy of the patient in her statements. They were confirmed by four repetitions on different days. The result is, that in the pile + E is connected with positive and warm sensations in regard to the new force, and — E with negative and cold sensations. It is highly probable that friction-electricity will, in like manner, be found to coincide.

247. The flames produced at the end of wires by wax-lights or by sunshine felt all cold. When 8 wax-lights were made to shine on a plate of copper connected with a wire, the flame proceeding from that wire felt to M^{lle}. Reichel distinctly cold at 54 feet. Here, no doubt, the effect was complex, includ-

ing that of heat and that of chemical action. When the same experiment was tried with the sun's rays and a large iron-plate, the wire connected with which was pointed towards M^{lle}. R., the cooling effect reached further than the 162 feet at the disposal of the author. But the moon's rays, acting on the same apparatus, invariably caused a sensation of warmth.

248. To determine the character of the influence as derived from heat, an earthen vessel was filled with cold water and covered, and a wire 9 feet long introduced, the other end of which was given to M^{lle}. Maix, who was allowed to become quite accustomed to it. Then the cold water was poured out and replaced by hot water. Immediately she felt the wire increase in apparent warmth, which in a few seconds reached a maximum. Some bits of ice were now thrown in: instantly the warmth began to diminish, and at last disappeared, being replaced by a cool sensation, gradually increasing, which soon became very agreeable to the patient, extending to the spine. It is remarkable that holding the wire in the left hand, that is, the positive hand, during the cooling, was much less agreeable than in the right: the left arm was affected with spasms as far as the shoulder; while in the right she felt long regular currents, of a calm cool agreeable nature. Judging from these facts, it would appear that warming causes positive, and cooling, negative currents of the new force in bodies.

249. Friction on a copper-plate with a wooden board gave a positive and warm current in a wire 18 feet long.

250. Chemical compounds are positive or negative, in reference to the new force, according to the prevailing ingredient, and in neutral compounds according to their place in the empirical scale. In § 139, 141-144, several examples were given. A few are here added. Iron filings with water in a glass, tested by a glass-rod, felt warm to the patient. On the addition of acetic acid, the sensation became cold. But as soon as the acid was neutralised, it again became warm, iron being now in excess. Acetic acid, like most vegetable acids, is negative and cold. The same result followed with citric and some other vegetable acids. In another experiment, strong aqua potassa was used as base, which, being positive, felt warm. The addition of a little sulphuric acid caused a momentary coolness, followed by decided warmth, the alkali remaining in excess. When acid enough was added to neutralise it, there was some warmth during the combination, but this was followed by permanent coldness, all sulphates being negative. Effloresced carbonate of soda, placed in water,

caused very remarkable cold: the absorption of water, in place of that lost by efflorescence was, consequently, a phenomenon accompanied by negative influence. By stirring the cold increased, and then became moderate, the carbonate itself being negative. The addition of weak sulphuric acid caused a strong sensation of heat during the effervescence, although the resulting salt was cold. The gasification of carbonic acid must, therefore, have set free positive influence. The patient often said that during decompositions she felt the result by starts or jerks: as the effervescence rose and fell, so she felt the influence by pushes in the glass-rod. We shall have occasion at a later period to return to this point; for in these matters there is no effect without a cause.

All chemical activity implies a manifold alternation of positive and negative, depending on the position of the elements in the scale, so that we can always predict the result, if we know the relative position and quantity of one element.

251. We now come to consider living structures; and, first, plants. The author brought several plants in pots to M^{lle}. Maix; as *Calla Æthiopica*, *Pelargonium moschatum*, and *Aloe depressa*. A stout copper-wire was so bent as to embrace the plant at one end, while the other end was in her hand. The effect was unexpectedly strong. The wire felt instantly hot, and the sensation extended up the arm. It was strongest in the calla, feeblest in the aloe, as if it bore a relation to the rapidity of growth. It is interesting to remark also, that the calla belongs to the family *Aroideæ*, in which the most marked production of heat occurs, and in which, consequently, peculiarly intense vital activity may be supposed to exist.

