THE

ELECTRO-CHEMICAL BATH,

FOR THE

EXTRACTION OF MERCURY, LEAD, AND OTHER POISONOUS SUBSTANCES FROM THE HUMAN BODY—IN PALSY, RHEUMATISM, SCROFULA, AND OTHER COMPLAINTS;

AND THE

RELATION OF ELECTRICITY TO THE PHENOMENA OF LIFE, HEALTH, AND DISEASE.

BY

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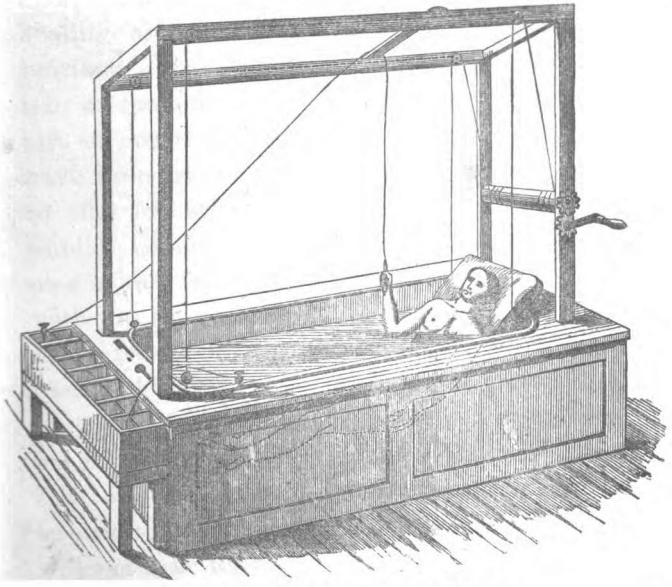

DR. CAPLIN'S ELECTRO-CHEMICAL BATH.

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PREFACE.

In presenting the following brief treatise to the reader, upon what we believe to be a great discovery in the healing art, two things have engaged our special attention:—First, the nature of the agent and its operation on the human organism; and, secondly, the practical test of our means as demonstrated on the patients who have been treated in our bath. We have no apologies to offer for bringing a matter of this kind before the public, because we conceive it to be a duty that we owe to our fellow creatures, to make them acquainted with the most simple and efficacious means of treating those fearful and generally considered incurable diseases, which owe their origin to the presence of metallic and other poisonous substances in the organism. And we deprecate no fair criticism. Those who sneer at a thing which they do not understand, can only expect to be sneered at in return; but if the Electro-chemical Bath will not bear the most thorough investigation, why then, so far as we are concerned, it shall go at once into the lumber room. What we invite, and what we have reason to expect, is, investigation; and when this is accorded to us, we always feel assured that the truth will do all the rest.

In the execution of this plan, we have adhered strictly to the one object of presenting the case without any of those extraneous attractions, which so often give weight and importance to a public statement: we have so much confidence in Nature, that we trust entirely to her, and stand or fall by her verdict.

We have only one word of apology to the reader, and that is, that this little work has been written in great haste, amidst the duties, cares, and interruptions of a large medical establishment, and that it has been printed just as it has been written. The first chapters were therefore in print before the last were composed, and, consequently, there has been no opportunity for making those corrections and emendations which are always necessary in a book of this kind. We may add, in conclusion, that this is only a forerunner to a more comprehensive and elaborate work, which will take a wider basis and more comprehensive analysis of the whole question.

ROYAL HYGIENIC GYMNASIUM,
9, York Place, Portman Square,
12*th September*, 1856.

THE

ELECTRO-CHEMICAL PHENOMENA OF LIFE.

CHAPTER I.

THE ORIGIN AND HISTORY OF THE ELECTRO-CHEMICAL BATH.

In a small pamphlet which we published a short time ago, entitled "The Origin and Use of the Electro-chemical Bath," we gave a brief sketch of its history, and shall reproduce here what we said in that tract, with such additions as have since come in our way.

Amongst the most potent therapeutic agents that have ever been discovered, Electricity, no doubt, occupies the first place, whatever may be the scepticism of those who have not studied that branch of science. We grant that the laws and phenomena of nature are far above the productions and speculative conceptions of man. No one, we presume, will contend that the electric fluid, which pervades the whole universe, in all the meteoric, atmospheric, vegetative, and animal kingdoms, will deny its extraordinary power. Dr. Bovee Dods, in his valuable work on "Electrical-psychology," has demonstrated the importance of that primary agent; but space prevents us from entering upon any digression upon this important subject here. An example known to the generality of our readers must bring the matter home to the most incredulous. Every one is more or less acquainted with the operation of electrotype, and the means of silvering and gilding by electricity. This simple operation consists merely in having a solution of silver or gold poured into a trough; into

this vessel is introduced the object to be covered over with one of these metals. A galvanic battery is put in contact with the two extremities of the trough, and the current of electricity, passing through the liquid, carries with it in a constant direction, from the positive to the negative pole, the imperceptible molecules of the solution, which attach themselves to any metallic substance intercepting their passage. Such is the simple mode by which the manufacturers produce their greatest ornaments. This important discovery is so familiar to every one, that nobody would dare to contest it. We know equally well, also, that the electric fluid is the only agent by which the chemist has been able to decompose substances into their primordial elements, or simple condition. In this extraordinary series of facts, man has not done anything but discovered one of the laws of nature, and he can do nothing but submit to these immutable laws, over which he has no control. When, however, the *modus operandi* of a natural phenomenon is known, it becomes comparatively easy for the meditative man to draw such conclusions as will enable him to enlarge the sphere of action of such laws. It was while engaged in the contemplation of electric phenomena, and in the pursuit of some experiments on electricity, by which we had introduced into the living tissues the virtues of herbs, that the thought occurred to us of the possibility of reversing the operation, for the purpose of withdrawing from the body the inert and obnoxious substances which, by their presence in the system, disturb the functions of the organism, and become the cause of alarming and fatal diseases. We had communicated this idea to some scientific friends, who thought that it was possible, and that the experiment was worth a trial. Just at this time, however, a friend, M. Delannoy, brought us a French paper, *Le Courrier de l'Europe*, containing the welcome intelligence that the discovery had been already made by MM. Poey and Vergnès.

The history of this discovery was related by M. Dumas, the celebrated chemist, at a meeting of the Imperial Academy of Science of Paris, held January 22nd, 1855, when he presented the note from MM. Vergnès and Poey on the *new application of Electro-chemistry to the removal of metals from the system.* We extract the following account of the discovery and process from a tract presented to us by M. Poey.

"M Vergnès, who had on the back of his hand a cankerous ulcer, caused by the introduction of metallic substances in the process

of gilding and silvering by galvanism, on plunging his hand into an electro-chemical bath at the positive pole, found to his great surprise on the metallic plate of the negative pole, a thin layer of gold and silver. A few baths proved sufficient to radically cure the ulcers, which had previously resisted the most active means. The first experiment was made at New York, the 16th of April, 1852, and was followed by several others, which have led to the introduction of a new therapeutic mode of removing metals from the system.

The patient is placed up to the neck in a metallic bathing tub, isolated from the ground and made to rest in a horizontal position upon a wooden bench, the whole length of the body, which is to be also isolated from the bathing-tub. The water is to be acidulated with the nitric or the hydrochloric acid for the removal of mercury, gold, and silver, and with sulphuric acid for the removal of lead.

One extremity of the bath is put in contact with the negative pole of the pile by means of a screw, and the patient takes hold of the positive pole, sometimes with the right hand and sometimes with the left. The arm is held up by supports in contact with the seat. The extremity of the positive conductor which the patient holds is armed with a massive iron handle, wrapped around with linen, to diminish the calorific action of the current, which is very powerful, and which, without this prevention, would burn the hands.

The patient being thus placed, the positive current enters either by the right or left arm, circulates from the head to the feet, and is neutralized at the negative pole on the sides of the bathing-tub. Being isolated from direct contact with the negative pole as well as from the ground, the electric fluid radiates from the body into the bath, forming a multitude of currents from the entire surface of the body, which, after having traversed the organs and even the bones, neutralise themselves upon the negative side of the bathing-tub."*

After reading this account, the only thing that remained for us to do was to test it practically, and we accordingly, with as little delay as possible, fitted up a bath, in every point agreeing with that recommended by the discoverers. When hearing that M. Poey was in Paris, we embraced the opportunity of visiting him there and witnessing some of his experiments. Having agreed with him to communicate to each other the result of our experience, we returned to London with the intention of commencing operations immediately, but here a difficulty presented itself that we had never contemplated before,—we could not get a single patient upon whom to make an experiment. It was in vain that we assured them that the operation was always pain-

* MM. Vergnès and Poey say that they have thus withdrawn from the femur and tibia a large quantity of mercury, which, according to the opinion of several physicians, had remained there fifteen years.—Editors of N. Y. Medical Journal.

less and generally pleasant, no one would submit to it. At last however, Mr. Griffiths, looking-glass manufacturer, 20, Southampton-place, sent us a patient in the lowest state of suffering. There was an unsteadiness and shaking of the arms and limbs, which prevented walking, speaking, or masticating. The tremours were almost constant, every action was performed by fits and starts, sleeplessness and loss of memory had set in, and there seemed to be no other prospect than a lingering death. Several medical friends were present, one of whom wrote the following:—

February 5th.—Joseph Thompson, 32 years of age, looking-glass worker, states, that he has been working at the silvering of glass for nine years, but has only been seriously affected for two years past. Has been obliged lately to give up his work and to keep his bed; he complains of great difficulty in breathing. Has been obliged to feed on bread and milk, still he cannot chew it; the pain is so great when he attempts, that he feels as if a saw was cutting between each tooth. He has a most violent shaking of the whole body; can scarcely walk. Has a difficulty in speaking, and vacancy of mind. He is altogether a picture of misery and wretchedness. If he carried a piece of gold in his pocket, it became coated over with mercury, and required to be burnt before it could be used. When taken upstairs, he was holding the banister with one hand, and supported by Dr. Caplin under the right arm; four or five times his knees gave way all at once, and he would have fallen had he not had powerful assistance. He was put in the bath at half-past two o'clock, lying on a stretcher made for the purpose, so as to support the body in a reclining posture. This operation proved rather a difficult one, and it required some time before the legs, which shook violently, could resume a somewhat quiet position. We noticed, in rather less than an hour, something like air-vesicles coming up from the axillaries; they followed each other with rapidity, and later some others appeared along the legs. The patient did not complain of any pain nor of any particular sensation, but felt comfortable; breathing more easily, and experiencing a genial warmth. Before the hour was expired, the face became flushed, and a gentle perspiration appeared round the mouth and the eyes. He was taken out of the bath almost fainting, but he soon recovered. After being dressed, he felt more steady and comfortable, the expression less anxious; he came down stairs with less difficulty, and walked with more ease.

Feb. 12*th.*—The patient has for two days felt a greater giddiness; he, however, feels stronger, and has a greater command of volition over his limbs than previously. It was observed by the patient's father-in-law that he had, since the last bath, less confusion of mind; the appearance of the skin was more healthy, the general countenance much improved. He entered the bath at half-past two o'clock; in a short time bubbles again rose, but in greater number, from the axillaries, and some time after issued also from the lower limbs, which were less shaky than the time before. On being asked if the soreness of his mouth had undergone any change, he said: "Yes, it is very much better; my teeth are not so tender; I can eat better." In testing the water with a piece of gold sheet, no mercury could be detected, although the patient was decidedly better in every respect. It was found that the acid had been forgotten to be put in the bath. Dr. Ridges, Mr. Browning, surgeon, Mr. Lavison, and the father-in-law of the patient, were present.

The patient was chatty and in good spirits all the time; he had no flushing of the face, nor fainting; he was taken out of the bath at half-past three; he is generally improved.

The boiler of the bath being out of order, the next bath was postponed to the 19th, viz. one week after the last.

Feb. 19*th.*—The general appearance of the patient is strikingly improved; he feels better and stronger; bubbles similar to those coming out of his body, while in the bath, have spontaneously come out of his mouth while he was walking. His head is much lighter and clearer, the mind still less confused, his limbs and hands less shaky; he is able to write with a little effort, walks a great deal better, has been able to walk upstairs to the second floor almost without assistance; his countenance is calm and composed; the complexion much more natural.

He entered the bath at thirty-five minutes past two o'clock; after ten minutes he felt a pricking sensation all over his body; he said, he could now enjoy a beefsteak or a mutton chop; his gums were a great deal better; he was less restless during the night. Taken out of the bath at forty minutes past three; his head was more comfortable; he did not require lying down after the bath: his back was less painful; he felt as if something was working in his inside; being a sensation he had not felt before.

Feb. 21*st.*—Thompson feels a great deal better altogether, according to his statement; his trembling is nothing in comparison to what it was before; he has very little shaking of the

head, feels more steady on his legs, and stronger in his hands; his appetite is very much improved; he can eat anything with pleasure; has no soreness in the mouth, feels warmer in his body, notwithstanding the cold temperature of the weather; the strong taste of copper which he had in his mouth is nearly gone; his head is light, his ideas clear, his spirits are very good, his whole appearance greatly improved.

He entered the bath at a quarter to three o'clock; he felt the same pricking over his body, as in the last bath, but less intense; bubbles were still appearing; the electricity was felt in the wrists; got out of the bath at half-past three; he felt better in every way; came down two pair of stairs without assistance, and walked out firm and steady.

The patient was so much better to-day, that he ascended the stairs two at a time without assistance; and on the following Sunday walked a distance of twelve miles.

Thompson has recovered all his functions and faculties, and is regaining his strength progressively.

Up to this time no effort had been made to collect the metal that had been extracted; but on the 5th of March we gave the patient a foot-bath, and the copper plate which was placed in the tub bore large spots of mercury, which disappeared on the application of heat; and we have since then collected a large quantity of the metal in the precise state in which it entered the body—namely, a compound of tin and quicksilver. It is but proper to state that those experiments were all conducted in the presence of medical men. Dr. Ridge, Mr. Browning, surgeon, and Mr. Levison, surgeon and dentist, were present when the first baths were given; and Mr. Manchester and Dr. Mill have assisted at all of the others.

Having communicated this and a number of other cases to M. Poey, we received the following communication from him, to which we beg to call the reader's especial attention. We deem ourselves fortunate not only in making M. Poey's acquaintance, for of that anyone may be proud, but in being the first who, upon an extensive scale, has put his valuable discovery to the test of a general practice.

CHAPTER II.

M. ANDRÉS POEY ON THE CHEMICAL, ELECTRICAL, AND PHYSIOLOGICAL RELATIONS OF THE ELECTRO-CHEMICAL BATH.

It was our good fortune, before we commenced to make any experiments with the bath, to have made the acquaintance of M. Poey, and been favoured with his advice as to the best method of conducting our operations. When we decided on publishing this work, he kindly consented to favour us with his views on the *modus operandi* of the electro-chemical bath, and in the fulfilment of this promise we have received from him the following important communication, which we cannot too earnestly commend to the serious attention of the reader. The letter was originally written in French, and we would gladly have published it *verbatim et literatim* in the original, only that as we write for the public at large, we should be sorry that any one should be unable to read a communication of so much importance. We have, therefore, given a popular translation, and one we hope which will present, if not the elegance of expression, at least the profound thought of the original.

As M. Poey is in no way responsible for what WE write, there is no impropriety in our saying a few words respecting him, for the public naturally desire to know something of any one whose name is often before the world in connexion with some great discovery.

M. Andrés Poey, then, although the discoverer of the use of the Electro-chemical Bath as a therapeutic agent, is not a medical man. He is a native of Cuba, and is known principally to the learned men of this country as a meteorologist. Dr. Shaw has lately communicated to the British Association for the Advancement of Science, and to the Geographical Society, in which publication it has appeared, a "Chronological Table of the Cyclonic Hurricanes which have occurred in the West Indies and the North Atlantic, from 1493 to 1855, with a Bibliographical List of 450 authorities by M. Poey:" a work which, although it only covers forty pages of letter-press, is such a thorough index to the literature relating to storms and hurricanes, that all who

come after him will feel grateful to one whose great research has entitled him to be a pioneer in whose steps they will be proud to tread. Of the same kind is his various "Memoirs on the Climate of Cuba," read before the French Meteorological Society, and published in the *Annuaire* of that learned body, and also in the *Comptes Rendus*, of the Academy of Sciences, of Paris. He is also a member of various academies and learned societies of Europe, and of the Ethological Society of New York. Neither is he without honour in his own country. The Captain General, and Royal Economical Society of Cuba, have sent him as their commissioner to the Universal Exhibition of Agriculture and Industry at Paris. He has promoted the establishment of a Meteorological Observatory at Havana, and in consequence he has received from his government the appointment to that useful institution, and is at present collecting instruments and philosophical apparatus to complete an observatory in that island.

Although the labour indicated by this enumeration of attainments must necessarily be great, we are happy to inform the reader that the discoverer of the Electro-chemical Bath is still a young man. The spring time of his life has been one of great promise, and we are full of hope that the autumn may be rich in those revelations of nature with which science always rewards the most gifted of her devotees.

We have said enough of M. Poey to entitle anything that he may write to the respectful consideration of all enquirers after truth, and shall therefore without further remark lay his communication before the reader.

To Dr. J. Caplin, Director of the Royal Hygenic Gymnasium.

PARIS *May* 18*th*, 1856.

MY DEAR SIR,

As you have often expressed a desire to know my opinion on the action of Dynamic Electricity on the human body, and its efficacy in the extraction of metallic molecules from the organism, I shall not hesitate to transmit to you my sentiments upon a subject in which I am pursuaded that you take a vivid interest, not only so far as it regards the progress of science, but as a therapeutic agent, which I trust will be employed by other learned physicians as well as yourself. Fearing, however, that I might be charged with boldness if I related all that

I could say of the extraction of metallic poisons from the body, during my experiments, made first in New York, then in Havana, and latterly in Paris, I content myself with referring to what is already before the public on that subject, and confine myself to solving some of the objections, theoretical and practical, which might be advanced against the employment of the Electro-chemical Bath for medicinal purposes, in the case of such persons as have, either in their ordinary occupation or otherwise, absorbed poison into the organism.

1st.—Does the galvanic current, when directed over the body, pass on the surface only, and scarcely penetrate the superficial muscle, or has it the power to reach the deep-seated organs and penetrate even the bones?

To this question I shall answer by well authenticated results, obtained by M. Duchenne de Boulogne in the application of localised electricity. This learned gentleman has proved that it is possible to limit the dynamical electric action to the skin or superficial muscles, or else to transmit its influence to the nerves or even into the *bones*. In the last case it is sufficient that the excitators should be perfectly moist, then no sparks, no crepitations, no sensations of burning are felt, but various phenomena are obtained according as the electric action is conveyed on one muscle, or on a muscular fasiculus: on a nerve or a bony surface. It is therefore evident from the above experiments performed by M. Duchenne, that when a patient is entirely *immersed in water*, and acted on by the *humid excitators*, the electric current must pass through the most deeply seated organs: as is the case in the Electro-chemical Bath. (*De l'Electrisation localisée, &c. Paris*, 1855, *p.* 28.)

2nd.—Does the chemical phenomena of electricity follow the same law in passing through the human organism as it does in its course through inorganic matter?

In anwer to this question, we shall report the opinion of M. Becquerel, in contradiction to that of Volta. He says, "an electric chain, or rather a circuit entirely formed of liquids, and through which an electric current passes, will produce the phenomena of decomposition and recomposition if there be in this circuit *some corpuscules which are conductors of electricity*, or if an organised living body be present; there are numberless examples of phenomena of this nature, which may produce electro-chemical effects, which hitherto have not been studied." (*Comptes rendus de l'Académie des Sciences de Paris*, 1854, vol. 38, p. 761.)

In the process of extracting metallic salts from the human body, the *corpuscular conductor* of electricity, alluded to by M. Becquerel, is simply some mercury or other metal accidentally introduced into the organism, and on which the dynamic current exercises its chemical action. Why, then, should not the electrical action decompose and carry out of the system the metallic salts held in the organism, as well as the metal in its pure state? particularly when the vital force has no power on metal or metallic salts which have no affinity for the living tissues, when it is known, besides, that both electric sparks as well as the electric currents are never transmitted without producing the transport of ponderable matter.

3rd. When metallic salts in the organism have been submitted to the decomposing action of a dynamic current, have we any reason to suppose the existence of a secondary action of transport acting as an eliminating power, collecting at the opposite pole each element separately?

You are aware, dear sir, that Berzelius, Hizinger, and especially Davy, have proved the action of transport, which always takes place in the decomposing power of the voltaic pile, namely, that dynamic electricity not only separates the elements from each other, but conveys them to their respective poles, a characteristic phenomena which belongs only to this mode of decomposition, a fact that M. A de la Rive says must not be confounded with the action of transport with the electric spark or with the voltaic arc.

This part of the transport is such, that it neutralises the chemical activity of the acid or alkali when passing through a compounded reactif, such as is demonstrated by the experiment made with water when coloured blue with the tincture of *tournesol*, which does not redden during the passage of sulphuric acid from the negative to the positive pole. A similar thing takes place with regard to alkali, which does not cause it to turn green when the saline solution is conveyed from the positive to the negative pole. There are, however, some circumstances when the substance so conveyed is stopped by the one it passes through. M. A. de la Rive observed that the neutralizing power of the current is limited in consequence of the degree of affinity that a substance passing through the solution has for the substance contained in the solution itself.—*Traité d'Electricité théorique et appliquée.* Paris 1856, t. ii., p. 280-284.

M. de la Rive has also proved by various ingenious experi-

ments, analogous facts, &c., that the elements of decomposed substances may be transported by the two poles.—*Annales de Chemie et de Physique*, 1825, t. xxviii., p. 190.

In 1833, De Fabré Palaprat, in a communication read at the institution, detailed the results of a curious experiment made by him, which consisted in placing on the arm of a man a solution of hydrotate of potassa, whilst he placed on the other arm a solution of amidon (starch), and then passing a galvanic current through the body. The iodite of potassium was carried towards the amidon, which evinced a purple line.—*Arch. Général de Médicine*, 2d Séris, t. 2, p. 126, 1833. This experiment, which was considered a phenomena of absorption, had, so early as 1822, been mentioned by Lundelin, and subsequently, in 1823, by Fodera, who stated that the slow operation of two saline solutions by imbibition through the diaphragm of a living animal, might take place in a few minutes by applying a galvanic current.—*Arch. Général de Médicine*, t. 2, p. 63. With regard to the mode of absorption above-mentioned, Mr. P. Bérard has demonstrated that the phenomena, instead of being a real absorption, was but the conveyance of a substance by the galvanic current through the fumeable and humid tissues.—*Cours de Physiologie*, vol. II., p. 729.

I have to add with regard to the dynamic transport of substances, that they are accompanied by chemical decomposition, and that such is the case in the electro-chemical bath.

M. Beckensteiner relates, that having in 1836 several patients to electrify, and being at that time in the habit of using brass excitators, he was attacked by colic, which increased all the time he used this kind of excitators. When he found that the one he held in his hand was oxydised at the place in immediate contact with the skin, he was struck with the idea that a slight transport of the metal might have taken place, and have been insensibly absorbed into the organism so as to be the cause of the disease. To avoid it he had conductors made of less oxydable metal, such as gold, platina, or silver, and since that time he has been free from the affections which he suffered from previously. Subsequently, taking advantage of this discovery, he selected various metallic and metaloide substances, for the purpose of transmitting them into the organism as therapeutic agents. M. Beckensteiner, in his remarks, adds, that Pivati pretended to have purged some of his patients by putting into their hands some cathartic substance during the time they were

electrified. Pivati, in a work which he published at Venice, states positively that by putting some medicinal substance into a glass tube, they could be transmitted into the system by means of electricity; that not only the substance contained in the tube was sensibly diminished, but that their odour could be distinctly ascertained; and the most interesting and important part of these experiments is, that by this means we obtained an almost sudden cure. Some other authors, such as the Abbé Nollet, and other physicians, relate that they have repeated the experiments of Pivati without success. Subsequently, in a work published at Naples (*Tentam. de vi electr. ejusque phenomenis, Auth. Baumacaro*, p. 183, note 6), it is said that Pivati had never succeeded but once in his experiments, whilst M. Beckensteiner affirms that, if Pivati failed, it was in consequence of not having used proper means.—*Etudes sur l'electricité—Nouvelle Métode pour son emploi Médicale.* Paris, 1852, pp. 159-164.

4th. What is the nature of the *transport* which takes place in the chemical action resulting from dynamic currents, and its effects on the organism for producing the elimination of metallic substances from the body?

To the preceding question, we have to state the fact that when an electric current is directed on a compound body, we find the disentegration of its elements, and secondly a new molecular organization takes place instantaneously. This is what is called *chemical decomposition and recomposition*, the power acting on the compound is merely a mechanical force belonging to dynamical laws hitherto scarcely known; but when the previous order of the molecules of a compound are destroyed by the chemical action of an electric current, which is in reality nothing more than a *dynamic action*, the atoms separated from each other, and being disseminated, cannot assume a new order and form a new compound but by a new power, improperly called CHEMICAL AFFINITY, because it is a *transport of atoms* which can take place equally as well without being close to each other. Consequently, the same electric current or force which has disorganised a group of atoms by separating them, can reorganise them anew and bring them together again and form them into new but different groups, according to the mechanical impulsion of the law of transport.

I shall now consider the essential character of the voltaic current as being the result of a force generated in the pile itself by the mutual mechanical action of ponderable particles brought

towards each other. This force or voltaic current propagates itself in an *undulatory manner* like sound, first, through the conductors of the pile, and thenceforth through the particles of the organism, which may by their nature prove the best conductors, until the operation arrives at a state of neutralization. Thus it is that the Electro-chemical Bath presents to the observer results of the same kind, by its propagating through the particles of the human tissues, with more or less energy, the dynamic force generated in the pile. This power passing through the organism separates the elements of the metallic compound, which are consigned to their respective poles by a continuation of impulsions, which take place from molecule to molecule, amongst the ponderable particles of the organism propelled by the voltaic force. It is therefore by a continuous impulsion of atoms, and by a mutual reiterated effort of atoms upon each other, that the metals are transported with more or less abundance on the negative electrode by the electric wave.

In conclusion, a group of atoms is disorganised by *a force* which has been vaguely called chemical action, without considering that this phenomena must be of a *dynamic nature*. Again, the same group of atoms that is disorganised, is reorganised by the resultant of the same primary force, which the power of transport, acting either at infinitely small or greater distance, accomplishes that which is attributed to chemical affinity. This may be but one of the *dynamical laws*, which, although still unknown, presides over the organization of new compounds according to the nature of the motive force acting on the ponderable atomic masses.

Thus you will see, my dear sir, that I consider the electro-chemical phenomena as being merely *mechanical*, and conducted by laws essentially *dynamic:* in fact, I do not hesitate to tell you that the electro-chemical phenomena have an equal right to claim a distinguished place in the chapter of *molecular mechanics*, as well as for its application to the interesting chapter of the analytical physical sciences, which are at present only in their infancy; if we judge from the application Mossotti has made of the mathematical analysis, and of the laws of mechanics in relation with the laws established by Coulomb and Poisson, on Electric Phenomena, as well as from the researches recently made by Carnot, Mayer, Heilbroun, Joule, Thomson, Clausius, Rankine, Foucault, and other distinguished philosophers. But

its application to chemical science has not even been dreamed of: let us hope, however, that before long, this important study will take its place amongst the others.

I have the conviction, besides, that the day will come, when the most intricate problems of *medical science* and those physiological phenomena, improperly called *vital*, will be solved by the same analytical principles of molecular mechanism.

Between the revolutions of the celestial bodies and chemical affinities, the only difference is the distances which separate the infinitely great from the infinitely small. The two branches of human knowledge which belong to the domain of rational mechanics must be submitted to the infinitisimal analysis, in order to ascertain the laws by which they are controlled.

Now allow me, my dear sir, to point out some other circumstances in which the Electro-chemical Baths might be applied. Although this is as yet but a mere theory, nevertheless, it might be realised, and become a great resource in the treatment of certain affections; at ali events I will submit the subject to your enlightened judgment, and leave you to decide of its real value.

Do you not think, dear sir, that after having found the means of extracting the metallic substances which are accidentally found in the organism, it will not be possible, by reversing the poles (electrodes), to introduce metallic substances into the system of debilitated subjects unfit to endure a long course of treatment, or who should have a reluctance to swallow such or any other kind of medicinal preparation. You will comprehend that this new method of introducing metallic preparations into the organism, might be a great resource in maladies requiring the use of metals, such as mercury in syphilitic disease, in typhoid fever, yellow fever, in phthisis, pestilential maladies, exanthema, hydrophobia, apoplexy, tetanus, &c., &c., as well as in other diseases which have their seat in the lymphatico-glandular system. Mercurial preparations being, according to Giacomini, an *hyposthenising remedy*. (*Traité Philosophique, et Expérimental de Matière Médicale et Thérapeutique*. Paris, 1842, pp. 441-447), it might be administered by reversing the poles of the battery, and preparing the bath with alkalies. The patient should hold the negative pole in his hand whilst the positive is fixed in the bath itself, or to a metallic plate connected with it, taking care that the handle placed in the hand of the patient should be of the same metal as the one placed at the positive pole, and the metallic salt placed into the bath, intended to be introduced into the patient's body,

I cannot but advise you to make some experiments on this mode of introducing metallic preparations into the system, by means of the negative Electro-chemical Bath. It might be equally possible to get rid of cancers and all species of calculi, as well as other alkaline substances which cause *rebelluous* ulcers, for the cure of which, the chemical action of electricity has been proposed by M. Becquerel. (*Traité de Physique consideré dans les Rapports avec la Chimie et les Scienes Naturelles.* Paris, 1842, t. 2, p. 637). Again, the calcareous salts which, according to the opinion of many medical men, exists in chronic rheumatism, I have myself employed alkaline baths against this affection, prepared with a slight solution of carbonate of potassa, in order to transform the insoluble calcareous salts into soluble salts of potassa, which the electric current could easily eliminate from the organism.

On the Electro-positive or Negative Action, as Hypersthenising or Hyposthenising the Nervous System.

You are aware, dear sir, that the hypersthenising or hyposthenising action of electro-positive or negative static electricity has been pointed out by Mauduyt and Giacomini, and supported by the Italian school.

This electro-physiologic theory seems, now-a-day, to be abandoned by the generality of medical men, its therapeutic action being, as well as its physiological effects equally null, from the testimony of M. Duchenne de Bolougne, who affirms from experiments, that this mode of applying static electricity, cannot offer any appreciable results; that the dry electro-static bath does not possess the two different and contrary actions of stimulants and counter-stimulants. We find it in a very high degree, however, in the Electro-chemical Bath, and in all the phenomena of dynamic electricity. M. Duchenne de Bolougne has proved it in his practice of localised electricity, as recommended by Faraday (Faradisation), acted upon the dry skin and caused a superficial action confined to the sensitive nerves, and by using moist conductors, he was enabled to penetrate more deeply into the tissues of the body, and reach such muscles and organs as he was wont to convey the electric power to, it being proved by this able practitioner that the mode of modifying the action of electricity depends merely upon the amount of moisture

or liquid applied on the skin. From this it is evident that the best method of operating will be to throw the patient into such a liquid substance as shall be the best conductor of electricity; this must supersede every other means that has hitherto been tried. The facility of changing the preparation employed in the bath, as well as the direction of the electric current, puts the practitioner in possession of the means of stimulating or soothing his patient as the case may require.

It is well known to those who are engaged in the practice, that the electricity of induction produced by the volta-electric, or electro-magnetic apparatus, which effects so powerfully the sensations of the patient, as to be sometimes intolerable, depends upon the mode of intermittance of the current. In such a case it is evident that the method does not afford the hyposthenising or soothing resource. M. Becquerel on this subject makes the following remarks:—"This mode of transmission is not available whenever the nervous system is in a permanent or even a transient state of surexitation. When it is required to sooth a nerve surexitated, we must employ a continuous current; if, on the contrary, it is in a state of atomy, an interrupted one should be applied."—*Traité d'Electricité cité et de Magnetisme.* Paris, 1855, p. 381. To this should be added the remark, that by changing the current in an inverse direction, the same results are obtained. I shall return to this subject again, and support my opinion by the observations of Volta, Nobili, Mariamini, Matteucci.*

All the inconvenience resulting from this method of applying electricity disappear when we use the Electro-chemical Bath. It is a fact worthy of attention that, when a dynamic current is passed through the human body whilst immersed in the bath, the more the tissues become premeable, the more easily the current circulates, and the more powerful is its action, increasing in proportion the nervous irritation. The same current which, in the first instance was scarcely felt by the patient, becomes more and more acute, in proportion as the body absorbs the water in the bath; so much so that I have been obliged, in several instances, to diminish the number of the elements: this phenomena is observable in many patients. On the other hand, the action may be increased by increasing the quantity of acid in the bath, or the metallic surface of the negative pole.

* Want of space has compelled us to omit a portion of M. Poey's letter which follows here.

Now, in order to conceive how the dynamic electricity, when continued in the same direction, can, in a given time, hypersthenise or hyposthenise the nervous system, the idea advanced by Nobili must be admitted, that the nerves have a peculiar structure, which make them fit for the propagation of certain movements in the direction of their ramification, till they lose the faculty of contracting, which cannot be restored but by propagating a movement contrary to the first in the direction of the fibres. Hence the electric current is one of the dynamic agent, possessing the power of repropagating itself in the same direction of the nervous fibres, and according to their atomic polarity; the effect of the current is therefore to produce a direct alteration, more or less permanent, according to the degree of its energy, yet subordinate to certain limits; as when the nerve has become tetanised, the continuation of the current has no more influence, the molecules having undergone the maximum of displacement.

It is in accordance with these principles, that Matteucci has been able to destroy or restore at will the excitability and sensibility of a nerve, according to the direction given to the current. These facts prove that the disorders arising either from a too feeble or too strong an excitability of the nerves, may be due to molecular derangement, more or less permanent, rather resulting from the polarity of the agent determining the nervous force, than from the nature of the nerve itself. If it were otherwise, it would not be possible to account for the phenomena of contraction and sensibility either in man, animals, or vegetables. We must, therefore, admit a derangement of the molecules and a vibrating movement of the nervous force, and even of the nervous fibres, which succeed each other in contrary direction in infinitely small spaces of time. According to the opinion emitted by M. Matteucci, if the vibration or current is directed from the extremities to the brain, it produces sensation; if on the contrary it is directed from the brain to the extremities, it will produce contraction.

It is now easy to conceive how the prolonged and constant action of an electro-positive bath may, in the course of time, alter the normal position of the nervous molecules in a more or less permanent manner, according to the intensity and duration of the current, and that a variety of effects may be produced from a mere numbness to a partial paralysis, either of sensibility or movement, and also how the nervous system, being sur-excited, will become tetanised.

The action of a negative electric bath will, as a matter of course, soothe the nervous irritation by restoring the organic molecules to their normal position. Should the action of the negative bath be continued, however, after the normal condition is re-established, the relation of the particles would equally produce paralysis, but of a contrary kind to the first.

Such, my dear sir, are the principles of electro-physiology, on which I venture to establish the virtue of the aqueous-positive and negative bath as an hypersthenising and hyposthenising agents of the nervous system. And such are, in conclusion, the ideas I had to communicate to you on the nature and application of the Electro-chemical Bath.*

I have the honour to remain,

My dear sir,

Yours very truly,

ANDRES POEY.

[We need not say that M. Poey is perfectly master of the subject upon which he treats in this important letter, but whilst we are most happy to print his most valuable communication for the instruction of our readers, it is but right to say there is one point suggested by him on which we do not entirely agree, namely, the introduction of metallic substances as therapeutic agents into the human body. We know that it may be easily done, but we doubt, as will be seen from another part of this work, that any good would result from it. The presence of metallic poison in the body is the cause of a number of incurable diseases, nor do we know of any means of removing them, except it be the Electro-chemical Bath, and we never therefore employ it to put into the body that which we are daily striving to eleminate from it. What is said about the alkaline and sedative baths, we have frequently tried, and found it in the highest degree beneficial.

It will be seen from what has been said in the first chapter of this work, that it was in the pursuit of these experiments that the first idea was suggested to our mind of reversing the operation.]

* We regret that want of space has compelled us to abridge slightly M. Poey's letter. The portions omitted relate principally to experiments made by M. Duchenne de Boulogne, on localised electricity; the substance of these remarks will, however, be found in another portion of this work.

CHAPTER III.

ON DISEASES WHICH OWE THEIR ORIGIN TO THE PRESENCE OF METALLIC OR OTHER POISONOUS SUBSTANCES IN THE BODY.

MUCH has been said and written on the entities of disease ever since the healing art has been thought of. The origin of disease has been attributed from time to time to the most absurd causes. For example: the great Galen, who was the propagator of the humoral doctrine, attributes all diseases either to the blood, the *phlegm*, the yellow or black bile, or *melancholy*. This absurdity of the great man has been controverted by Paracelsus,* who has substituted something still worse. According to the opinion of this great man, there are five entities of disease. 1st, Planetary influence; 2nd, Poisons; 3rd, Natural predisposition; 4th, Supernatural predisposition; and 5th, God. Who is the man of common sense who would not be ashamed, now-a-day, to utter such ridiculous ideas? This work is not intended to enter in detail on this question; that we propose to do in a subsequent work. Suffice it to say, for the present, as being particularly connected with our subject, that we believe the principal cause of disease to be the presence of obnoxious substances in the body. Let them be inert, metallic substances, or the natural effete of the body, living animalcule, or whatever may derange the vital functions, whether brought on by mental anxiety, acting on the body and disturbing its functions, and thereby perverting the circulation and the secretions, or otherwise troubling the organism, through nervous influence, by carbonic acid resulting from our own breathing, or any thing emanating from our own body, — we are of opinion that four-fifths at least of the mortality may be attri-

* Paracelsus is the first who used mercury in the treatment of disease, from which comes the word quack, which is an abbreviation of the German word *Quacksalver*; and the most curious thing is, that the name of quack is now generally given to those who repudiate the use of this deleterious mineral.

buted to poison—let it be introduced medicinally or through adventitious circumstances: let it be by immediate corrosion of the living tissues produced by large doses, or the slow destructive process of small ones,—we are satisfied in our own mind, that if the facts were well investigated and known, the coroner's verdict would be "died from poison." But, as before said, our present object is not to dwell on the matter; we shall bring facts to corroborate everything that we advance.