252. The author went into the fields with M^{lle}. Reichel, and tried all the plants they met. Entire trees she felt cold: single plants in pots the same; but in most she found the stalk warm, and the flower cool. Trees were found cold at their upper end, warm near the soil. Among the *aggregatæ* many were cold in the rays, warm in the disc. Some plants were cool in the stalk, warm in the flower; a few appeared cold and warm mixed. It appeared, on the whole, that different parts of different plants had different relations to the new influence.

253. A large turnip being taken up, was presented to M^{lle}. R. for examination. She found the fibrils of the root warm, the root cold below, warm above, the neck where the leaves began, very warm, all the leaves warm at the base, less so at the point, and beyond the middle zone, where broadest, very cold. A *Heracleum sphondylium*, 6 feet high, was warm at

the root, the stalk to just below the crown, warm, the involucre warmer, the umbel itself cold. A ripe gourd and a melon were cool above, near the rudiments of the flower, and cold below at the junction of the stalk.

254. Since no universal polarity could be traced in plants, but on the contrary the positive and negative conditions varied at different points, while yet like members, and within these like named points possessed like conditions, it was necessary to study individual organs, and without entering here into the details, we may state the general result.

255. The roots are warm or positive ; the upper end of the leaves cold or negative. The point of the stem belongs to the negative division, since it is resolved into leaves and buds. We may therefore say, generally, that, in the descending stem, positive, in the ascending, negative, influence prevails. This, however, is only true with great limitation. But we can perceive that where nature is least active and vigorous in construction, the result is negative ; and where she exhibits propulsion, it is positive. Thus those parts of the leaves where growth chiefly takes place are positive, and *vice versa*. It would appear as if nature, when engaged in formation, must be associated with the positive forms of all the imponderables, as light, heat, electricity, and the new influence ; the prevalence of the negative forms being hostile to vitality.

256. To turn now to the animal kingdom. How infinitely important the part is which is played by the new influence in animal life, is best shewn by the profound and enigmatical phenomena of somnambulism. But here that subject is not discussed ; we only notice certain effects produced in our patients by animal life. When any living animal, however small, such as a gold beetle or a butterfly, was placed on a copper leaf, connected with the hand of M^{lle}. Maix by a long wire, the author was astonished to see that she instantly discovered it, without seeing it. A cat produced a very strong sensation. The hands of the author laid on the plate, overcame the effects of these, as might be expected from the former experiments. This effect of animals could be conducted through bodies : it is warm on contact, but the wire gives out a cool aura, like most dead matter.

257. The author's hands being raised and directed towards M^{lle}. Reichel, she felt, even from a distance, the left hand streaming forth warmth, the right coolness, like a distant magnet. M^{lle}. Atzmannsdörfer felt the same still stronger. The author's whole right side was cool and negative, the left warm and positive. The head appeared to the patients

very strongly charged, its right side negative, and its left side positive. The forehead was rather cool, the occiput rather warm. In the arms, there are 6 points of great power, increasing downwards, and always at the lower end of a bone and on the inner side: consequently, these points are at the lower end of the arm, of the fore-arm, of the hand, and of the three finger-joints, all on the inner side.

The mouth, with the tongue, is strongly negative, and cool, and appears to enjoy a large share of the influence. When the mouth is approached to any object, even without contact, the sensitive patients find that object as strongly charged as by contact with a magnet, a large crystal, the sun's rays, or the author's right hand.

As it appears that the lips are a kind of focus of concentration for the new force, the author hazards the conjecture that the true theory of kissing with the lips may depend on this circumstance. He states that the flames depicted on the lover's lips by poets, do really and truly burn there for those who can perceive them.