We have discussed, in another chapter of this work, the important question whether mercury and the other minerals should ever be given as medicine or not. It is enough for us to show here, that in all cases when poisons are once absorbed into the system, they are removed with difficulty, and that they are often the cause of the most alarming and incurable diseases. Upon this matter all medical men are agreed, and we shall do little more in this chapter than present the opinions of the very highest authorities to establish the fact beyond dispute.

Dr. Copeland says, "The poisons most liable to cause palsy are lead, mercury, arsenic, ergot of rye, monkshood, and thorn apple.

"Palsy from lead generally occurs after one or more attacks of colic, but it occasionally appears without any severe disorder of the digestive organs. It is seated chiefly in the upper extremities, and effects the extensor more than the flexor muscles. The hands and fingers are always bent, unless they hang down by the sides. The palsy in the arms is sometimes associated with deafness.

"It is supposed to act directly on the nerves and muscles.

"Mercury, when carried into the system in the form of an oxide, or of a salt, sometimes causes palsy; but generally in the form of what is termed shaking palsy. It usually occurs in miners, in gilders, and in other workmen exposed to the operation of mercurial substances.

"*Arsenic* sometimes occasions limited or partial palsy. In some cases an incomplete form of paralysis, resembling palsy from lead, and affecting one or more of the extremities, is caused by this poison."—(See *Med. Dic.*, Article "Palsy.")

Dr. Copeland also gives the particulars of an interesting case of paralysis arising from the use of monkshood.

Dr. Howship, in his work on "Morbid Anatomy," gives a remarkable case of suppuration of the lymphatic glands of the

neck from the use of mercury, which occurred in a young woman aged twenty, treated in the St. George's Infirmary, who had been six times under a process of salivation in the course of five years. She took cold, and a number of painful tumors formed below the margin of the jaw, and upon the neck. The whole of those burst in the course of three weeks, but the neck did not heal for a second, third, and fourth formation; and suppuration having taken place, the whole side of the neck and left jaw were surrounded by an indurated indolent mass, which never properly healed.

Another very remarkable instance of chronic affection of the glands, arising from the long use of mercury, is related by the same author as having occurred in a young man, who for five years had rarely been free from mercurial excitement. Owing to another complaint, from which he was suffering at the time, it was thought desirable to continue the mercurial treatment; but the tumour formed into a large pulpy mass, extending from the ear down to the sternum, which never yielded to any medical treatment whatever.

Sir Charles Aldis, also, in his work on "Glandular Diseases," has narrated several cases in which tumours, that were previously indolent and inoffensive, have been aggravated into malignant cancers by the use of mercury. He says, "In the breast, also, was a tumour of the size of a turkey's egg, and a second over the scapulum of the right side, besides which there were various other tumours on the legs, &c. These last had existed for nearly thirty years, and it is a curious fact that, as soon as mercury affected the constitution, they then rapidly increased, and the skin that covered them became red and painful." Again, in relating the case of Mrs. Pear, which is precisely similar to the above, he concludes by saying, "To the questions put to her with regard to the sensations occasioned in the affected breast when she was under the influence of mercury, her reply was, that she constantly found herself worse: the tumour increased and became more painful; and that the nervous head-ache was always then considerably aggravated."

Carmichael, in his Treatise on the "Effects of Preparation of Iron in Cancer," relates a perfectly analogous case of the aggravation of tumours by mercurial treatment; his sentiments are clear upon this matter. "In forming an opinion," says he, "on this head, we should recollect that the mercury

seemed to be the exciting cause of those tumours; for until that medicine was exhibited, they remained perfectly indolent without exciting the smallest uneasiness."

Sir Charles Aldis thus sums up his views upon the matter: "Mercury used in scrofulous glands generally increases them, by exciting into action the irritability of the constitution. It also quickens the pulse, occasions purgings even to the evacuations of blood; and has even been known to produce mortification by an inflammation in the mouth. Its most general effects are a prostration of strength, attended with cold rigours, profuse perspiration, a trembling of the limbs, loss of appetite, paleness of the countenance, violent headache, cramp in the stomach and vomiting: the dismal climax ending in eruptions of the leperous kind, which sometimes spread over the whole body. * * * There is hardly a constitution which has been at all subject to its influence that does not suffer in the end from the noxious properties of this poisonous mineral."

The eruptic mercurial disease of the skin has been vividly pictured by Dr. Howard. He says, "It commences in large red patches in different parts of the body, attended with pain and intolerable itching; pimples appear which soon break; all the red surfaces then become raw; an acrid humour flows from it which scalds and corrodes the surrounding skin, until the whole surface of the body, from head to foot, is sometimes in a state of painful excoriation, pouring out a burning ichor, which, polluting the whole air with a most sickening odour, stiffens all the covering of the body which sticks to the flesh. The skin is chapped in deep fissures in various parts; the hair, the teeth, the finger, and toe nails often drop off; and thus the sufferer is reduced to a condition of misery which no language can describe."

Dr. Alley also records a case, in which "An eruption appeared over the entire body of a boy, about seven years old, for whom but three grains of calomel had been prescribed ineffectually as a purgative."

A case is recorded by Dr. Falconer of a lady who was subjected to a course of mercury for redness of the face, which was removed by it. The treatment resulted in dropsy of the chest, from which she died.

The celebrated Dr. W. Beach says, "Mercury appears to destroy the energy of the nervous system, producing weakness,

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existence is going off. Sometimes he preserves the sight and hearing, while he loses the voice and locomotion: he is dead to the world, and sees himself buried alive—it is in fact a nightmare lasting a longer or shorter time—the abuse of stupifying substances throw in a state of apathy for everything around him. The intoxicating poisons disturb the circulation by sanguine conjestions, determined by their spherical action, and cause disorders of the muscular antagonism in consequence of the circulation being interrupted in the sanguineous channels—hence nervous tics, trembling of the limbs, complete or incomplete paralysis, epileptic convulsions; tetanus, or curve of the body backwards (opisthotomos) or forward (emprosthotomos); or on one or the other side (pleurosthotomos), according as the contraction takes place—or as the nervous circulation or *animal electricity* is interrupted in the antagonist muscles of the anterior, posterior or lateral portions of the body;—from hence coma, syncope, depravity of taste and passions, disordered movement independent of the will; at the beginning the countenance appears much excited; but little by little, from the progress of poisoning, the face turns blueish and swells. Poisons with alkaline bases or minerals provoke vomiting more readily than acids; they cause a feeling of gnawing, constriction, causticity, which cannot be better described than by cramps, more or less violent, and crudities of the stomach. This kind of poisonings have no pathological character by which they may be distinguished from each other; nature has only given us the consciousness of the destruction of the organs, but not of its mode of operation. All kind of poisoning may be either slow or rapid, according to the substance given at once, or by repeated small doses.

Stupifying poisons suspend the course of the circulation; intoxicating poisons congest it;—the first class have ammonia for their basis, they liquify the blood without altering it; the second are alcholic, and coagulate it. The other poisons commence their disorder in the tissues before acting on the circulatory liquids. As soon as the circulation is suspended, the nervous system looses it action and becomes paralysed. When the circulation is congested, the influence of the nervous system is irregular; the harmony of the movement and sensibility are troubled; the disorders are manifested in the body and mind; the animal economy is the passive instrument of the *chemical intestine reactions*, instead of being master of

his will and actions. The individual never recovers completely from poisoning by a large dose; he always comes out mutilated, the maladies resulting thereof vary according to the organ on which chance or the medicines have transmitted the violence of the poison. If poisons are given in small doses, they act without the patient being conscious of it, because it does not react but on decayed and andermic surfaces of the affected organs, when it exhausts itself, and saturates them by their decomposition and disorganising action—it might even act as antihalminthic remedy: because a man has nothing to fear from a dose scarcely sufficient for killing an infinitively small animalcula.

In conclusion, there is no kind of morbid affection, either acute or chronic, comprised in the range of nosology, which cannot be produced as the consequence of the various kinds of poisoning, viz.: on the one hand those which result from the poisoning itself; on the other hand, those resulting from maladies arising from it.

We have spoken more fully of mercury, because it is the most common, and most fatal kind of poison that we have to contend with. It must not be supposed, however, that it is the only one. We have already referred to Dr. Copeland's opinion relative to palsy being produced by *arsenic*, a poison which may be absorbed into the body like mercury, or if taken internally produces the most painful results. Dr. Beach says, "A few grains are sufficient to destroy life. It is usually disguised and given in the form of Fowler's solution, which is very pleasant. It is also applied externally in the form of powder or plaster, for the destruction of cancers; and is in this way sometimes absorbed and proves serious. Given internally, it causes nausea, sinking, burning pains, and heat near the heart and over the whole body; inflammation and erruptions on the face, lips, tongue, palate and throat; vomiting, black and fœtid stools; small pulse; palpitations; great thirst; fainting; coldness; cold sweats; difficult respiration; bloody urine; swelling and aching of the body; livid spots on the surface; great prostration; loss of sight; delirium; convulsions;—and sometimes it proves fatal. It has been shown, on dissection, that the stomach and bowels have by it been inflamed and ulcerated, and partly destroyed. It is known that this mineral is given to destroy rats, and yet persons take it for medicine."

Hooper states that arsenic is one of the most sudden and violent poisons that we are acquainted with. When the quantity is so small as not to prove fatal, tremors, paralysis, and lingering hectics succeed. We are, on the combined testimony of many medical practitioners, conspicuous for their professional zeal and integrity, irresistibly induced to declare our opinion, at least, against the internal use of this active and dangerous medicine.

The following symptoms which follow the administration of arsenic, are abridged from Jahr :—

Paroxysms of suffering, with anxiety and desire to lie down. Nocturnal pains which are felt even during sleep, and which are so unbearable as to excite despair and fury. Want of strength; excessive weakness even to complete prostration; emaciation and atrophy of the whole body; with great sweats and weakness;—the face becomes earthly and eyes sunken, with a dark ring surrounding them; tearing of the limbs; fainting fits; and torpor as if the limbs were dead.

The skin is dry, parched, and blueish, and is often troubled with violent burning; and reddish or blueish spots; or ulcers with hard edges, surrounded by a red and shining crown. The sleep is troubled with agitation and constant tossings; jerkings and burning under the skin as if there were boiling water in the veins; great agitation and anguish at the heart. Cold over the whole body; with cold or varied sweat; shivering and shuddering. The mind is also affected with melancholy, anxiety, restlessness, and excessive anguish; fear of solitude and vexation. The pains of the head occur periodically, and are increased by the slightest touch;—there are also ulcers on the scalp. The face is subject to eruptions, and looks pale, hollow and cadaverous. The lips are bluish or black, dry and chapped; great pain in the region of the stomach, and occasional vomitings, accompanied with cramp-like pains. The voice is husky or hoarse, accompanied with a dry cough, shortness of breath, compression of the chest, and violent and insupportable throbbings of the heart, chiefly when lying on the back, and especially at night; swellings in the arms and acute drawing pains in the legs.

We have given this table of symptoms, that any one into whose hands this work may fall may at once be able to judge for themselves, whether they are suffering from the presence of this deleterious substance in the body.

The most prominent symptoms observed in those who have taken zinc, are described by Jahr to be tearing in the limbs, aggravated when over heated or when taking exercise. Spasmodic pains or cramps in the limbs, tingling in the limbs, pain which sometimes seems between the skin and the flesh; the pains are generally worse after dinner and towards evening. Heaviness, lassitude, and excessive weakness. Itching, with violent lancinations, especially in the evening in bed, disappearing immediately on being touched. Tingling between the skin and flesh. Tetters and herpetic ulcers. Disposition to sleep by day, and especially in the morning. Febrile shudderings, with flushes of heat. Fretful peevish humour, with dislike to conversation, especially in the evening. Shooting and tearing pains in the head, especially in the sides, temples, forehead, and occiput, aggravated after dinner or by drinking wine. Pale and earthy countenance, gloomy and wandering look. Small yellow ulcers in the mouth, and copious secretions of saliva. Sour risings after a meal, and a burning sensation in the stomach; violent pressure and tension in the abdomen, with flatulent colic. Pressure on the chest, palpitations in the heart and pains in the loins.

The most prominent symptoms accompanying the administering of *antimony*, are rheumatic pains and inflamation of the tendons. Pulling or shooting tension of the limbs. Great sensibility to cold. Itching, especially in the neck, chest, back, and limbs; eruptions, which appear chiefly in the evening. Miliary eruptions and nettle-rash. Tumours and blisters as if from the stings of insects; eruptions similar to cranoid chicken pox. Red and hot swellings, degeneration of the skin. Fever, disgust of life, with an inclination to blow one's brains out, Dizziness in the head with nausea, sensation as if the forehead were going to burst; teasing itching of the head, and falling off of the hair. Suppurating eruptions of the face, with painful crackings in the lips. Cramps in the pit of the stomach, and violent cutting pains in the abdomen. Stifling oppression or shooting pains of the chest, and rheumatic pains in the neck and arms.

It is hardly necessary, neither does our space admit of our entering into a fuller description of the action of mineral substances upon the living organism, as this matter is more fully discussed in the next chapter. All these substances are given as medicines, and are also subject to absorption into the

body through the skin, especially when the cuticle has been removed or broken. Some of them are more easily expelled from the system than others, but generally speaking we may affirm that, until the discovery of the Electro-chemical Bath, no effectual means had been found of removing either mercury, lead, or the other minerals from the human organism. Huge quantities of sarsaparilla and iodite of potasse have been administered for this purpose; but we appeal to the experience of any one who has either prescribed or taken those medicines for chronic mercurial symptoms, if the effect has not generally been doubtful, and in some cases pernicious, as our own cases will show.

The learned and justly celebrated Dr. Cheyne has the following severe but truthful remarks upon this matter:—"Minerals are the most destructive to animal bodies that malice can invent, beyond gunpowder itself, and even spirituous liquors; for nature has provided none such, but as poisons in venomous creatures to kill their enemies. They become iron bristles, nails, and lancets, darting perpendicularly into the solids of the body, so as to quickly tear, rend, and destroy, and therefore can never be proper for food or physic."

CHAPTER IV.

OF METALLIC POISONS, AND THE MANNER IN WHICH THEY ARE ABSORBED INTO THE SYSTEM.

ALTHOUGH we have spoken fully of the influence of metallic poisons in producing disease in the preceding chapter, this view of the matter would not be complete if we did not give the reader some further information as to the action of those preparations on the human organism, as well as the method in which they are prepared and administered. In this matter we shall principally follow three eminent authorities, Giacomini, Raspail, and Jahr, not because they alone have written upon the subject, but because they have each of them an European reputation, and will be regarded every where as impartial witnesses.

Respecting the action of mercury upon the human body, Giacomini in his "*Traité Philosophique et Expèrimental de matiére Médicale et de Thérapeutique*," when speaking of the lymphatic vessels, says:—"The subclavian vein is not the only one which communicates with the lymphatics. The right subclavian internal jugulars, the emulgents, and all the other veins of the body receive lymphatics, which are directly in their interior. If this should not be demonstrated by material facts, the knowledge of the physiological law should be sufficient to admit it, as well as many other phenomena, which although acknowledged cannnot be explained but by induction. Absorption is the great work intrusted to the lymphatics, which transport to the veins the materials absorbed in three different ways; the shortest one is the direct communication existing between the veins and the lymphatics. This communication may be observed at every point of the organism, even where the minuteness of the vessels cannot be detected by the naked eye of the anatomist who has not been able to discover the connecting point of these two classes of vessels. It is evident that these vessels cannot receive the small molecules they convey, but in a gaseous state, and their instantaneous effect shows that they are passed immediately into the blood without any previous elaboration. This is particularly remarkable when we apply on any part of the body some diffusible and volatile substance. Again, the same thing may be observed by noticing in a lymphatic, one of those ganglia through which the molecules must pass, and be elaborated before reaching the veins. These lymphatics present a certain diameter and are easily perceived; there are some others which are of a great size, such as the great lymphatic vein and the thoracic duct. They meet in every part of the body, but more particularly in the neighbourhood of the articulations, the peretonium, and the small intestines; these are intended to convey into the circulation those substances which require to be elaborated before they can be converted into blood, by being previously transformed into chyme or chyle. The third way is by the *vena porta*, which receives indiscriminately every substance, even those which cannot be assimilated. It admits the greatest portion from the large intestine, with some of the portions of the indigested food; the *vena porta*, therefore, is not to be considered as appertaining to the veinous systems; as it has not, like any other vein, any artery connected with it, it is in

every way different. It carries a humour differing from veinous blood, not only in its chemical composition, but also in regard to its appearance. It is a fluid of a new formation, and before it can be converted into blood, must first part with certain constituent colouring, odoriferous and almost ceruminous principles; generally insolubles and rather capable of forming lapidiform connections than real animal matter. This chemical process takes place in the liver, where the *vena porta* is divided and subdivided in a manner similar to the arteries. The office of the liver appears to be the conversion of all the materials brought by the *vena porta* into veinous blood, for the purpose of transmitting them in a purified state to the *vena cava*, whilst all the materials which are not fitted for organic assimulation, form the bile and excrementous humours which, during the process of digestion is poured out to be evacuated through the intestines. The *vena porta* should therefore be considered as belonging rather to the lymphatic system than to the veinous, participating, however, in both, the lymphatic being, so to speak, an appendage of the veins; their structure being the same, they have the same valves, the same concentric motion, and the same functions, being destined to gather new materials, and convert them into blood, which is thrown into the general circulation. The only difference between the lymphatics and the veins are, 1st, that the former are smooth; 2nd, that they have a great number of circumvolutions; 3rd, that they are interrupted by ganglions; 4th, that they contain a white humour and incomplete blood. From this it results that the question respecting the absorption of the veins is inconsistent, because they must either absorb the blood itself or materials differing from the blood. According to the first supposition, they should communicate with the blood vessels, which would not constitute an absorption. In the second place, it would be necessary that they should have open communication with the tissues of the various textures of the body, then they would be real lymphatics, since these vessels transport a liquid different from the blood. We must, however, remark, that although there is a great similarity between the lymphatics and the veins with respect to their structure, the motion of the liquid in the former is a great deal slower than in the latter; and this phenomena, we may observe, is of the highest importance for the elaboration of the materials which they contain. It results on the one hand from the smallness

of their calibre, and on the other hand of the obstacles they encounter in passing through their ganglion, as well as from the small amount of vitality in their walls. This explains how it is that morbific matter may remain for a long time dormant in these vessels before manifesting its deleterious effects; how the diseases of this system offer the singular aspect we are going to elucidate; how the effects of hyposthenising substances act in the same manner in the lymphatic vessels and on the veins; and how some remedies of that kind display their action on the lymphatic system, rather than those characterising the order *of the vascular hypersthenising medicines.*"

In accordance with the physiological data laid down above, Giocomini proceeds to illustrate the influence of mercury upon the living organism. He says—

Notwithstanding the little affinity of mercury for oxygen, it may form two oxides: it forms more readily with brimstone, chlorides with different acids and other substances, and gives an immense quantity of products, constituting as many mercurial preparations, but we shall speak only of those employed in medicine. They shall be classified in the following order:—

1. Preparations in which mercury remains in the metallic state, although so much divided that its globules cannot be detected by the naked eye.

2. Preparations in which mercury is combined with oxygen, forming protoxide and deutoxide.

3. Preparations in which mercury is combined with brimstone and forms sulphates.

4. Preparations in which it is combined with iodide and forms proto-iodine and per-iodine of mercury.

5. Preparations in which, combined with brome, it forms the proto-bromine of mercury, which is white and volatile, insoluble in water or alcohol, and the deuto or bi-bromine soluble in water.

6. The mercurial preparations forming the proto-chlorine and deuto-chlorine of mercury. The first is known under the name of calomel, it is white, insipid to the taste, volatile, insoluble in water. The second, named corrosive sublimate, is white, crystallizes in prisms, soluble in sixteen portions of cold water, or three of boiling water, is more soluble still in alcohol, and very volatile.

7. Composed with cyanogene, it forms the cyanure or

prussiate of mercury. This salt is white, inodorous, with stiptic taste, and soluble in cold and hot water.

8. The different salts, such as the hydrochlorate of mercury, which is the deuto-chloride or sublimate disolved in water. Azotade, of protoxide of mercury. The azotate of mercury, the deuto-sulphate of mercury, and many others.

These are the principal forms of mercurial preparations now in use, and having given this brief list of them, we will now procede to notice their effects upon the animal economy.

The action of mercury upon lice, worms, and the smaller animals, was well known to the ancients, who used it for a long time as a vermifuge. It was generally applied in the form of an ointment under the thighs of sheep and hogs, to preserve them from insects. They knew also that eggs submitted to the action of mercury became sterile.

Rhodes relates the result of a number of experiments which he made on dogs, by rubbing under the groins a scruple of mercurial ointment; in a few days they began to tremble from time to time; appeared dejected and exhausted, crawling, and often remaining without motion until they died, which generally happened in two or three or weeks.

Olivier also killed a number of dogs by giving them from five to six grains of cyanure of mercury. They died in from twelve to fifteen minutes. Duprey killed a horse by giving him a scruple of deuto-chloride of mercury. Giacomini has however given us the most interesting list of experiments, the principal of which are here subjoined. They throw considerable light upon the action of this metal on the living organism, more particularly on its toxic effects. He says—

1st. We gave ten grains of deutoxide of mercury in eight ounces of water to a big dog, and the same dose in powder to a small dog, the first died in eleven hours, and the second in twenty-three.

2nd. We gave twenty grains of sublimate to a middle-sized dog; he died in four minutes. The same quantity was given in powder to another dog, who died in thirty-five minutes.

3rd. Forty grains of sublimate dissolved in eighty-three of water was given to a middle size dog, which died in a few seconds. The same dose given in powder to a large dog, operated fatally eighteen hours afterwards.

Dr. Giacomini also relates a number of experiments made

on rabbits, porcupines, hares, and other animals, too long to be inserted here. The results were precisely similar in all the cases. Upon a careful consideration of the whole, he draws the following conclusions:—

1st. That the deuto-chlorine of mercury is a poison, the action of which is much more energetic when dissolved in water, and consequently less corrosive.

2nd. The symptoms of that kind of poisoning are not accompanied with pains or fever, even when death does not take place for several hours or several days. "This remark," he observes, "is in opposition to the opinion of toxicologists, who have written from preconceived ideas, instead of careful and actual observation of facts."

3rd. The cadaveric lesions of that kind of poisoning do not present any phlogistic or corrosive appearance; on the contrary, the tissues are pale and colourless. It is true, that now and then some portions are found either injected, red, livid, or softened; but this has no real relation to the violence of the symptoms and the promptitude of death. Thus, the authors who advanced that corrosion is the principal effect of this poison, are speaking rather *a priori* than from observations. It is the word *corrosive* which have induced them to make this mistake. Orfila himself could not help confessing that out of eighty animals killed with sublimate and other mercurial preparations, he has never observed the least appearance of corrosion. (44 *Archives Générales de Médicine*, May, 1830.) However, the corrosive action may sometimes be manifested after death, as we shall demonstrate further on.

4th. The local alterations of the œsophagus, the stomach, and the intestines, depend entirely on the chemical action of the poison. Some of these alterations take place during life, some after death; the former consist in some slight congestions or redness, which are only found when the venemous substance is endowed with great chemical action and when administered in a concentrated state, but when the dose is not quite large enough to cause instantaneous death. The second alterations are of a contrary nature. The tissues are of a pale colour, the mucous membranes are corrosed, controverted, indurated, or softened, and almost melted away; however, these characters are slight when the animal is dissected alive, but very conspicuous after death, particularly if some time has elapsed before the examination takes place. Many experiments made on the human

body, as well as on animals who have been submitted to the action of corrosive sublimate, have demonstrated the correctness of the above facts. Every one knows the affinity of mercurial salts for some molecules of the organic tissues, and how readily they combine with them, and if in sufficient quantities, decompose and dissolve them. If the quantity is not large, the tissues are crisped and hardened, which causes them to resist the corrosive action. It is upon this principle that the method of the naturalists and anatomists is based for the conservation of their preparations. It is also on this principle that Dr. Tronchid has founded his process of preventing the putrefaction of dead bodies.

The effects produced on the human organisms are of three different characters:—1st, Dynamic; 2nd, Mechanical; and 3rd, Pretended specific. Under whatever form it is administered, it may produce dynamic effects on the healthy body, even in the metallic conditions as it penetrates by absorption, becomes assimilated in consequence of its extreme volatility, and never fails to act with great energy.

Of the subtle nature of this poison some conception may be formed from the manner in which it is absorbed into the system, for it is not necessary that it should always pass through the stomach in order that it may produce its deadly effects; the lungs and skin often receive it and the result is much the same in every case. Persons attending in hospitals where mercurial frictions are practised, are subject to its influence, this has been observed and mentioned by a great many medical men; those who have written more fully upon the subject are Fabrice, Goulard, and Coulson. The latter has remarked it in the Hospital de la Pitié a Paris. The effects were similar to those produced by the slow gradual administration of oxide of mercury or calomel. It always produces perspiration, alvine evacuations, secretions of the saliva, and sometimes vomiting.

The atmosphere may also be made the medium of conveying mercurial poison into the system, as may be seen by the following cases:—The "Edinburgh Medical and Surgical Journal" relates the circumstance of the *Triumph* ship of war, having saved from the wreck of a Spanish ship a large quantity of quicksilver. The bags however, having been saturated with sea water, many of them burst, and the mercury became mixed with the bilge water. The stench became so intolerable, that two men were suffocated in attempting to sound the well; an

alarming illness broke out in the ship, every one of the crew were salivated; every rat, mouse, and cockroach on board perished; and the ship had to be taken to Gibraltar, and the crew removed from her.

Dr. Christisom also relates the case of a barometer maker and his workman being injured by sleeping one night in a place where they were exposed to the vapours of mercury, from a pot which was placed on a stove that had been accidentally kindled. Both were severely injured, the former lost his teeth, and the latter became paralytic for life. Other cases of a similar nature are reported in medical journals.

But perhaps the most remarkable effect of mercury is to be observed amongst men working in the quicksilver mines, looking glass manufactories, gilders, &c., who use mercury at a temperature more or less elevated. Most of these workmen, like Thompson (see Chapter I.), are subject to weakness, trembling of the limbs, asthma, numbness, palsy, insensibility, deafness, and amourosis; their complexion becomes livid, and they generally die at an early age. Dr. Fernel has, however, spoken pertinently on this point, he says:—"A state of langour takes hold of the whole constitution; the throat, the tongue, the palate, the gums, swell and become ulcerated; the breath is fœtid; the teeth become loose and affect a livid colour; the salivary glands are painful and tumified: and the saliva runs in abundance from the mouth, and is viscous and corrosive; it reddens the part it comes in contact with; appetite disappears, nausea and vomiting takes place, diarrhœa ensues; the patient's face is pale, and swells; they are subject to vertigo and delirium; the trembling sometimes lasts for years, and even during the whole life. A feeling of chilliness is felt all over the body, which becomes covered with what is denominated mercurial eczema; the perspiration has a fœtid smell; some experience an extreme anxiety in the precordial region, and death often puts an end to their cruel sufferings."

The mercurial treatment employed for the cure of syphilis has often occasioned serious accidents, and even death. And the annals of science present a great number of cases, in which death, voluntary or accidental, has resulted from the swallowing of mercurial preparations.

Frederick Hoffman records the case of a patient affected with the itch, who having washed himself with mercurial water, was subject to fainting and contractions in the left arm, which resisted a great number of remedies.

Borelli relates the history of another patient affected with the same disease, who having washed himself with a preparation of corrosive sublimate, had the whole body covered with vesicles in the space of a few hours, and fell into syncope.

The irregularity, smallness of the pulse, precordial suffocation, and trembling of the limbs, are the phenomena described by Pearson under the name of mercurial eretism, and which are generally observed in patients who have persisted for any length of time in the use of calomel.

Vadekin says that the pulse becomes slow and soft, if the patient persists in the use of the corrosive sublimate bath.

Sudden death, caused by mercurial frictions, have been several times observed by Richter. In the relation published by Olivier d'Angers and Barrud, of a case of poisoning by the deuto-chlorine of mercury on three children, it is said that the first child, seven years and a half old, died within three hours after having taken twenty grains of that preparation; the second, three years and a half old, died in eleven hours, after taking twelve grains; and the third aged two years, died after twenty-three days, having taken six grains. On a post-mortem examination of the two first, the bucal membrane was found of a greyish colour, the epithelium of the œsophagus was detached in plates, the mucous of the stomach and intestines were of a pink hue. The stomach of the third was of a dark red, and contained a residue of sublimate. Without relating other facts of the same kind, so numerous in the annals of the healing art, we must call the attention of the reader to a very important circumstance; it is the absence of fever amidst the alarming symptoms, it being observed that, whatever may be the duration of the symptoms, the circulatory system does not show any marks of excitation; on the contrary, it falls into a progressively relaxed condition, till the action of the heart is extinguished. This important fact has not escaped that great observer, Ramazzini, who has noticed it in the case of a young gilder, who, through the effects of mercurial vapours, became first cachectic, then pale, of a lead colour, with an almost cadaverous aspect, his eyes were congested, his breath offensive, had a kind of physical and mental deficiency, the mouth ulcerated, the saliva infected, was constantly running out of his mouth, and transmitting its impurity to everything he took; ultimately he died, after two month's sufferings, without having shown any febrile symptoms.

In none of the numerous cases we have under our eyes, fever mentioned; we can scarcely conceive, therefore, how certain toxicologists speak of fever as one of the symptoms of mercurial poisoning.

The absence of fever, either acute or chronic, is, according to our opinion, an incontestible proof that the action of mercurial preparations is not hypersthenising or irritant, that on the contrary it is hyposthenising to such a degree as to diminish and extinguish life. One of the greatest absurdities ever maintained in pathology, is to pretend that irritation and inflammation can be the cause of a prompt death, without evincing febrile symptoms; it is, however, the doctrine of several toxicologists, but what is still worse is, that it is the foundation of their therapeutic practice.

A fact no less surprising, with regard to the secondary effects of mercury is, that salivation is reproduced at long intervals, without the mercurial treatment being repeated. Fordyce reports a case of salivation renewed spontaneously twelve years after the treatment has been left off, which ceased, and appeared alternately from week to week.

It has been noticed on several occasions that, after a course of mercurial treatment, continued for a length of time, little vesicles appear on the skin, through which *Fourcroy and Horn assure us they have seen some little globules of mercury come out. Sometimes these globules are preceded by a very troublesome itching, and a particular redness, to which the name of mercurial erethismus has been given.**

It is not uncommon to meet with patients after having followed a treatment of mercurial salts, such as chlorine or azotate of concentrated mercury, even in small doses, who complain of a sensation of heat and burning of the œsophagus, sharp pain and pricking in the stomach and bowels, with a retraction of the navel, as in *colica pictorum*, or of encephalic irritations, with mental confusion, loss of memory, and delirium.

* These symptoms are evinced in our patients while taking the bath.

Remarks on the Use of Metallic, Mineral, and Inert Substances, as Medicine.

We have seen by the foregoing observations, drawn from experiments and practical observations, and related by the highest scientific authorities, unbiased by routine or prejudice, that all metallic, mineral, or inert substances, namely, anything which cannot be assimilated with the organism, acts as a poison. It may therefore appear strange that they are employed as medicines, and that their use is advocated by men of the greatest repute, who otherwise command respect and admiration for their indefatigable researches and labours, as well as for their laudable exertions, which they daily make for the relief of suffering humanity.

But although most willing to give them all the credit they deserve, we cannot help thinking that we have a greater right to trust to the laws and dictates of nature, than to any man's opinion or any scholastic precepts; and we think also that the failure of our profession is the result of the sophistication and speculative disposition of many of its members; and the reason also why the healing art has, at all times, been the subject of criticism and satire for the great writers of every country. That passage in Shakspeare, "throw physic to the dogs," speaks volumes. Moliere has not been more merciful; and Lesage, in his description of Dr. Sangrado, has attacked medicine in its foundation, and as long as the world lasts his sarcasm will be a thorn in the side of the practitioner. Had these men been alone in their remarks, it might be attributed to the imperfect knowledge of the practitioners of that time; but we find in the No. 82, of the "Medical Dissenter, or Inquirer after Truth in Medicine," December 31st, 1836, an "Essay on the Uncertainty of Medical Science, and the Numeral Method of M. Louis," read at the Medical Society of the University of London, November 25th, 1836, by Edwin Lancaster, the following remark:—"The uncertainty of medical science has been, in all ages and times, a subject of attack to the satirist, and of regret to the philosopher. It has been said 'that almost the only resource of medicine is the art of conjecturing.' In speaking of the duties of a physician, in watching and administering remedies in disease, a facetious writer observes: 'Nature is fighting with the disease; a blind man, armed with a club (that is, the physician,) comes to settle

the difference; he first tries to make peace, when he cannot accomplish this, he lifts his club and strikes at random; if he strikes the disease, he kills the disease; if he strikes at nature, he kills nature.'" Should we pick out remarks of this kind, our work would be too small for such quotations. We must not, however, think for a moment that the fault should be attributed to medical men, except in that part where preconceived ideas and prejudice prevent them from using their own judgment; whilst on the other side, the bigotry of the public for old things and old systems, force the practitioner in a great many cases to act in accordance with the prejudices of his patient. The following anecdote may serve us as an illustration of such a case:—

On my return from Manchester, I met an old acquaintance, who, to the usual question, "how are you," did not answer according to custom "very well, thank you," whether well or not. He complained at once of being very poorly, and of having been so for a long time. Having inquired what was the matter with him, and if he had not taken medical advice, he told me the history of his case, and that he had consulted three or four medical men. In talking, I told him what I should have recommended if consulted in a similar case: he found my ideas so contrary to his, although he has no knowledge of medicine, being a lawyer, that he ejaculated with surprise, "Well, my dear sir, your method is not in accordance with legitimate practice." I smiled at the pretention of the solicitor, and replied "Well, sir, it is true that it is not quite in accordance with the old school, but permit me to tell you one thing, there is not a single medical man who is not anxious to cure his patient, and who would not do every thing in his power to succeed; it is to his credit and to his interest to do so. You have consulted four medical men, who have failed; I suppose they were, according to your expression, all of the same creed, and I can assure you that, if they have not brought you round, it is not their fault, the fault is in the means they have employed; should I follow the same theory, I should use the same course they have pursued, and come exactly to the same result." "Well," he said, all prejudiced as he was, "there is something true in that. Will you permit me to send you my present medical man, he is an intimate friend of mine, and you can consult together on the matter." The gentleman called, and we talked on anything else but the patient; it was

not for me to break the ice; it would have been a breach of decorum on my part, so we parted, according to etiquette, and the patient has not been much wiser or better for our interview. This is one of those scenes which take place behind the curtain, much more significant than they appear at first sight. For myself, I am satisfied that the gentleman in question will never come to me, his prejudices are too strong, and it is these prejudices that medical men have to meet, and to which some are obliged to yield. The reader, we trust, will forgive us this little digression, it bears on the subject so far, as it proves what kind of contention it is with which we have to bear in fighting against public prejudice, and how new discoveries are rejected without investigation. Let us beforehand say, that we have not the presumption to assume to be a reformer in medicine, but merely to prove, for the information of the community, what we have advanced in our first premises; namely, that amidst the various doctrines, more or less recognised or supported by men of knowledge and ability, what we have to consult and to follow in preference to the opinion of men is, nature herself.

What, then, are the laws of nature with regard to the point under consideration? Can a man in good health feed on metallic, mineral, or any other substance not assimilable to the body? No! Can we say that such a substance which cannot afford nutrition to the system, nor be used for the growth and development of the human organism, will be good to repair it when it is weakened and diseased, and restore the living tissues and their functions? We say no, because it is contrary to the natural or physiological laws of the organism; never will a portion of iron be transformed into a piece of flesh; never will mercury restore the parenchymal texture of the liver; never will antimonial preparations restore the conditions of the mucous of the stomach; never will zinc, in any shape, produce the granulation of a wound.

Let us see now, with what care nature has provided the means of eliminating from the body every particle of inert matter, even those of the most minute description, such as the effete or residue which, after having been an integral portion of our organism, is thrown away from the system, or it would otherwise produce diseases and death. We have already, in our lecture on cleanliness, and the functions of the skin, delivered in Manchester,

under the auspices of the sanitary committee, demonstrated that almost every disease may be traced to a bad condition of the skin, causing thereby the retention in the system of obnoxious matter, inimical to the functions of the organism. Let the matter be what it will, and by whatever manner it may be introduced or retained in the animal economy, if it interferes with the vital functions it has the generic name of poison. We may, therefore, be poisoned with the very substances which have been previously the support of life, the same as we may be poisoned by the carbonic acid coming from our lungs. If, therefore, nature has provided excretory organs to throw constantly out of the body, by the pores of the skin, by the lungs, by the kidneys, and otherwise, those substances which are poisonous, because they are inert, how can we, philosophically, throw into the organism for its relief when diseased, substances which are a great deal worse in their character? What are we to think of the infatuation of those who presume to improve on nature by violating her laws? Is it not a matter of common sense to avoid what nature repudiates. I am well aware that those practitioners which do not approve of my doctrine, will bring forth arguments to prove that cures have been, and are daily performed by the use of the remedies they prescribed; but to this we answer, Mr. B. had a liver complaint, of which he is relieved, or cured, in appearance, but sometime after, Mr. B. had another disease, from which he died; and as the disease had attacked another organ, and had therefore another name, the medical man has the credit of having cured the liver complaint, and is absolved from being the cause of the second affection; for the secondary symptoms of mercury, which, after having cured certain other diseases, present themselves in more serious forms than the disease itself, and generally end in incurable and most atrocious affections.