258. It now occurred to the author to examine whether any variations could be discovered in the distribution of the new force in the human body, in reference to the period of the day. It was not only highly probable that such variations should exist, considering the different conditions both of mind and body occurring during 24 hours; but if it were so, it promised to yield most valuable explanations, or at least hints, in reference to sleep, digestion, heating, chills, hunger, and mental emotions. And even if but little should be accomplished at first, still we have entered on a promising field of investigation in regard to matters which are very obscure and difficult. The author, therefore, requested M¹¹⁶. Reichel to make hourly observations on his condition, in reference to the new force, and to represent these in graphic lines, the times being represented by abscissa, and the strength of the influence by ordinates. Similar investigations were made in regard to the hourly condition of his daughter H., and M¹¹⁶. R. herself. This patient had a period, in which she remained three weeks sleepless, and she was thus enabled to continue the hourly observations uninterruptedly. M¹¹⁶. R. examined the right hand every hour, and marked on the prepared paper the point corresponding to her sensation at each trial. In each experiment this was continued 12, 18, or 26 hours. During this time he lived very simply, waking at 6, reading in bed till 9-10, rising and breakfasting at 10-11 on cold weak tea, dining at 3, eating a little sweetmeat at 10 P. M., and returned to rest at 11-12 P.M.,

He drank neither wine, beer, spirits, nor coffee, and never smoked tobacco. He took little exercise, and spent most of his time quietly at his study-table. He was in good health and tranquil spirits, and his age was 56. For $\frac{1}{2}$ hour before each observation of his hands, he carefully avoided touching all metallic objects, such as the door-handles, spoons, forks, &c. He also avoided exposing himself to the sun's rays, or to a large fire.

259. As the measure of the influence was here the estimate of a sensation, absolute exactness was not to be looked for; but to ensure as much accuracy as possible, one experiment was repeated 5 or 6 times, namely, that of examining the author's hand hourly from morning till late at night, and projecting the result in curves. These are seen in Plate II., fig. 1., and their agreement is so satisfactory, as to give great confidence in the accuracy and uniformity of the patient's estimate of her sensations. This being ascertained, the investigation was extended to various persons, including females, and to the night as well as the day. Different parts or organs in the same person were also compared.

260. Let us here examine briefly the results. In fig. 1., are the curves obtained from the author's right hand, observed by the right hand of the patient. It was negative invariably, but the amount was never long stationary, rising and falling as in the curve. From 6 A.M., when the observations generally began, a gradual rise occurred till the period between 10 and 12: a fall then took place till 3 P.M.; and at 3 a second rise was observed, lasting from 7 to 9 P.M., after which a continual fall took place till late in the night.

261. This shews that while the author lay quietly in bed from 6 to 9 or 10, the force steadily increased, and after breakfast continued to do so till midday. The ascending sun, therefore, added to the force in his hand. The succeeding depression lasted exactly till dinner (3 P.M.), and was obviously caused by the growing hunger. For no sooner was that appeased, than, even with the first mouthful of food, the depression ceased, and a rise set in, which reached its maximum about the evening twilight. Both M. Schuh and M^{le}. Maix also found the author's hands more powerful after he had taken food than before.

About 9 or 10 A.M., there is a slight tendency to a fall in the curve, owing, no doubt, to the desire for food, since it was arrested by breakfast. It forms a pendant to the great depression before dinner.

262. To test this view, the experiment was repeated with a person whose habits, as to meal-times were different.

M^{le}. Reichel, who dined at 1 P.M., could observe her right hand perfectly with her left, and she then obtained an entirely different curve, fig. 2, Plate II. From morning till midday there appeared the same general rise; but the depression then beginning, instead of lasting till 3, extended only to 1 P.M., when it gave way to a second rise, lasting till the day began to fail, when it reached its maximum. In this case, also, the slight depression before breakfast was observed.

263. Hence, it appears, that hunger diminishes the force in the right hand, while the taking of food increases it. Here we come to coincide with the effects of chemical action, as formerly described. The food enters at once into a state of chemical activity; digestion, that is, decomposition, begins, and currents of the new force arise. It matters not what share we ascribe to vitality in these phenomena; they are still decompositions, from which spring manifestations of the new force, extending over the whole system, and charging the limbs with it.