As we have said before, every inert substance acts as a poison in the body, even iron itself, which is given as a strengthening medicine. This had been our opinion, many years before we knew of Dr. Giacomini's work; it was not, therefore, in consequence of any practical experiments we were then acquainted with, but because the introduction of metal into the organism is not consistent with physiological laws.

The asumption on which iron is given as medicine is, that we have it as a component part of the blood, but when we

consider its quantity to the other elements of that fluid, we find it to be so infinitely small, that it does not bear any comparison with the quantity of the others, and is but a small fraction. Such being the case, we have no right to admit that the Supreme intelligence, who has determined the quantitative proportions of all the natural chemical compounds, should have, in His wisdom, neglected to provide the amount requisite. Is there any chemist who can boast that he can approach to the chemistry of nature? Has not Providence determined the quantity of the oxygen and nitrogen composing the air we breathe? the proportion of oxygen and hydrogen which compose the water we drink, and can we alter these quantities without deteriorating the quality of this element? How is it, then, that men dare presume to improve on the products and designs of the Creator? Is it presumption, misconception, or blind conviction, that the voice of nature is not listened to, and that iron is prescribed in daily repeated doses, much surpassing the whole quantity of iron that the blood ought to contain? We have had in our practice a proof of the evil it produces, in a patient of ours, a young lady fifteen years of age, the daughter of Colonel P——, who was brought to us for the purpose of promoting her growth.

Having been very delicate during her infancy, she was submitted to a long course of iron preparation. Her teeth were quite discoloured, without enamel, of a tinge of oxide of iron (rust); having had however a favourable turn at the time of puberty, she gained strength, and her body began to increase, not in length, but in bulk. The diameter of the bones were the size of an adult, and her figure, limbs, and fingers, quite disproportionate. The cause of that anomaly was not accounted for, and was an object of wonder to every one. We find it, according to our diagnosis, a natural consequence of the treatment she had followed. Every anatomist knows that nature has provided the means to the end; that the long bones are composed of three portions, the shafts and two extremities, which are separated from each other, that the bones grow by the edges, and that their elongation takes place there where the head of the bones join the shafts: thus the apophysis forming the condyles, are formed of a cancellated structure, very vascular, and enveloped by a bony lamella, of the thickness of a piece of brown paper; it is in these cells that the blood comes to deposit the earthy substances which increase

the length of the bones. But as bones are not made of iron, if the blood contain an excess of this metal, it is deposited in the stead of phosphate of lime, and stops the normal development of the organ. And when we see in the teeth, iron occupying the place of the enamel, have we not a right to suppose that the other osseous portions of the skeleton are in a similar condition. Do we not see every day in our medical establishments, that mercurial frictions on the limbs produce salivation? We see also, when the patients are in our bath, that the mercury comes out from the legs and feet, whilst the patient complains of the mouth, and it must be evident to every one if mercury, lead, and any other substances, are transmitted to some conspicuous part of the body, through the blood, it must be propelled by the same means wherever the blood circulates, namely in every part of the body. Thus it is that the brain becomes affected like the rest, from hence result that despondency of spirit, that weight of the head, that loss of memory, burning of the ears, loss of taste and smell, and indifference to food.

Some years ago, the Countess of —— came with four of her daughters to see my gymnasium in Manchester. The time was fixed to send them as pupils, but one week previous to the time appointed, I received a note from her ladyship that she had consulted her physician, who advised her that her children, previous to taking the exercises, should follow a course of strengthening medicine; to which I answered that, with due respect to her medical adviser, I did not know of any strengthening medicine, excepting good food, pure air, and plenty of exercise. I mention this merely for the purpose of pointing out that my opinion has long been fixed on the subject. I have explained the foundation of my reasoning as arising from the study of nature, but as we have a great many unbelievers, who will not admit of any but tangible proofs, we shall submit, for the consideration of our readers, the following practical experiments, taken from the work of Giacomini, already cited.

"This metal is one of the most abundant in nature. In the pure state it is hard, tough, ductile, and maleable, particularly when heated. It is of a granulated, lamellous texture, capable of being finely polished, having no special smell and savour, of a grey bluish hue, and melting at a high temperature.

"The effects produced on animals are so slow as to prevent

us from making any precise experiments with ferruginous preparations. Whinhold has observed, that the injection of sulphate of iron into the stomach of a dog, makes it swell immediately, and accelerates the beating of the heart; but this is rather the effect of mechanical action than the dynamic effect of the medicine. That it causes the blood to get redder is a thing very difficult to ascertain; that the spleen becomes atrophied, as is advanced by this author, can scarcely be admitted, his observations not being supported with sufficient evidence. The only interesting fact resulting from experiments of this kind made upon animals, is that the most active martial preparation does not cause death, nor any great alteration, as has been proved by experiments made with prussiate of iron, the stomach having been neither irritated nor inflamed. This is proved by Cameres' observations, he having given, during two days, four grains of hydro-chlorine of iron to a rabbit, whose stomach he found perfectly healthy after death.

"When a man takes some preparations of iron, the fæces are found of a black colour. A craving for food is experienced, and if it be not satisfied, uneasiness is felt in the stomach, which seems as if it were empty, and causes a sensation like cardialgia. If the dose is rather large, continued vomiting or diarrhœa ensue. Halmeman relates that he experienced a kind of vacillation whilst stooping or coming down stairs, as if his legs were giving way; some other authors speak of having giddiness in the head. Trousseau and Bennet state that they felt a confusion of ideas and general weakness. Wadell and Harche felt a great debility and trembling in the whole body; loss of strength, small pulse, and fainting, has been observed by Ritter. The diminution of the pulse and its smallness, are the constant characteristic action of iron on man in good health. We have several times verified on ourselves the effect of the action of iron, as well as on convalescents, who have taken it for too long a time. In a young woman of eighteen years of age, of a delicate constitution and very sensitive, who was recovering from *arteritis*, the pulse which had been as high as one hundred, was reduced by the action of iron to forty-two, when it was necessary to discontinue the use of the metal."

We are convinced of the truth of these remarks, but do not wish to be believed on our own word. We earnestly desire the matter to be fairly observed and verified, a thing which may very easily be done by those who seek for truth. They

have only to take one gramme (twenty grains), of carbonate of iron after having previously ascertained the condition of the pulse; if after a short time it does not present any alteration, a second dose, or even a third may be taken, according as the constitution of the individual may require. It will be found that before taking the last dose, the pulse is already weaker and slower; the skin pale, a shivering is experienced and general weakness felt, followed by trembling of the limbs. This will be an evident proof that iron does not give tone to the man in good health, that it does not increase animal heat nor promote the circulation, but positively weakens the whole organism. This experiment is without danger, for if the symptoms should not be dispelled soon enough, it will be sufficient to take some wine to remove them.*

These experiments ought incontestibly to establish the character of this medicine, and yet the authors of our *Materia Medica* still consider iron as one of the medicines which increase the frequency and strength of the pulse, and accelerate the animal heat, re-animating the colour of the skin and increasing the capillary circulation. This is evidently a mistaken notion.

It is a consolation to those of us who take an interest in the progress of medicine, towards what we believe to be a more healthy or rational course, to know that the use of metallic substances is on the decline; one preparation after another is being abandoned, and even in those which are retained, the dose is considerably diminished in quantity. In the "London Dispensatory, published in 1696, by William Salmon, Practiser of Physic, at the Red Ball, by the ditch side, nigh Holborn Bridge," and giving the practice of the College of Physicians at that time, there are no less than 330 preparations of metals. Of these there are—

Gold	26
Silver	20
Copper	24
Iron	31
Tin	17
Lead	17
Antimony	106
Mercury	66
Other Preparations	23
	330

* Giacomini, p. 373.

But the most remarkable thing in this is, that every preparation is said to cure almost every disease. Thus, the *Aurum Potabile*, or potable gold, "is accounted a universal remedy against all diseases. It is a sudorific and counter poison; restores in consumption, cures the plague, all sorts of fevers, epilepsies, apoplexies, palsies, megrims, leprosy, scab, itch, ulcers, fistulas, and old virulent sores, which are hard to heal, reviving such as are almost dead. It is in vain to enumerate what it will do; six or eight drops given in canary, will revive such as are senseless and stupid."* All the other preparations are equally efficacious; if there be any pre-eminence, it is due, perhaps, to the "Quinta Essentia Auri," 24, for "this is one of the chiefest of restoratives, and indeed exceeds (*omnia, alia, arcana, suith, horstius*) all other secrets in strengthening the heart, brain, liver, and all other parts of the human body, which serve for the conservation of life, for it hath a moisture and substance agreeable to ours, and strongly resists all things which may any way incommodate our essence. It keeps back old age, renews and restores the radical moisture, and, as some think, gives long live. It may be given in all diseases, because its intention is the fortifying and defending the life against the assaults of all enemies."†

With an unlimited supply of such medicines as this at command, why on earth did the faculty or any of their patients die?

Neither is silver without its medicinal properties, and those of a high order. Silver pills, we are told, "are a specific in the dropsy and diseases of the head and old headaches, megrims, epilepsies, vertigoes, &c. It cures convulsions, palsies, and fits of the mother; these things it does almost to a miracle."‡

Copper, we are told, at least the quintessence of it, "is good against all effects of the brain coming from cold or heat, for it wonderfully strengthens radical moisture. It is the only remedy against the leprosies (there are at least fifty others mentioned in the same book), for it cleanses and purifies the blood, and cures all sorts of fevers, whether continual or intermitting. It fortifieth the whole viscera, and excites the natural heat. It heals all excoriations of the skin, wounds, ulcers, old and new, by anointing; it heals all pains of the gout, proceeding from what cause soever; it stops and dries up catarrhs, comforts the head, brain, and joints, dissolves and

* Lib. II., p. 277. † Lib. II., p. 276. ‡ Lib. II., p. 280.

expels the mucous and tartarous matter afflicting those parts. It dissolves all stones and scirrhous tumours, strumas, and such like. Horstius commends it to the skies."

The properties of iron are equally astonishing, as are also the curative properties of tin and lead, but it is to mercury that we are to look for the grand panacea against all the ills that flesh is heir to. "It is," we are told, "an antidote against poison, and doth really wonders by heat in all diseases of the head. *It is almost a divine remedy*, it eases pain and giveth rest." And again at page 309 we are told, "this is one of the most noble medicines yet this day known in the world, and will do as much as any whatsoever. It will easily, safely, and speedily cure any old malign and deplorable disease; it purges gently without vomiting, except the stomach be foul. It is a wonderful arcanum in dropsies and gout, as also in jaundice, all manner of defluctions, scurvy, leprosies, scab, itch, plague, poison, all fevers, whether continual or intermitting, the colic dysentery, and all obstructions in any part of the body. It begins, continues, and perfects the cure alone, thoroughly and substantially, rooting out all maladies and the seeds of every disease." With such physic as this at hand, who would be ill? Nay, is it any wonder when the faculty held such sentiments as these that the public at large were poisoned!!

It is unnecessary that we should continue these extracts, here is our last sample; speaking of a preparation of antimony, the author says:—"This wonderfully cleanses the blood, cheers the heart, revives the spirits, strengthens the whole body, fortifies the stomach, causeth appetite, opens all manner of obstructions, cures cachexies, hypochondriacs, melancholy, jaundice, and dropsies, &c."

Such was the practice of medicine two centuries ago, of which our present mineral treatment and practice is nothing but a relic. Of the 330 metallic preparations referred to above, there are hardly a dozen now in use. A few new ones have been introduced, but the majority of them have been discontinued altogether. We hope the day is not distant when our pharmacopœia shall be entirely rid of them.

RASPAIL'S LIST OF THE PRINCIPAL MEDICINES, IN THE COMPOSITION OF WHICH METALLIC POISONS ARE INTRODUCED, AND THE USE OF WHICH SHOULD BE AVOIDED.

I. Arsenical Preparations to be Prohibited.

1. Fowler's liquor, containing 1/100 of the weight of arsenious acid.
2. Pearson's liquor, 1/550 of arseniate of potassa.
3. Biett's liquor, 1/625 of arseniate of ammonia.
4. Fontanielle's powder, 1/910 of white arsenic, and 1/100 of mercury.
5. Asiatic pills, 4 milligrammes of arsenious acid.
6. Biett's ferruginous pills, 3 milligrammes of arseniate of iron.
7. Biett's pills of arseniate of soda, 4 milligrammes of arseniate of soda
8. Barton's pills, 3 milligrammes of white arsenic.
9. Powder of Boudin, half milligramme of arsenious acid.
10. Pills of Boudin, half of arseniate of potassa
11. Potion of Donavan, 4 centigrammes of iodine of arsenic and 4 of iodine of mercury.
12. Cigarettes of Trousseau, each containing 5 centigrammes of arseniate of soda.
13. Escorotic powder of the frère ôme or of Rousselot, 1/5 white arsenic.
14. Dupuytren's powder, four diegrammes of arsenious acid, and 32 grammes of callamelas.
15. Pommad de St. Louis, 1/166 of iodine of arsenic.
16. Collyre of Lanfranc, 1/76 of sulphur of arsenic.
17. Turkish rusma epilatory, 1/8 of sulphur of arsenic.
18. Plenck epilatory, 1/25 of sulphur of arsenic.

II. Mercurial Preparations to be Prohibited.

1. Oliver's biscuits, the inventor has been the first victim in making this preparation.
2. Liquor of Van-swieten, 1/1000 of its weight of corrosive sublimate, deuto-chlorine of mercury.
3. Syrup of Larrey, 1/2000 of deuto-chlorine of mercury.
4. Syrup of bellet, 3 decigrammes of nitrate of mercury for 30 grammes of syrup.
5. Syrup of lagneau, 1/80 of mercury.
6. Syrup of velno, 10 centigrammes of corrosive sublimate on 500 grammes of syrup.
7. Antimonial ethiops of huxham, almost half mercury.
8. Plenck's pills, 1/3 of mercury.
9. Napolitan pills, 50 milligrammes of mercurial ointment.
10. Bandelocque's pills, 1 decigramme of sulphur of mercury, each pill.
11. Ricard's pills, 5 centigrammes of proto-iodine of mercury, each pill.

12. Citrin unguent, 1/80 of nitrate of mercury.
13. Neapolitan unguent and double mercurial ditto half mercury.
14. Unguent gris, mercurial ointment, 1/6 of mercury.
15. Brown unguent, 1/6 of red precipitate.
16. Pomatum of Sichel, 1/10 of red precipitate.
17. Mettemberg's water, for curing the itch, 1/250 of corrosive sublimate.
18. Black German's water, 1/34 calomel.
19. Phagedenic water, 1/34 of deutochloride of mercury.

The above horrid preparations, decorated in a thousand manners by those jealous to connect their name to this scourge of the human species, may be seen everywhere, but they do not the less deserve our reprobation, because of the names of those who propound them. Even now, we see again the corrosive sublimate gargle of Ricord; the one of cyanure of mercury of Parcut; the collyre of Conradi and Sichel; the injection of Lagneau; the antipediculary water of F. Cadet Gassicour; the Boerhaave lotion, the red water of D'Alibert; Bateman's embrocation; Ricord's fomentation; Duncan's emulsion; Gowland's liquor; Siemerling's cosmetic; antidartrous water of Cardinal de Luynes; Sublimate bath of Beaumé and Widekind and Dr. Green; mercurial honey; mercurial cerate; Planche's ointment; Dupuytren's ointment; ointments of de Saint Eve; of Grand Jean; of the Regent, of Desault; Gibert's de Monot's of Willan's; of Zeller's; of Cazenave's; of Cirillo's; of Duchesne Duporc's, &c.

III. Antimonial Preparations to be Prohibited.

Julep of Rosai's; of Lannec's; of Royers'; of Louis'; of Trusen's of Trousseau's; Kermetised potion of the French codex (pharmacopœia); Peysson's potion; James and Preziozi's Powder.

IV. Saturnine, or Lead Preparations to be Prohibited.

Acetate of lead, or saturnine extracts, internally, as drink, or in lotion.

N.B. Every honest man who shall impartially meditate the principles of this work (Raspail's), will join with us in order to eradicate from the formulary every preparation we have pointed out.

CHAPTER V.

THE ELECTRO-CHEMICAL PHENOMENA OF THE HUMAN ORGANISM.

"As the Creator of the universe has endowed man with reason, and assigned him a noble and intelligent rank in the scale of intellectual and moral being; and as he has commanded him

to use this faculty, so I may with justice remark, that he who *cannot reason, is a fool;* he who *dare not reason, is a coward;* he who *will not reason, is a bigot;* but he who *can*, and dare reason, is a man."—JOHN BOVEE DODS, M.D., author of the "Philosophy of Electrical Psychology."

We have chosen this quotation as our motto, because it has always been our opinion, although we could not perhaps express it so well as Dr. Dods has done for us; we are pleased to be able to appreciate the talent of others, and we use their language in preference to our own, whenever it conveys our meaning, and to follow their example in a firm determination of giving to the public whatever we think may prove beneficial to the welfare of the generality of mankind. We shall have to give in the sequel of our researches and observations some new ideas contrary to the opinions generally received; but we *dare to reason*, and we will to do so. We are aware, beforehand, that our capacities are not adequate to the undertaking; we are not, therefore, prompted by conceit or vanity, and if mistaken in our conclusions we shall be most happy to confess it, when the error is once pointed out. Truth is all we aim at, and if we discover it ourselves, or are the instrument only by which it is brought out, the result will belong to the community at large.

Discoveries are of two kinds, partial or entire. One gives the first idea of a system—it is a discovery; another adds to it—that also is a discovery; and when a number of scattered facts are assembled together, the man who has connected every link into one homogeneous chain, of which he forms a system, has also made a discovery, the most important of all. Such was the history of the discovery of the circulation of the blood by the great Harvey. When the great philosophers Descartes, Malabranche, Bossuet, Fontenelle, had exhausted the power of their genius in the research after the animal spirits, the student Borden, scarcely twenty years old, in a memoir read at the school of Montpellier, destroyed at once the whole frame-work of their philosophical edifice. (*See l'Historie de la Découverte de la Circulation du sang par, de Florens*, 1854.)

If, therefore, Harvey has succeeded in bringing into the world this most important physiological discovery—the circulation of the blood—it is because those made by his predecessors, beginning with Galen, were substantially correct. If Borden knocked down at once the philosophical edifices constructed

by the most celebrated philosophers it was because their premises were false.

In our researches on the subject of this chapter, we have been fortunate enough to meet with substantial aid in the discoveries of our predecessors, and by uniting the whole, we have arrived at the conclusion, which we now present to the public, namely, the circulatory system of electricity in the human body, according to the physiological laws of the organism. This is the ethereal fluid of the ancient philosophers, which has given place to the nervous fluid, and this again to the electro-nervous fluid, which we shall for the sake of simplicity call *electric fluid* only.

It is well known that the nerves do not generate a fluid, *sui generis*; that what is found in the nerves, is but a secretion for lubricating their texture; therefore, no circulation of nervous fluid can take place, if such fluid does not exist. What are the nerves, but a medullary substance similar to the brain, of which they are but the continuation, the branches and filaments. If we suppose a system of water pipes for distributing a liquid in various directions, it implies first, the existence of a liquid, next, a receptacle or reservoir to contain it, and the means also of supplying this depôt. In the preconception of a nervous fluid, the above conditions are wanting, and the only positive fact is the pipes, viz.: the nerves, and no more. Still it is admitted that there is a mode of transmitting our ideas and will from the brain to some other part of the body through a certain medium, and this is true, because it cannot be otherwise, and if there is but one way alone, by which a thing may be performed, that way must be the correct one. The only philosophical means which nature presents to us for the accomplishment of the phenomenon of volition is, the electric fluid, as we shall demonstrate hereafter, for this mode answers to every condition of volition and rationality. If our idea is correct; if the nerves are but the conductors of electricity; nervous affections must take another name in nosology, and become electrical complaint, and we shall have to distinguish the diseases resulting from the derangement of the fluid from those of its conductors, as we distinguish the disease of the blood itself from the disease of the circulation and those of the vascular system. Next, if we are correct, we shall naturally come to the conclusion that the pathological statement of nervous diseases, as they are now

conceived, must be wrong, and ultimately, that the means in use in the treatment of nervous affections are inadequate, if not injurious, because medicine must produce some change in the organism, and if that change is not productive of good, the result must be evil.

The reader will have already perceived our idea of the circulation of an electric fluid through the nervous system, which we shall, for the sake of distinction, call the electricity of volition. We shall not say, as we have heard and read, that such or such a portion of the organic system is the most important, because life is the result of a congeries of organic systems, every one indispensable to the existence of the individual; therefore, although it is granted that the nervous system is the medium through which every function and action of the body is performed, without the material, of which the nerves have the control, they would be perfectly useless.

The electricity of volition is confined to its own department, and has its course or circulation, but does not go farther than its limits, and to complete the tableau, we require another supply of electricity to constitute a perfect system, to which the first may give assistance. This we shall denominate organic electricity, from its acting immediately by decomposition, renewal, and recomposition of the organic tissues. We expect our assertions will meet with the objection of many; there is in man a sort of pugnacity of mind which prompts him to reject the things he has not discovered himself, and the higher he stands in the world, the more prone he is to pooh pooh the things of which he has no knowledge. Conceit, pride, or interest, may all influence men who have acquired a reputation even well deserved, for they may be jealous of those under them. We might also attribute much to want of time to examine new things, and in some cases to indolence. The impunity with which new discoveries are trod upon, by those who should encourage the seekers after truth, is a painful subject for reflection. It is shorter and much more easy to call a thing humbug! than to prove it to be such; so it is that every man of repute may, and often does with a word, crush an innovator, without trouble or scruple. We rely, however, on the intelligence, honesty, and good faith of our readers to think and judge for themselves. We do not pretend to impose our own opinion, nor the sentiments of others on the public. It is nature herself to whom we appeal

for the support of our doctrine. We all know that the things which she has produced in the greatest abundance, are those which are of the greatest use to mankind; such for example as salt, which not only saturates the oceans, but is found everywhere on the land; oxygen, the active agent of life, light, heat, and water; but electricity occupies more space still, and must consequently be the highest in value of all the elements of nature. It is the fluid in which stars and planets swim, which controls all the actions and phenomena of the universe. It produces light, heat, magnetism, attraction, repulsion, decomposition, and recomposition; the simplest, the purest, the most active, the most refined, the most volatile, imponderable. It has always been, and always will be the inexhaustible and incomprehensible medium between the Creator and all that exists. Could man in his reason suppose that this divine production is created without a great design, in accordance with the wisdom of its author? In speaking of the science of electricity, we say that it is in its infancy; but electricity itself is as old as the sun; it existed before vegetation ornamented our globe with its various and rich productions. We leave sceptics to deny what they please, for ourselves we are satisfied that electricity is the most important element of the human organism, and indeed in the whole world, that it presides over all the functions of the body, from the highest to the lowest: is the medium between the spirit of man and the matter he is made of, and we may add also, that it is the instrument of volition, transmitting his will to all parts of the body under the command of the voluntary nerves. It acts equally independent of his will on the organs of life, whose interrupted action would cause immediate death. Electricity presides also over other phenomena, entirely independent of the above, and forming a set of operations in relation only with the physiological functions.

It has been hitherto a prevailing opinion amongst philosophers, that the two kinds of electricity, viz., the static and dynamic, are identical; and they imagine that they have solved the question by stating that electricity is electricity. We are very far from adopting their definitions, as will be presently shown.

Works have been written on animal electricity, but then, is it one of the two above mentioned, or one only, or a peculiar kind of electricity? Such are the important questions we have

to solve, and to which we call the attention of our readers as being the key of the system we are going to elucidate. Let us see first the difference of the two kinds of electricity, and understand what their natures are. We premise, first, that the want of appropriated words is the cause of confusion in the way of expressing our ideas, and that the term *static electricity*, when used in opposition to dynamic, is a very vague expression, and, according to the meaning of the two words, one might be substituted for the other. We shall therefore, for the sake of clearness, call static electricity, *atmospheric electricity*, because it comes from the atmosphere, and produces all the external phenomena on the surface of our globe; and we shall call dynamic electricity, *chemic electricity*, because it is the result of chemical decomposition. Let us now examine and establish the distinctive action of these two kinds of fluids. We collect the atmospheric electricity by means of a machine made of glass, and the mere friction of the plate or cylinder attracts it, which having been received in a prime conductor, may be there accumulated in proportion to its size, and disposed of for the production of certain phenomena. That electricity is the same substance, so to speak, as lightning, is certain, for it has been drawn by Franklin from the clouds by means of a kite. When accumulated in the atmosphere, it will, under certain circumstances, burst off in the shape of what we call lightning, often accompanied with thunder, striking and destroying everything in its way. In the same way we produce, on a small scale, similar phenomena in our laboratory; for example, if you charge an electric jar with a certain number of sparks, and have a chain formed of any number of persons holding each other by the hand, the two last holding one of the conductors when the jar is discharged, every one will receive a shock of the same intensity. It shakes the whole body, is felt in the bones, and should the amount of electricity be sufficient, it would, as lightning does, destroy life instantaneously. Here we see at once the distinctive nature of atmospheric electricity. It is to be observed, that in passing through the body, it does not in any way combine with it or leave any portion of the fluid behind. *Galvanic, or dynamic*, or what we call chemic electricity, acts in quite a different manner; it is not abstracted or collected from any other element; it is produced and generated in the body, it combines with all substance, separates or unites them accord-

ing to a wise purpose, and acts in a similar way on the human organism and its various compounds. Let us take an example which, like the preceding, is known by every one. We have seen that every individual forming the chain receives the shock with the same intensity, but we had forgotten to mention, that if one only had received the whole discharge, he would not have felt it stronger in one instance than in the other. Here, then, is the difference: if a person holds the conductors of a galvanic apparatus of a certain power, it will cause the muscles to contract, independent of the will, to such a degree, that it will not permit him to let them go. The pain may be very severe, the blood vessels will increase in size; the perspiration ooze in every direction; all the fluids will be affected, and the effect will last as long as the conductors are connected with the battery, without the experimenter being able to release himself. But the apparatus being left in the same condition, if, instead of a single person holding the handle of the machine, two persons holding each other by the hand, take each of them one of the conductors, they receive and feel but half of the electric fluid, and by adding three, four, five, or a greater number of persons to form the chain, ultimately, no one will feel the passage of the electricity at all, thus demonstrating that the fluid has combined with and been divided between each of the experimentalists.

From the above experiments, it is evident that the two kinds of electricity are not identical, that they are produced by different means, possess different actions, and produce different effects.

By reasoning on the subject, we shall understand by and by, how the organism possesses and is acted on by both kinds of electricity, and establish the peculiar functions of each. It does not require a great effort of the mind to comprehend, that the atmospheric electricity being in the air we are surrounded with, we cannot breathe one without breathing the other also, and thus, therefore, we receive a constant supply of atmospheric electricity in the lungs. We are aware also, that this kind of electricity is the great promoter of vegetation, and exists in all the productions of nature, either vegetable or animal, it is logically evident therefore, that we cannot take any article of food without at the same time swallowing the electricity it contains; thus, we receive into the lungs and the stomach, a constant supply of atmospheric electricity. On

the other hand, all our experiments have undoubtedly established the fact, that chemical decomposition of any kind, cannot take place without evolving electricity, and as the body is subject in all its parts to a constant chemical decomposition, from birth till death, when each element returns to its primitive condition, is it not evident that electricity must be constantly evolved and generated within the body? Could we for a moment suppose—without insult to the wisdom of the Creator, who, in His omniscience, has not made or provided any thing without a useful and beneficent purpose—that these two kinds of electricities have not distinct functions to perform in the living organism? No man impressed with the idea of the existence of Supreme power, and conversant with the wonders of nature, will ever attempt to deny that some great design is fulfilled in the production of these two electric fluids.

We need not say, that we have laboured very hard for the solution of a problem which was to explain the *modus operandi* of electricity on the organism. It was long before we could determine if these two kinds of electricities were, by an unknown process of nature, combining together and forming a third kind, which has been called by various authors, *human electricity*, until at last, by a close investigation of the opinions of many philosophers, and particularly of facts, and practical experiments, we came to the conclusion that atmospheric electricity is the nervous fluid itself, and the instrument of volition, supplying at the same time the involuntary action of the organs; and that this kind of electricity has a mode of circulation similar to the sanguineous circulation, forming a regular circuit, in a given limit, the head being, with regard to the circulation of electricity, what the heart is to the circulation of the blood. Whilst on the other hand, we see chemic electricity pervading every atom of the organism, and performing its chemical functions, decomposing, from the head to the feet, all the inert substances which form the effetes of the body, and conveying them to their proper channels, and preparing the place for the admission of new vitalised substances, destined for the repair and regeneration of the organism. Preparing the different fluids and secretions, harmonising all the materials, and keeping up, under the influence of its action, the incessant molecular changes of the human edifice.

Such being the admirable provisions of nature, let us now try to explain how this wondeful arrangement takes place.

We have said at the beginning, that we did not pretend to be the discoverer of the different laws and facts on which we have based our system, no more than Harvey was of the partial discoveries of his predecessors, but which he used to illustrate or demonstrate his theory. We read in the *Histoire de la Découverte de la Circulation du sang*, by P. Flourens, that Galen has been the first to discover that the blood was running in the arteries, instead of air, as it was believed before his time; that Servetus has discovered the pulmonary circulation; that Cesalpin had an imperfect conception of the general circulation; that Fabrice d'Aquapendente has discovered the valves of the veins; that Duverney has discovered the fœtal circulation; Vesale, the foramen ovalis; and Fallope, the arterial canal; thus it is, on partial discoveries, that the great Harvey has arrived, by connecting the discoveries of his predecessors, and reducing them into a single system, at the grand result of his splendid theory.

Thus, in imitation of this great man, have we tried in our simple way to follow the steps of our predecessors, and to draw such deductions from their researches and experiments, as might lead us to the realisation of the system we have conceived. We are indebted to Dr. Bovee Dods, of America, for the original conception of this matter.* He was the first, so far as we are aware of, who expressed his opinion with regard to the instrumentality of electricity, as being the medium between the spirit of man and its organism. He says:—"If then, the *mind*, invested with royalty, is enthroned in the brain, and if the mind commands the foot to move, or the hand to rise, then it must send forth from its presence an agent as its *prime-minister*, to execute its command; this prime-minister is electricity, which passes from the brain to the nerves, as through so many telegraphic wires, to give motion to the extremities." Further, page 59, he says:—"Having clearly and philosophically established the truth, that electricity, in the form of nervous fluid, is indeed the connecting link between mind and inert matter, the question now presents itself, if the mind continually throws off electricity from the brain by its mental operations, and by muscular motions, then how is the supply kept up in the brain? I answer, through the respiratory organs, electricity is taken into the blood at the lungs, and from the blood it is thrown to the nerves and

* See "Electro Psychology," p. 58.

conducted to the brain, and it is then secreted and prepared for the use of the mind. It will be impossible for me to argue this point fully, unless I explain, at the same instant, the philosophy of the circulation of the blood. As I differ also with physiologists on this point, and as I do not believe that the heart circulates the blood at all, either on the hydraulic, or any other principle, so I will turn your attention to this subject.

The philosophy of the circulation of the blood is one of the greatest themes that can be presented for human contemplation. While discussing this matter, it will be clearly made to appear how electricity is gathered from the surrounding elements, carried into the system, and stored up in the brain to feed the mind with impressions. I desire it to be distinctly understood, that when I speak of *electricity*, *galvanism*, and *magnetism* of the human system, or of the *nervous fluid*, I mean one and the same thing. But before I proceed to notice the philosophy of the circulation of the blood, and the secretion of the nervous fluid, I will first make a few observations in relation to the nerves and blood vessels, so that I may be distinctly understood.

I have already stated, that the brain is the fountain of the nervous system, and that both its hemispheres are made up of a congerie of nerves, they both pass to the cerebellum; and the spinal marrow, continued to the bottom of the trunk, is but the brain continued. In the spinal marrow, which is the grand conductor from the brain, is lodged the whole strength of the system. From the spinal marrow branch out thirty-two pairs of nerves, embracing the nerves of motion and those of sensation. From these branch out others, and others again from these, and so on till they are spread out over the human system in net-work, so infinitely fine, that we cannot put down the point of a needle without feeling it, and we cannot feel unless we touch a nerve. We see, therefore, how inconceivably fine the nervous system is—in all these millions of nerves there is no blood. They contain the electric fluid only, while the blood is confined to the veins and arteries. I am well aware that the blood-vessels pass round amongst the convolutions of the brain, and through them the blood freely flows, to give that mighty organ action; but in the nerves themselves there is no blood, they are the residence of the living mind, and its prime agent, the electric fluid.

Though I have frequently, in my public lectures, touched upon the philosophy of the circulation of the blood, and thence those remarks were reported and published in my "Lectures on the Philosophi of Animal Magnetism," in 1843, in connection with my views of the connecting link between mind and matter; yet I have never taken up the subject in an exact, full, and connected detail of argument, this I will now proceed to do in connection with the secretion of the nervous fluid.

I would, then, in the first instance remark, that the air we breathe, as to its component parts, is computed to consist of twenty-one parts of *oxygen*, and seventy-nine parts of *nitrogen*. Electricity, as an universal agent, pervades the entire atmosphere. We cannot turn the electric machine in any dry spot on earth without collecting it. Oxygen is that element which sustains flame and animal life. Neither can exist a moment without it, while nitrogen, on the contrary, just as suddenly extinguishes both. The atmosphere, in this compound state, is taken in the lungs. The oxygen and electricity, having a strong affinity for moisture, instantly rush to the blood, while the nitrogen is disengaged and expired. The blood being oxygenised and electrified, instantly assumes a bright cherry-red appearance, and by this energising process, has become purified and prepared for circulation; the lungs and the blood they contain, are both rendered electrically positive; and we know, that in electrical science, two positives resist each other and fly apart. Hence, the lungs resist the blood and force it into the left ventricle of the heart. The valve closes and the blood rushes into the arteries. Hence the arterial blood is of bright cherry-red hue, it is, by the positive force of electric action, propelled through every possible ramification of the arterial system, till all its thousands of minute capillary vessels are charged. Along these arteries and all their thousands of capillary branches, are laid nerves of involuntary motion, but no nerves whatever attend the veins. Why is this so? Why is it that nerves, like so many telegraphic wires, are laid along the whole arterial system in all its minute ramifications, but that none are laid along the veinous system? I press this question:—Why do nerves attend the arteries, while none attend the veins? I answer, that nerves are laid along the arteries to receive the electric charge from the positive blood that rolls in them, which charge, the blood received from the air inspired by the lungs. But as the

veinous blood is negative, it has no electricity to throw off, and hence needs no attendant nerves to receive a charge; because that very electric charge, which the blood receives from each inspiration at the lungs, is thrown off into the nerves by friction, as it rolls through its destined channels in crimson streams. At the extremities of the arterial system, at the very terminus of its thousands of capillaries, the last item of the electric charge takes its departure from the positive blood, escapes into the attendant nerves, through them is instantly conducted to the brain, and is there basined up for the use of the mind."*

Thus have we found in the above, the first step of our doctrine, something similar to the discovery of arterial blood by Galen, a single part of a system, but so incomplete with regard to the whole, that there are in this ingenious theory, many points which remained unexplained, and some objections to it are unanswered. Thus our breathing electricity is quite correct, but as before stated we have another supply of electricity through our food, and we shall prove besides that Dr. Dods is mistaken when he considers *electricity*, *galvanism*, and *magnetism*, all as one element, but we have to point out another discrepancy in the remarks of the author, and to ask what becomes of that amount of electricity constantly propelled to the brain, particularly during the state of repose and sleep, when breathing constantly increases the supply, which is not spent by either volition or physical action? It is evident that something is wanted here to complete the *modus operandi* of the phenomenon.

M. Beckensteiner in his work entitled *Etudes sur l'Electricité, Nouvelle, Methode pour son émploi Médicale*, speaks also of a constant circuit of electricity rising from the extremities to the head. We borrow from him the following passage, which we translate from his work, page 97.

"In a perfect state of health, the nervous fluid pervades the whole organism; a constant slight current rises from the extremities to the brain, from which it is transmitted along the great nervous centre or spinal marrow to all the nervous system.

"In a state of disease, the feeble current of the extremities becomes stronger, and the repartition coming out of the brain is irregular and imperfect. The electricity which possesses the greatest analogy with the nervous fluid, if it is not

* See "Electrical Psychology," p. 63.

this very fluid itself, easily accounts for this unequal distribution. The heat of the body is equal everywhere, if there is an equal radiation of the nervous fluid; but the part where the fluid is deficient, is cold, and the heat is increased where it is in a greater amount. If a pain is felt somewhere, it is caused by an accumulation of nervous fluid, or by some heterogeneous substance which attracts it there. Electricity produces the same effect.

"In a state of health, neither the ascendant current or the one going from the head to the extremities through the spinal marrow are felt, but in disease, various sensations prevail and attest a derangement. At the beginning of a fever the patient complains of a chill and headache more or less intense; the head gets hot in proportion to the cold experienced in the feet. I have felt myself, on two different occasions, the effect of the ascendant current, vulgarly called shivering. A distinct current starting from the feet was gradually increasing from the legs to the thighs, up to the chest, and I could feel it perfectly passing through all the ramifications of the nervous system. A headache, more or less violent, was always the result of the ascendant current, and shivering, the cold of the feet, and the headache, were equally persisting all the time. I was not then able to continue my observation any longer, but, I believe that the ascendant current was going on till my feet got warm. The inequality of the repartition of the nervous fluid, is again observed in cases of paralysis and neuralgia.

"The inequality, or total deficiency of the passage of electricity, is correspondent with the state of the enervation; on the dead body. Electricity is the same in every part, the passage taking place only over the surface; but in the living body, the electricity is furnished by the internal organs. In paralysis, sometimes, the nerves of motion alone are affected, then the passage is feeble with comparison to that of the healthy organs. If the motive and sensitive nerves are both affected, the *circulation* of the nervous fluid is arrested in the rachidian system, and the passage of the nervous fluid only partially takes place, through the plexus and internal anastomoses. These symptoms are not evinced in paralysis only, but they are observed in a series of other affections, which seem to result from the unequal repartition of the nervous fluid; this is the reason why I always begin to examine the condition of the vertebral column,

and by re-establishing the passage of the electricity in that organ, I have cured various maladies.