264. What is the state of matters at night and during sleep, in the absence of the sun? To ascertain this it was necessary that the sensitive observer should wake while the healthy subject of observation slept, and hourly observations in this way were not easily compassed. But the author, having convinced M^{le}. Reichel of the scientific value of these observations, and of the merit attaching to the person who should make them, prevailed on her, during her sleepless period, to examine his hand hourly while he slept, and to note the result. No other method was possible, since it was necessary that he should sleep just as usual, if the result was to be unmixed. In fig. 3 (Plate II.) are seen the results of varied trials on him and on others. From the morning there is, in the right hand, a general rise, with occasional depressions, as we have seen, till the evening, the maximum being attained at earliest by 6, at latest by 9 P.M., according to the individual and his habits. The curve now falls decidedly, and does so steadily till 2 to 3 A.M., when it reaches an almost stationary minimum, lasting till dawn, which at the time of the experiments was at 5 or 6. As the light dissipates the darkness, the force instantly starts upwards, and new life flows into the animated world; vitality and the new force increase anew throughout the day, as long as the sun shines.

265. Here also we are enabled to obtain confirmation for a law obtained in a different way. It is the sun, one of the chief sources of the new influence, which sends it to us along with light and heat, and saturates with this influence all on

which it shines, till, towards evening, a maximum is attained. As soon as the sun sets, the tension of the new force in the human organs sinks, and with this change, in the man who lives a natural life, come feelings of weariness, drowsiness, and sleep. As the day-spring of the influence ceases to flow, so fails also the spring of conscious and waking life. Light and heat, electricity and magnetism, are not the only powers by which the sun infuses life and vigour into all beings: it employs another influence with which, as with heat, it penetrates all matter, and the fluctuations of which we may now compare with and measure by the waking and sleeping conditions.

It is not necessary to be exposed to the direct rays of the sun, as we have seen that the new influence is conducted through all bodies, and even diffused without contact.

266. Careful simultaneous observations on both hands gave the result shewn in fig. 5 (Plate II.), by which it appears that the positive energy of the left hand follows a course not exactly similar, but still very analogous to, that of the negative energy of the right hand. It reached the smaller (midday) maximum later, the greater (evening) maximum somewhat earlier. On the whole it appeared more powerful.

267. Since the hands, symmetrical as they are, are thus opposed, it is probable that the brain, composed of two halves so symmetrical, and of which the hands are the tools, must exhibit some differences perceptible to the delicate senses of our patients. M^{re}. R. found the author's head cold on the right, warm on the left hemisphere; both sensations very strong. The same result was obtained in every case tried, male or female. M. Kotschy was minutely examined by the patient, and found in every point to agree qualitatively with the author. This appeared so important, that the author had a double set of observations made, each extending over many consecutive hours. Fig. 6 (Plate II.) shews the result. The continuous line shews the first observation of 24 hours; the dotted line the second of 16 hours, which could not, unfortunately, be completed.

268. The result was remarkable. As in the hands an unequal amount of force occurs in equal times, so also do the two sides of the head differ, only to a greater extent. The left side increases far more slowly than the right in the morning, and indeed hardly does so before 3 P.M., while the right side has reached, at 1, a maximum little inferior to the evening one. The depression due to hunger is perceptible in both, but feebly marked. While the right side remains

nearly at the same level from 1 to 9, the left rises steadily from 3 to 11 P.M. The right begins to sink even at 8, crosses the left, sinks below it, while the left only begins to fall from its maximum at 1 A.M., that is 5 hours later.

The course of the influence in the head or brain is, in general, analogous to that of the hands; rising in the morning, falling slightly at midday, reaching its highest maximum in the evening, and the lowest minimum towards 4 A.M.: these points agree tolerably, and may probably represent the daily movement in the whole organism in a person leading the life of the author. The great difference between brain and hands lies in the fact that the brain participates far less in the effects of hunger and the taking of food. It is wisely ordained that when food fails, the energy of the mind which provides for its supply does not at once give way. Of the two sides, the right is sooner disposed for sleep, and sooner roused to action in the morning, and indeed exhibits generally more excitability, but not more strength, than the left.