"In neuralgia of the face, for example, the greatest portion of the nervous fluid is concentrated on the painful spot, and, during the sufferings of the patient, the passage of the fluid, along the spine is very feeble; but, as soon as the patient is relieved, the electric vibrations are perceived, but again cease if a new paroxysm take place.

"I have many times made this remark. A lady who was affected with a neuralgia of the right side of the face, embracing all the ramifications of the facial nerve, was labouring under great pain in all the teeth and inferior jaw. I noticed that the passage of the nervous fluid was extremely feeble along the dorsal vertebræ. A few sparks given with iode, followed with a gold conductor, took the pain away; the passage of the nervous fluid I found was then perfect along the cervical and dorsal vertebræ; a short time afterward, the pain reappeared in the superior maxilary bone, and the electric vibration of the spine disappeared again. The pain was again removed by the same means already employed, and the same result was manifested in the spine.

"This lady was constantly subject, before following my treatment, to cold feet, even when the temperature of the weather was from twenty-five to thirty degrees.* She had a cold spot as large as my hand in the dorsal region, and a burning heat in the sacrum, which used to disappear whenever the neuralgia came on. I have shown the coincidence of the enervation with the weakness or absence of electric vibration to all the patients who have taken the trouble of investigating this phenomenon, and every one has acknowledged the correctness of the facts advanced.

"There is no doubt that the condition of electric vibration will some day afford a new means of diagnostic for ascertaining the pathological alterations of either superficial or profound lesions."

These observations of M. Beckensteiner are founded on practical experiments, and leave no doubt about their correctness. We have been to Lyons for the purpose of visiting this gentleman, and have witnessed his operations and talked with his patients, who have derived much benefit from his treatment. M. Beckensteiner discarded entirely the use of galvanic electricity, and is therefore, very far from adopting the opinion

* Centigrade.

of Dr. Dods, that electricity, galvanism, and magnetism, are but one element. He, however, claims the discovery of his mode of electrization. The two gentlemen have worked the same idea in a different manner; still we dare say their doctrine is incomplete, as we trust to prove hereafter; also, as we have said before, we are inclined to claim for ourself the discovery of the circulation of electricity in the body, that is, it must be understood, as far as we are aware of, as we know of no one who has advanced the doctrine before us. Still we feel the necessity of being very cautious in such matters, considering that we were once thought to be the first discoverer of the electro-chemical bath, while it was at the same time in operation in America and Havannah; and when, on the other hand, we see M. Beckensteiner attribute to himself the discovery of the electric current, we are reminded that the same thing had been noticed before by Galvani, as will be seen by the following extract from Dr. Carpenter's "Manual of Physiology," with this difference however, that the first gentleman discovered it in the human body, whilst Galvani found it only in the frog.

"It was observed by Galvani, that there exists in the frog, during its whole life, a continual current of electricity, passing from its extremities towards its head; and as no such current has been detected in any other animal, it has been called the *courant propre*, or peculiar current of the frog; it bears this curious analogy to the electric discharges of fishes, that it is *not* manifested if the connection be made between corresponding points of the opposite side, but that it shows itself when the communication is made between points higher or lower in the body, whether on the same or opposite sides. There now seems reason to believe, however, from the observation of Mattencci, that this proper current of the frog is but a special case of the ordinary muscular current, depending upon the peculiar arrangement of the muscular and tendinous elements in this animal, both currents are alike influenced by agents which affect the vitality of the muscles; and it is curious that poisoning with sulphuretted hydrogen should almost immediately put an end to each, although ordinary narcotic poisons have very little influence.

Manifestations of electricity may be produced in most animals having a soft fur, by rubbing the surface, especially in dry weather; this is a fact sufficiently well known in regard to the domestic cat. Some individuals of the human race exhibit

spontaneous manifestations of electricity, which are occasionally of very remarkable power. There are persons who scarcely ever pull off articles of dress that have been worn next their skin, without sparks and crackling noise being produced, especially in dry weather, this is partly due, however, to the friction of the material with the surface, and with each other. But the case of a lady has been recently put on record, who was, for many months, in an electric state, so different from that of surrounding bodies, that, whenever she was but slightly insulated by a carpet or other feebly-conducting medium, sparks passed between her person and any object which she approached. When she was more favourably circumstanced, four sparks per minute would pass between her fingers and the brass ball of a stove, at the distance of an inch and a half. Various experiments were tried, with the view of ascertaining if the electricity was produced by the friction of articles of dress; but no change in these seemed to modify the intensity; from the pain which accompanied the passage of the sparks, this condition was a source of much discomfort to the subject of it." To the above facts, cited from Dr. Carpenter, we might add a great many others recorded by various authors, and some that we have witnessed ourselves, particularly of an old gentleman, a skilful chemist, to whom that science is indebted for several discoveries in the making of new chemical tests, and who was so charged with electricity, that by passing the hand over his head, his long white hair stood up, and crackling sparks were distinctly emitted.

We are no doubt authorised to take Dr. Carpenter's statement for granted, for at all events, those acquainted with electrical phenomena, will readily admit it. But since the discovery of the frog current by Galvani, which is now comparatively of old date, philosophers have progressed in their researches, and made new discoveries, which although, not generally known, are nevertheless as true as those that are fifty years old. We may at least admit them as well from one author as from another, particularly when they are equally learned and truthful. M. Beckensteiner, in the work we have already cited, says, that there exists a current of electricity in quadrupeds and human beings similar to the frog's current; he relates that he has made several experiments on various animals, that, by putting one hand on the chest of a cat, and making passes with the other along the spine, after a few passes, a shock was produced, so distressing to the

animal, that it flew away in the greatest stupor, and that if the operation is repeated the animal will pine away and die in a short time. He concludes from this experiment that the discharge of electricity deprives the animal of the quantum required for the vital functions, which cannot be performed, and hence death is the result. He has repeated the same experiment on a cow, and the shock was so powerful, that he was himself much distressed from it, while the beast was so infuriated, that he was in great danger of his life.

Having in the preceding pages given the opinions and experiments of several authors on a constant current of electricity in the living body, and having pointed out, that although we participate in the same idea, that, as the thing stands, it does not amount to a circulatory system; we have now to develop our own conception, and, so to speak, to make it work in all its branches, and to define its nature with such limitations, as establish the basis of a principle, which, on the one hand, demonstrates the relation of atmospheric electricity, with that contained in the human organism, and also the advantages which will arise from the adoption of this principle, for the prevention and cure of disease, and the preservation of life and health. Our first object, then, is to establish the fact that there exists in nature two different kinds of electricity, which we have called, for the sake of distinction, atmospheric and chemic electricity. The first being ever existent in the atmosphere, whilst the second is generated and evolved from chemical decomposition. Secondly, to prove that, contrary to the preconceived opinion of authors who consider them as identical, they are of a different nature and quality. Thirdly, to demonstrate that they exist separately in the human organism, exercising their different action, although, in some cases, they may mingle transitorally, in which case they produce abnormal results.

We shall begin with the atmospheric electricity, as being that fluid which regularly circulates in the body, and replaces the so-called nervous fluid, on which the organic phenomena, attributed to the nervous system, depends; showing thereby, that the two kinds of electricity, performing two distinct functions in the organism, cannot be employed indiscriminately as remedial agents, but that both to be useful must he applied according to their natural functions. Dr. Dods, who told us that electricity, galvanism, and magnetism, are the same, and

that it is absorbed by the lungs, has committed a serious error, as I shall prove in another chapter, and that this fluid is very injurious, and causes disease when introduced in the respiratory organs.

Let us now proceed in a rational way. The atmosphere contains electricity, we breathe it, and hence it is introduced into the lungs. Electricity and oxygen are thus absorbed by the blood, but as the atmosphere is the great agent in the process of vegetation, including the electricity, both again enter into the composition of the vegetable, and by the same process, into the flesh of cattle, of which our food is composed. In this way electricity is introduced into the stomach, and through the process of digestion becomes incorporated in the new blood, which, after passing through the heart, is sent to the lungs, and meets with additional electricity there. It then returns to the heart again, from which it is propelled to every part of the body, through the arteries and capillaries, when it is taken up by the nerves, as described by Dr. Dods, and conveyed to the brain; there it becomes the instrument of volition, that is, it is thrown by the will on the nerves, which carry it wherever we wish to produce a voluntary motion. It also oozes out through particular channels, and slides on along the involuntary nerves of the organs, which are not under the control of the will, such as the heart, the stomach, and intestines. But something more is required to account for the whole *modus operandi* of these phenomena, because, if this was the extent of the functions supplied by electricity, what would become of that incessant supply of the electrical fluid to the head? It is evident that a great accumulation would take place, and that the normal condition of the brain would be constantly subject to disturbance, unless by a wise provision of nature electricity has a regular circulatory system, and by constantly passing through the whole body, along every nerve and its most minute ramifications, returns by their anastomoses through the sensitive nerves to the fountain head. Thus, atmospheric electricity is constantly received into the system, constantly moving through the nerves of motion, and promoting the vital action of every part of the organism, and constantly returning to its reservoir the brain, by the nerves of sensibility. This explains at once the vital and moving principle, called vital spirit, by the ancients; the active principle,

vitalisation and movement, and the phenomenon of sensation; in the first instance, by its natural and continual passage from the head to every part of the body; in the second, by the interruption of the current, which is returning to the brain, causing thereby a vibration, either pleasurable or painful, which is felt in the *sensorium commune*. Thus, electricity is the nervous fluid, and indeed it cannot be otherwise, or else where would the nervous fluid come from. The nerves, as before mentioned, have no fluid, *sui generis*, and the brain has none, thus the fluid must come from somewhere. We breathe it from the common reservoir of nature, and this explains how our spirits are exhilirated or depressed by the climate in which we live, by the change of the weather, by the mutation of the atmosphere, in fact, according to the quantity of electricity which we receive. We find another analogy in the electrical with the sanguineous circulation, namely, that when it is either too active or too slow, regular or irregular, we may trace in these changes the cause of disease, and the means to be adopted for their cure. Diseases arising from a derangement of the circulation of the blood are cured by restoring the circulation to its normal condition, and those arising from the derangement of the electric circulation, are cured by restoring that circulation. But we must observe, that the derangement of the circulation of the blood is not a disease either of the heart, arteries, or veins; neither is a derangement of the electric circulation a disease of the nerves, which are but the conductors of the electric fluid; this, corroborated by practical experiments, becomes a question of the highest importance to all who are engaged in the treatment of disease.

These, then, are our ideas relating to this important matter. We repeat again, that should any one be able to *prove* that we are wrong, we shall be glad to surrender, and shall feel very much obliged to them for putting us in the right: in conclusion, we think that the remedy for the so-called nervous affection is atmospheric electricity, and thus it is that M. Beckensteiner has been so successful in his practice for the cure of nervous diseases. The disturbance of the electric circulation, which may be so easily deranged by a simple draught or cold, by a fall, by a blow, or a hurt of any nature, by mental anxiety, by abuses of any kind, is the cause of most nervous diseases. The space will not allow us to enter on more details; we can but advise our readers to think on the matter, and to read the books we have cited.

CHAPTER VI.

CHEMICAL ELECTRICITY.

We have already stated that there are two kinds of electricities entering into the composition, and contributing to the functions of the human organism. We have in the former part of this work given a sketch of the first, and shall now attempt an explanation of the other. The atmospheric electricity is that peculiar fluid which is the medium between spirit and matter, presiding over all the functions connected with the nervous system. The chemic electricity acts on matter itself, and is produced by the reaction of one atom upon another; chemical operation always implies substance and compounds; whilst atmospheric electricity is given to us ready-made. We wish this difference to be well understood, as it must be the key to our system. We need not say, that it is contrary to the opinion generally received, and that those who are already imbued by the preconceived ideas, may have some trouble in reconciling themselves with our view of the subject. But we do not write for bigotted minds, and trust that the right-minded will pause and reflect before giving their verdict. One of the objections which might perhaps be offered to our principle, is the action produced on the nerves by chemic electricity (galvanism), and to reconcile this with the fact that atmospheric electricity is the especial agent of the nervous system. It is well, therefore, to explain this fact, which is likely otherwise to lead to some mistakes. It is therefore essential to observe, that atmospheric electricity acts by the nerves on the muscles, by the will, causing voluntary motion; whilst chemic electricity, by acting mechanically on the molecules of the nervous substance, changes their situation, and becomes a mere mechanical stimulant. Their action therefore, is not of the same nature, and the *modus operandi* is different. Still it may be asked, how it is that galvanism cures paralysis? and we reply, because it removes the molecular substance, which prevents the circulation of the atmospheric fluid, and by restoring the normal state of the

tissues, and stimulating to action the part affected, it restores the general equilibrium. Thus, chemic electricity presents another series of phenomena that we may call material. The common way it is produced in our laboratory is by a galvanic battery; this necessitates, first, a trough; secondly, some diluted sulphuric acid; thirdly, two plates of zinc; and fourthly, a plate of platinised silver. The plates are immersed in the liquid, and the chemical decomposition of the zinc begins. It is that mere decomposition, which evolves the galvanic fluid, which is then collected by the silver plate which gives it off. This process is known almost by every one, and we do not therefore state it for the sake of information, but to show how complicated the production of chemic electricity is in comparison with the atmospheric electric fluid, and for the purpose also of showing their dissimilarity; but, wonderful to say, that this kind of electricity is at the same time effect and cause, and cause and effect. It is the result of decomposition, and becomes the cause of further decomposition, more and more powerful, by which air, water, salts, minerals, and metallic compounds, have been separated, decomposed, and reduced to their simple elements. The fact that this electricity destroys the power of cohesion is to be borne in mind, as we shall, when speaking of the phenomena of the electro-chemical bath, demonstrate that its efficacy to eliminate metallic substances from the body, more particularly depends on its power to overcome the virtue of chemical affinity, as it is called. It is needless to observe, only common things are not thought of, that the human organism, composed of so many various elements, constantly changing and decomposed, cannot cause their disintegration without evolving chemical electricity, and that when once produced, it increases in power and never stops from the beginning of life to its close, when each element, of which the body was composed, returns to its primordial state. It is well known to physiologists, that the substances of the nervous tissues are renewed, as well as the other portions of the organism; this change is the result of natural decomposition produced by chemic electricity. Here, therefore, we have a striking proof of the necessity for this kind of electricity in the system, because, if atmospheric electricity had the power of decomposing the living tissues, it is clear that by its rapid and constant motion it would soon destroy its conductors (the nerves). But the same wisdom which has provided the

wonderful dissolvent of the stomach (the gastric juice), has not permitted that it should dissolve the organ in which it is secreted; no more has nature, in the admirable arrangement she has provided for the preservation of the human organism, suffered any part to be injured by its own secretions, however elaborate and complicated the structure.

There is no doubt, that the chemistry of the human organism, is that branch of science which affords the most remarkable phenomena, and the most perfect result; this fact will be fully admitted, if we consider man altogether as the masterpiece of creation. We recollect that we have been told by a medical friend, that we were considering the human frame as if it was a piece of machinery; so we do, as the most perfect which we can conceive. So also do we consider it as the most perfect chemical laboratory which exists; and when we see it through the eyes of the mind, we are impressed with the beautiful operations of those laws, by which countless millions of atoms are constantly moving to some grand purpose. Galileo has proclaimed the rotation of the earth round the sun; has he seen it? Yet, as he said in his dungeon, when incarcerated for his belief—*still it moves;* and the earth was turning, and will ever turn; but the fact had never been before explained. Thus it is also that chemic electricity was known, but its *modus operandi* never understood. Our learned friend, M. A. Poey, in his letter, has given us many valuable hints on chemic electricity, and we beg our readers to return to it, and digest it well for the sake of the information it contains, but we do not ask that our friend should be believed on his word, and we shall offer, as a corroborating proof of what we advance, the following remarks taken from an English work of great authority which we have already mentioned—"The Manual of Physiology," by Dr. Carpenter. Speaking of electricity as a condition of vital activity, page 85, art. 142, he says:—"Much less is certainly known with respect to the ordinary influence of this agent, than in regard to either of the two preceding (light and heat), and yet there can be little doubt, from the effects we observe, when it is powerfully applied, as well as from our knowledge of its connection with all *chemical* phenomena, that it is in *constant though imperceptible operation.*

"Electricity differs from both light and heat in this respect, that no manifestation of it takes place so long as it is uniformly

diffused, or is in a state of *equilibrium;* but in proportion as the equilibrium is disturbed by a change in the electric condition of one body, which is prevented, by its partial or complete insulation, from communicating itself to others in that proportion is a *force* produced, which exerts itself in various ways according to its degree.

"The *mechanical* effects of a powerful charge when passed through a substance that is a bad conductor of electricity, are well known; on the other hand, the *chemical* effects of even the feeblest current are equally obvious. The agency of electricity in producing chemical change, is the more powerful, in proportion as there is already a predisposition to that change; thus, the largest collection of oxygen and hydrogen gases, or of hydrogen and chlorine, mingled together, may be caused to unite by the minutest electric spark, which brings into the condition required for their active exercise the mutual infinities that were previously dormant. Hence it cannot but be inferred, that its agency in the chemical phenomena of living bodies must be of an important character; but this may probably be exerted rather in the way of aiding decomposition, than of producing new combinations, to which (as we have seen) light appears to be the most effectual stimulus. Thus, it has been shown that pieces of meat that have been electrified for some hours, pass more rapidly into decomposition, than similar pieces placed under the same circumstances, but not electrified. And in like manner, the bodies of animals that have been killed by electric shocks, have been observed to putrify much more readily than those of similar animals killed by an injury to the brain. It is well known, moreover, that in thundery weather, in which the electric state of the atmosphere is much disturbed, various fluids containing organic compounds, such as milk, broth, &c., are peculiarly disposed to turn sour; and that saccharine fluids, such as wort of brewers, are extremely apt to pass into acetious fermentation.

"143. The actual amount of influence, however, which electricity exerts over a growing plant or animal, can scarcely be estimated. It would, perhaps, be the most correct to say, that the state of electric equilibrium is that which is generally most favourable; and we find that there is a provision in the structure of most living beings for maintaining such an equilibrium, not only between the different parts of their own bodies, but also between their own fabrics and the surrounding

medium. Thus, a charge given to any part of a plant or animal is immediately diffused through the whole mass; and though organised bodies are not sufficiently good conductors to transmit very powerful shocks without being themselves affected, yet a discharge of any moderate quantity may be affected through them, without any permanent injury, and this more especially if it be made to take place slowly. Now, the points on the surfaces of plants appear particularly adapted to effect this transmission; thus it has been found that a Leyden jar might be discharged by holding a blade of grass near it, in one third of the time required to produce the same effect by means of a metallic point; and an electroscope, furnished with vegetable points, has been found to give more delicate indications of the electric state of the atmosphere than any other. Plants designed for a rapid growth have generally a strong pubescence or downy covering, and it does not seem improbable that one purpose of this may be, to maintain that equilibrium between themselves and the atmosphere, which would otherwise be disturbed by the various operations of vegetation, and especially by the process of evaporation, which takes place with such activity from the surface of the leaves.