269. The forehead and occiput are anatomically more different than the two sides of the head. Two experiments were made, each of 24 hours, to compare them. The result is seen in fig. 7 (Plate II.). There appeared a marked opposition; the forehead being generally cold, the hindhead very warm, and these results were also obtained in animals, cats, horses, cows, &c. The human forehead, in regard to the energy of the influence, gave a curve, rising decidedly with the break of day, little affected by the hunger before breakfast or before dinner, and reaching its maximum after sunset. All this time the curve of the hindhead remains almost unaffected, so that at 6 P.M. it stands exactly where it had been at 6 A.M. But now just when the curve of the forehead begins to fall, it begins to rise; so that the two curves cross each other, the one falling and the other rising till about 3 A.M., when the curve of the forehead reaches its minimum, that of the hindhead its maximum. From this point they again pursue opposite courses, and while the latter quickly falls after 3 A.M., the former begins about 4 A.M. to rise nearly as rapidly.

270. This curious relation is the image of our sleeping and waking, the former being represented by the occiput, the latter by the forehead. They are not only opposed in polarity, and in the sensations they cause to the sensitive, but in their activity and its periods, they are as distinctly opposed as day and night.

271. In reference to the new force, therefore, the differ-

ence between sleeping and waking is not that between activity and rest, or between motion and repose; it is merely that the focus of activity is changed. The force does not cease nor diminish, but shifts its seat, and what it loses in intensity before, it recovers behind. Sleep thus appears, not as a depression of vital activity, but as a dislocation of it. In the same degree as during the day vitality was active in the forehead, did it predominate at night in the hindhead. Sleep is only to be compared to death in poetry, not in physiology. Vitality is just as active during sleep as in our waking hours, only in a different direction.

272. A curious supplementary proof of this occurred, which is represented in fig. 4 (Plate II.) The author had, soon after dinner, become drowsy, and dozed for ten minutes in his chair. Before, during, and after this sleep, his right hand was tested by the patient. The result is seen between the hours of 4 and 5, where it is seen that the curve, instead of rising steadily as usual, made an anomalous leap downwards, and then again rose. This short slumber was enough to cause a very perceptible change in the distribution of the force, so that the amount in the hand fell, and only rose after he was fully awake, and the normal condition restored.

273. The pit of the stomach is a point of the body which plays a peculiarly important part in somnambulists. As great obscurity prevails in regard to this matter, it was important to ascertain the relation of the new force to the pit of the stomach. An experiment, of 24 hourly observations, gave the result fig. 8 (Plate II.) The curve agrees generally with that of the hands, but it seems to be retarded, all the marked points occurring later. In this sense there is nothing remarkable in the pit of the stomach. But the author promises, in a future publication, to give accounts of some very remarkable effects produced on this part of the body by mental emotions, and reflected in the physical functions of life.

274. A series of 24 hourly observations on the right hand of the author's daughter Herminia, see fig. 9 (Plate II.) yielded a curve so near that of his own hand, that it is evident there is no marked difference between the sexes in this respect.

275. A similar experiment, in which M^{lle}. Reichel's right hand was tested by her left, during her period of illness. The fig. 10 shews that it differs little in general from the healthy curve; and what difference there is, is owing to her dining two hours earlier than the author.

276. But there occurs in this projection, about 5 A.M., a small unusual depression. This coincided with an attack of pain in the stomach, lasting till 7, when the normal rise was again established.

277. It is also worthy of remark, that, although her sleep was broken and interrupted, as she only obtained from time to time 7 or 8 minutes of light sleep, yet the nightly portion of the curve exhibits its character of uniform opposition of direction, compared with the daily portion.

278. Many applications of these facts suggest themselves; but one appears of great practical value. If the day, with its supply of sunlight, and its rising energy of the new force in hands and forehead, is destined for the intellectual exertions of man, and the night with its darkness, its energies sinking in the forehead and rising in the occiput, rather for the unconscious vegetative functions, then everything in our habits which agrees with this arrangement must be favourable, and everything at variance with it unfavourable to our physical wellbeing. It is right, therefore, to eat by day, and not later than some hours before bedtime; because the taking of food and the daylight, both promote the development of the new force, and the chemical action of digestion lasts for some hours. Late eating is followed by broken sleep and dreams; because, while the food favours the activity of the forehead, night, in opposition to this, causes the energy of the hindhead to rise. In these circumstances, there must be an unpleasant struggle in the system. It was found that the nightly fall of the force in the hands and forehead took place in the author and his daughter exactly as much later than in M^{lle}. Reichel, as their dinner-hour was later than hers. He who will go late to bed, does well to eat proportionally late.

279. But to do this is contrary to the natural course of animal life, and must be injurious to health. The sleep obtained about midnight, is the most sound and refreshing. This naturally follows from the fact, that sleep naturally comes on, at sun-set, at the time of the change in the direction of the new force, and continues till, with the sunshine, new force arises in the forehead. If we go late to bed, we must sleep till late in the morning; but in this case the natural current is against us. just as when we go to sleep with a full stomach. It is well known, that when we go late to bed and rise late, we are generally dull and out of spirits, compared with those who accommodate their habits to the arrangements of nature.

He who would ensure the continuance of health by attend-

ing to the distribution of the force so often mentioned, the influence of which is so penetrating and universal, must rise at latest with the first rays of the sun, take his chief meal at from 11 A.M. to 12, never later than 1 P.M., eat little or nothing afterwards, and retire to rest at the evening twilight. All animals do this, and, indeed, so does the half savage in his condition, which is, in many points, a natural one. So also do many poor people and many persons of small means, especially in the country. It is only civilised man, as he is found in our cities, who does better ; he sups at 10 or 11 at night, goes to bed at 2 or 3 in the morning, and then sends for the physician on account of gout, scrofula, or spleen.

APPENDIX.

I.—*Extracts from Dr Haygarth's Pamphlet "On the Imagination, as a Cause, and as a Cure, of Disorders of the Body, exemplified by Fictitious Tractors," &c.*

"April 20th.—I requested Mr Barton to operate on Peter Seward, aged 32, who had, for four years, been troubled with pains and weakness in his right arm. * * * I learnt that he had experienced a good deal of pain during the operation (of drawing the tractors downwards, so as barely to touch the skin). * * * The next day I was assisted by Mr Bernard, and Mr Lowe jun. ; and as the case is rather curious, I shall copy *verbatim* the notes taken on the spot. In one minute 'feels pain coming on at the same place as yesterday; the limb feels warm; the pain higher up, and sharper;' in two minutes 'pain increases;' in 3½ minutes, 'very acute, darting towards the collar-bone, and begins to give him so much uneasiness, that he will not have it done any longer;' 'perspires profusely, and is gone to bed.' It was fortunate for me that the above gentlemen could bear witness to the remarkable effects of the *Imagination*." * * *

* * * "On the 25th, however, in presence of Messrs Jolliffe, Barton, Gaisford, Emery, and Wilde, Dr Lovel made use of one bit of mahogany, whilst I gently drew down his arm the point of the other. When he sat down 'he was perfectly easy;' in a few seconds 'the pain commenced as before;' in two minutes it was 'very acute at the elbow and collar-bone;' in four 'he became very uneasy, looked very red in the face, and begged the operation might be discontinued.' His request was complied with, and he went to bed with a pulse at 120. Three quarters of an hour after (being still in bed), I asked him how he felt? He replied, that he was in more pain than when the surgeon took five pieces of bone from his leg in a compound fracture which he had met with. It may, perhaps, be thought that he feigned all this. I cannot assert that he did not; but he could have no point to gain by such conduct; and he certainly must have been a very excellent mimic to deceive so many people. The experiment was again repeated on the 2d of May, in presence of Dr Moncrieffe, Messrs Noble, Yeatman, Clayfield, Probert, Notcutt, Lax, and Jolliffe. The patient felt spasm and pains in

the arm and collar-bone ; and the pain continued, as before, for some time. He could scarcely be persuaded to submit longer to the use of the tractors, although he confessed that, 'on the whole, he had received much benefit.' "

"On the 24th of May, I requested permission to attempt the relief of a patient of Mr New's, by the new operation. He had great stiffness and occasional pain in his shoulder. Mr Gaisford, therefore, began to treat him in the usual manner, with the pieces of pencil. In a few minutes he was seized with a tremor in his limb, and so violent a shivering fit, that it was judged prudent to desist for the present. Next day I wished to repeat the trial ; but he positively refused, alleging that his arm was quite well, and therefore it would be putting him to useless pain. It is worthy of remark, that this man's countenance betrayed very evident symptoms of apprehension ; and it was the general opinion of the bystanders, that the dread of experiencing a second time so severe a discipline induced him to make use of his arm so freely."

[The above are two cases, out of ten, described in a letter to Dr Haygarth by Mr Richard Smith of the Bristol Infirmary in 1799. In all of these cases distinct effects were produced ; and in most of them the patient was cured, or at least relieved. It is instructive to observe how the anxiety to disprove the peculiar efficacy of the patent metallic tractors blinded Mr Smith and Dr Haygarth to the obvious interpretation of these experiments, namely, that not only iron, but many other substances, could produce the remarkable sensations and effects described by them. No evidence is adduced to shew that these effects were really produced by the imagination. This seems to have been taken for granted. But even granting imagination to have had these effects, surely it was the duty of medical men to investigate the phenomena—to ascertain the laws which regulate them—and to endeavour to discover the means of applying this knowledge to practical purposes. Although we have no proof that imagination, in the sense in which the word is used by Dr Haygarth, is the agent which produces these phenomena, we may, in one sense, admit that it plays an important part. If, by imagination, we merely mean the action of the nervous system, as affected by external causes, we can hardly doubt that, in all these cases, the effect was produced through the medium of the nervous system. At all events, it is interesting to compare Mr Smith's cases, above cited, with some of those described by Baron von Reichenbach in the preceding pages. The close coincidence between them cannot fail to strike the attentive reader.—W. G.]

II.—*Extracts from a Letter addressed by Baron von Reichenbach to the Translator, dated Vienna, 7th February 1846.*

MY DEAR FRIEND,

* * * * *

Berzelius has expressed himself in the same way as you have done; and carries on with me a friendly and brisk correspondence on the subject of my researches, on which we may shortly expect a report from him to be laid before the Swedish Academy of Sciences.

* * * * *

In my researches, so far as they have been as yet published, I have only described minutely the results of my observations and experiments on five highly sensitive persons. But now there are already 23 such persons; and among these are men and matrons, in all of whom I have tested the statements formerly made. You will be pleased to hear that what was stated of the former cases has been entirely confirmed in the new ones, and that, consequently, my views, formerly announced, have been fixed and established by very numerous additional facts, derived from a more extended field of observation.

* * * * *

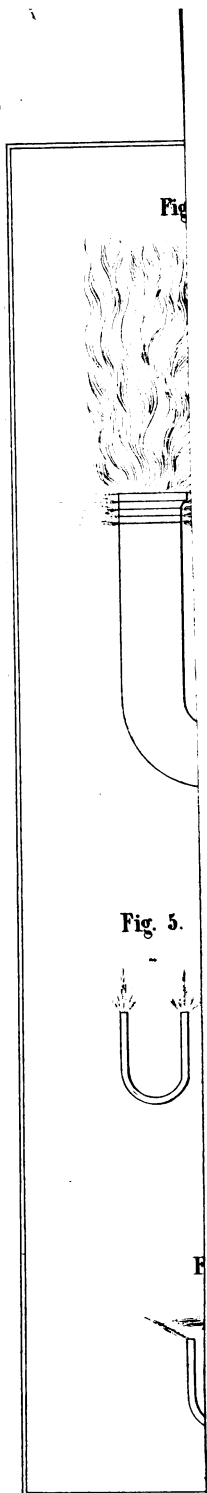
I have not yet published any additional memoirs; but one is ready, and will, I trust, appear in two months. It treats of the luminous emanations; and you will find in it some new and not unimportant views, in reference to Electricity and Magnetism, especially Electro-magnetism.

* * * * *

Yours, &c.,

REICHENBACH.





Fig

Fig. 5.

F

H. Schenck, Lith. Baden!