"144. There appears to be sufficient evidence that, during a highly electrical state of the atmosphere, the growth of the young shoots of certain plants is increased in rapidity; but it would be wrong thence to infer that this excitement is useful to the process of vegetation in general, or that the same kind of electric excitement universally operates to the benefit or injury of the plant. From some experiments recently made, it would appear that potatoes, mustard and cress, cinerarias, fuschias, and other plants, have their development, and, in some instances, their productiveness, increased by being made to grow between a copper and a zinc plate, connected by a conducting wire; while, on the other hand, geraniums and balsams are destroyed by the same influence. The transmission of a series of moderate sparks through plants, in like manner, has been found to accelerate the growth of some, and to be evidently injurious to others. It is not unreasonable to suppose that, as a great variety of chemical processes are constantly taking place in the growing plant, an electric disturbance, which acts as a stimulus to some, may positively retard others; and that its good or evil results may thus depend upon the balance between these individual effects. This would

seem the more likely from the circumstance that, in the process of germination, the chemical changes concerned in which are of a simpler character, electricity seems to have a more decided and uniform influence. The conversion of the starch of the seed into sugar, which is an essential part of this change, involves the liberation of a large quantity of carbonic and of some acetic acid. Now, as all acids are negative, and as like electricities repel each other, it may be inferred that the seed is at that time in an electro-negative condition; and it is accordingly found that the process of germination may be quickened by connection of the seed with the negative pole of a feeble galvanic apparatus, whilst it is retarded by a similar connection with the positive pole. A similar acceleration may be produced by the contact of feeble alkaline solutions, which favour the liberation of the acids; whilst, on the same principle, a very small admixture of acids in the fluid with which the seed is moistened, is found to produce a decided retardation.

"145. It is well known that trees and plants may be easily killed by powerful electric shocks, and that, when the charge is strong enough (as in the case of a stroke of lightning) violent mechanical effects—as the rending of trunks, or even the splitting and scattering of minute fragments—are produced by it. But it has also been ascertained, that charges which produce no perceptible influence of this kind, may destroy the life of plants, though the effect is not always immediate. In particular it has been noticed, that slips and grafts are prevented from taking root and budding. There can be little doubt that, in these instances, a change is effected in the chemical state of the solids or fluids, although no structural alteration is perceptible.

"146. In regard to the influence of electricity upon the organic functions of animals, still less is certainly known; but there is evidence that it may act as a powerful stimulant in certain disordered states of them. Thus, in amenorrhœa, a series of slight but rapidly repeated electric shocks will often bring on the catamenial flow; and it is certain that chronic tumours have been dispersed, and dropsies relieved by the excitement of the absorbent process, through similar agency. In fact, there is strong reason to believe that electricity may be advantageously employed remedially in many states of disordered nutrition, in virtue of its power of modifying the operations of the vital forces.

"147. The closest relations of electricity, however, are with the proper animal functions; for these, as will be shown hereafter, are more directly and obviously subject to its influence, than are the organic. Thus electricity, when transmitted along a nerve, whether sensory or motor, a nerve of 'special' or one of 'common' sensation, is capable of calling forth all the actions of which that nerve is the instrument, and, when brought to bear on a muscle, it immediately excites a contractile movement. It is probably through the influence of this agent upon the nervous system, that electric states of the atmosphere induce in certain individuals a degree of languor and depression, which cannot be accounted for in any other way. An instance is on record in which the atmosphere was in such an extraordinary state of electric disturbance, that all pointed bodies within its influence exhibited a distinct luminosity; and it was noticed that all persons who were exposed to the agency of this highly electrified air, experienced spasms in the limbs and an extreme state of lassitude.

"148. Animals, like plants, are liable to be killed by shocks of electricity, even when these are not sufficiently powerful to occasion any obvious physical change in their structure. But as formerly mentioned (section 69), there can be no doubt that minute changes may be produced in their delicate parts, which are quite sufficient to account for the destruction of their vitality, even though these can only be discerned with the microscope. The production of changes in the chemical arrangement of their elements is, however, a much more palpable cause of death, since it may be fully anticipated beforehand, and can easily be rendered evident. To take one instance only, it is well known that albumen is made to coagulate, *i.e.*, is changed from its soluble to its insoluble form, under the influence of an electric current; and it cannot be doubted that the production of this change in the fluids of the living body (almost every one of which contains albumen), even to a very limited extent, is quite a sufficient cause of death, even in animals that are otherwise most tenacious of life. 'I once discharged a battery of considerable size,' says Dr. Hodgkin, 'through a common earthworm, which would, in all probability, have shown signs of life long after minute division. Its death was as sudden as the shock, and the semi-transparent substance of the animal was changed like albumen which has been exposed to heat.'

Of Moisture, as a Condition of Vital Activity.

"149. Independently of the utility of water as an article of food, and of the part it performs in the chemical operations of the living body, by supplying two of their most important materials (oxygen and hydrogen), there can be no doubt that a certain supply of moisture is requisite, as one of the conditions, without which no vital actions can go on. It has been already remarked, indeed, that one of the distinguishing peculiarities of organised structures, is the presence in all of them of solid and liquid component parts; and this in the minutest portions of the organism, as well as in the aggregate mass. And in all the vital, as well as in the chemical actions to which these structures are subservient, the presence of liquid is essential. All nutrient materials must be reduced to the liquid form, before they can be assimilated by the solids; and, again, the solid matters which are destined to be carried off by excretion, must be again reduced to the liquid state, before they can be thus withdrawn from the body. The tissues in which the most active changes of a purely vital character are performed, namely, the nervous and muscular, naturally contain a very large proportion of water; the former as much as 80, and the latter, 77 per cent. On the other hand, in tissues whose functions are of a purely mechanical nature, such as bone, the amount of liquid is as small as is consistent with the maintenance of a certain amount of nutrient action in its interior. By the long continued application of dry heat to a dead body, its weight was found to be reduced from a hundred and twenty pounds to no more than twelve; so that, taking the average of the whole, the amount of water, not chemically combined, but simply interstitial, might be reckoned at as much as 90 per cent. It is certain, however, that much decomposition and loss of solid matter must have taken place in this procedure; and we shall probably estimate the proportion more accurately, if we regard the weight of the fluids of the human body as exceeding that of the solids by six or seven times."

We have again seen in the foregoing remarks, which forcibly corroborate the chemical functions of the organism, that the author does not make any distinction between the

two kinds of electricity, and no doubt this is the reason why, when he speaks of experiments made on plants, he tells you that one experiment has succeeded, when another failed. He tells you that a blade of grass placed near a Leyden jar, has taken up the electricity it contains in one third of the time any other kind of conductor would do; the fact is very interesting, as it proves the great affinity of vegetable matter for atmospheric electricity; it being this kind of electricity which is contained in the jar, having been collected from the atmosphere by the electrical machine. Thus it shows that free electricity as we may also call it, is equally allied with both organised kingdoms, the vegetable and animal. But we have here to observe, that the rules of adaptation are equally applicable with both. We see that atmospheric electricity is beneficial to plants when applied by the leaves, which are their respiratory organs, when free or atmospheric electricity passes through the channels nature has prepared for its admission; but when chemic electricity is applied in the same way, then it becomes, as proved by the experiments, prejudicial. It is however, very likely that if chemic electricity should be conveyed to the soil, instead of directly to the plant, it would prepare its nutrition by decomposing the elements, and then it would be in harmony with the principle we have established, and answer the desired effect. We are too much engaged now to spare the time for such experiments, but if ever we have the leisure, we intend to do it. Meanwhile, as we have pointed it out, it may be an agreeable pastime for those who take a pleasure in the study of natural phenomena.

We must say, that the more we consider the matter, the more we are satisfied of the correctness of our ideas. For example, Dr. Carpenter tells us that a plate of zinc, and one of copper, have been introduced into a flower-pot, which accelerated the growth of the plant it contained; this is a very strong evidence of the truth of our remark. The zinc and copper produce chemic electricity, which dissolves the salts contained in the mould. The roots of the plants are the conductors which absorb it, and thus the nutrition of the plant is increased. Thus we see in the learned author's remarks two things, namely, the beneficient effect of atmospheric electricity on plants when absorbed by the portion out of the soil, and the beneficial effect of chemic electricity, when applied to the soil, which corroborate what we have said

at the beginning, namely, that atmospheric electricity descends from above, and chemic electricity ascends from beneath.

We see again that Dr. Carpenter is doubtful about the action of electricity on the human organism. We venture to assert that it is exactly the same as on a vegetable production, which may be very easily conceived if our explanation be attended to. Dr. Carpenter tells us, and this is acknowledged by every physiologist, that there exists two different actions in the organism, namely, the animal functions and organic functions. What is the real distinction between these two lives, as it is called by some authors? The first, that is the animal life, is dependent on external influences, or those organs which hold us in relation with the external world, such as the lungs, the skin, the mucous of the organs, volition and motion, on which atmospheric electricity exercises its immediate influence. The second, or organic life, is dependent on the condition of the substances composing the organs themselves, which depends on chemical aggregation, decomposition, renewal, and repair, without which they could not exist. Thus, the living organism, in common with plants, require both atmospheric and chemic electricity, in the same manner, for its growth, development, preservation, and the performance of its natural functions.

It is astonishing to the free thinking and unprejudiced observer, to perceive how inconsistent some authors are in their remarks. We find in a pamphlet entitled "Practical Observations on Galvanic Electricity and Electro Magnetism," written by John Palmer Tyke, of Bath, that, notwithstanding the title of his work, he begins the first chapter by common electricity as he calls it in opposition to galvanic electricity; and then, without perceiving his error in confounding two things essentially distinct, says:—"To apply electricity to different parts of the body, a very simple apparatus is required: a few straight and curved directors, or rods of brass surmounted with brass balls and wooden points, and fixed in glass handles, suffice for most cases; they are connected with the prime conductor by common bell-wire, or brass chain, the patient in some cases being seated on a chair with glass legs, or, which is more convenient, on a chair, the legs of which rest on four thick cups of glass."

Let us now take a rapid glance at some of the diseases, in the treatment of which frictional electricity has been found of

the most efficient service; so much so, indeed, as to make it really a matter of the greatest wonder, that there should be found in these enlightened days, any professing the healing art who still continue to deny the efficacy of this powerful agent. We might fill our little work, even were it ten times its size, with well authenticated accounts of cures effected by this form of electricity, in obstinate cases of almost every kind; our limits will, however, only allow of our directing attention to a few of the most remarkable, which may be found in the "Philosophical Transactions," and the "London Medical Journal." The cases which appear the most striking and unobjectionable, and which will illustrate the extraordinary success which may attend the judicious employment of electricity are the following:—1. Paralysis; 2. Tetanus; 3. Muscular Contractions; 4. St. Vitus's Dance; 5. Neuralgia; 6. Amaurosis; 7. Deafness.

I. PARALYSIS.—The following is from the "Philosophical Transactions," vol. 1, p. 386. A woman, in the prime of life, was attacked with paralysis, under which she gradually lost the use of her limbs, and all sensation of the left side. Her head was palsied, her tongue shook, and her eye-sight was beginning to fail. Her father had previously fallen a victim to the same dread disease. In this distressing state she was brought to the Rev. Mr. Brydone, a philanthropic gentleman, who was devoting himself to the pursuit of medical electricity. He determined on trying the effects of shocks from the Leyden phial. We are not told the size of the jar he used, but we may here mention, once for all, that powerful shocks in these, and indeed in all cases, should be carefully avoided, and the electrician will rarely require a jar having more than *one square foot of coated surface.* Several severe shocks were communicated, which seemed to raise her spirits. She said she felt a heat and pricking pain in her left thigh and leg, which gradually spread over all the side, and, after undergoing the operation a few minutes longer, she "cried out with great joy that she felt her foot on the ground." This was a great encouragement to proceed. Two hundred smart shocks were administered, under the influence of which the palsy of the head yielded; and, from being a perfect cripple, she was able to stand without support. The next day, being electrified as before, "she walked without a stick, and could lift several pounds' weight with her palsied hand;" the experiment was repeated on the

third day, by which time she had received in all upwards of six hundred shocks; when, declaring herself to have as much power on the left side as on the right, she was pronounced cured.

The truth of this most extraordinary case is attested by the minister of Coldingham, in Berwickshire, and by a letter from Dr. Whytt to Dr. Pringle. After reading it, what man of sense and reflection will refuse to make a trial of an agent so readily commanded, and which, if it does no good, can possibly do no harm, in a disease which has hitherto baffled all the resource and ingenuity of the physician? We had noted several other cases, almost as remarkable as the foregoing, of the successful employment of *frictional electricity* in paralysis, but we find we must content ourselves with referring those who may desire further proofs to the passage in the journals above referred to, and to Mr. Donovan's Essay in the "Dublin Medical Journal;" and also to a case of tetanus, almost miraculously cured, related by Dr. Watson, "Philosophical Transactions," vol. 53, p. 672.

We shall not, therefore, relate the remaining cases, as they would occupy more room than we can dispose of. Our object in reporting the above, was not so much to prove the value of electricity, as to point out the inconsistency of the author taking for a title, *Galvanism, Electricity, &c.*, when, according to our denomination, galvanism is *chemical electricity;* and he begins his book by cures obtained with *frictional electricity*, which we distinguish by the name *atmospheric electricity*. We shall terminate our quotations by putting under the eyes of our readers a beautiful article taken from the "American Practice of Medicine on Reformed Principles," by W. Beach, M.D., Member of the Medical Society of the City of New York; Professor of Clinical Practice in the Eclectic Medical Colleges of Cincinnati and of Syracuse; Correspondent Member of the Royal College of Physicians and Surgeons of Berlin and Prussia; and it is almost by chance that it came in our mind to ascertain if the learned author of the eclectic system had devoted some attention to electricity, when, to our great gratification, we found the following remarks:—

MEDICAL ELECTRICITY.

GALVANISM.

"As the Creator has formed all substances upon this, our habitable earth, out of such few materials that, even with our present imperfect chemical skill, we have been able to reduce them to fifty-two elements, and as it is likely, as our progress in chemical analysis advances, we shall find this number much reduced; so in this same point of view it is interesting to notice that electricity of the same atmosphere, that invisible and extraordinary agent, which is at once a terror and the ornament of the sky, as developed in auroræ or in lightning, which is with much probability believed to be the safety of the mariner on the boundless ocean, which is essential to the purity of our atmosphere, and formed the crystalline beauty and treasure of the mineral kingdom; thus bending chemical effects to its power, is the result of the action of one body on water, and that body the same which maintains the planets in their orbits, the sun, the centre of the planetary system. When so many effects are thus seen to result from the action of one body, the sun, and when we know that its light and heat are necessary to the existence of every organised being, in the planetary system, what an idea becomes impressed upon us of the existence of the Great Disposer of all things; well may we exclaim, in the language of the poet:—

"'His wisdom guides the rushing wind,
And tips the bolt with flame;
His goodness breathes in every breeze,
And warms in every beam.'

"Neither is this universality of action peculiar to the great luminary we have been speaking of, but is common to all the great agents in nature, and even those of a secondary character. Thus we see the multiplied offices of the atmosphere, the moon, &c., indeed this is obvious.

"It is well known that electricity is one of the most subtle and powerful agents in nature, and it would appear that it is not only the great principle that supports the whole planetary world, but that it keeps them in order or in their several

spheres, by the specific laws which govern it—that it sustains perpetuates, and is the origin of life, both animal and vegetable, that the whole creation, including every substance, is filled with it, and that it is ordinarily diffused in all animate, inanimate, or inorganic bodies. When this is the case, there is uniformity in all the laws of nature; but when there is an unequal distribution of this fluid, or the balance is deranged, or when one body contains more of it than another, then an instantaneous and powerful action takes place in the laws of nature, causing great commotion or convulsions. The dreadful thunder is then heard, and the vivid lightnings flash. These phenomena are produced in consequence of antagonistic objects being unequally charged with electricity. The lower clouds that pass over the earth are surcharged with it, it is thrown or passes to the earth to restore the loss of balance, and when it passes it becomes visible to the eye in the shape of lightning. The experiment of Dr. Franklin, who it is said drew lightning from the clouds, is illustrated in the same manner. An account is given of a ship at sea, in which the lightning passed from the clouds to the water, and back again from the water to the clouds, by the conducting medium of the masts and ropes of the vessel; when the clouds contained a greater quantity of electricity than the water, it descended; and when the water contained more than the clouds, it ascended, to equalise the fluid, or restore the loss of balance. This is also shown by the experiments of the electrician, who passes the fluid from jar to jar at pleasure.

Is not this electricity, then, the *primum mobile* of the human system? Is it not the source of life, and of every action and movement of the body? It appears that the brain is nothing more or less than a galvanic battery, having positive and negative poles. It produces the action of the heart, propelling the blood to every part of the body, and then, as Dr. Hammond has further very scientifically suggested to me, it sends the blood back again to the heart, by an inherent law peculiar to itself, by which it returns in a circular or concentric sphere; and that every motion, nervous and muscular, is derived from this all powerful and wonderful agent.

Even before the present century, when that form of electricity was alone known, which is developed by the friction of glass and silk, the rapidity with which volition was transmitted along the nerve to the muscles, had induced many persons to

suppose that this was the agent employed by nature to traverse the high road of the nerves as messengers of its will, and it was then remarked by these observers, that these latter bodies were by far better conductors of electricity than any other portion of the human frame. It was subsequently observed that a strong spark or passage of electricity along any nerve, called its dependent muscles into action. These facts, combined with others, led many, even at that early period, to believe that the nervous influence and electricity were identical; still, it was difficult to conceive, how electricity of such high tension could exist in the human body, the fluids of which endow the entire with the power of electrical conduction. But, when the genius of Volta had, at the commencement of the present century, unfolded to the world a new form of electricity, of tension so low that, with the exception of the nerves, which are excellent conductors, the animal solids would transmit it with difficulty; and when it was further seen that this new form of electricity, thus developed in a state of tension, so low as to be quite consistent with the structure of the human body, exerted on the muscles, when transmitted to them by the nerves, a stronger action than frictional electricity had ever done; and further still, that animal matter alone, independent of metals, could constitute an arrangement capable of developing this electricity, the electro-nervous theory received a great accession of probability. And when, at a period a little later, Sir Humphry Davy, Wollaston, Cruikshank, and others, had shown that this electricity of low tension was capable of decomposing saline fluids, and of eliminating their acid constituent at one extremity of the arrangement, and their alkaline at the other, it was soon seen that the secretion of our most important organs, as of the skin, stomach, liver, intestinal canal, &c., might be the result of the electrical condition of these organs impressed upon them at birth by Divine Power, and hence, after the discovery of electro-magnetism, by Oersted, the galvanometer was proposed as a means of ascertaining whether or not these organs, whose secretions are characterised by opposite chemical qualities, were not also in opposite states, and the result of this beautiful test was strongly confirmatory of this theory, for these organs all indicated opposite electric states, whose secretions were of opposite chemical natures. Thus the skin, whose secretion is acid, indicated positive electricity when examined by the galva-

nometer; the intestinal canal indicated negative electricity, and its secretion has been proved to be alkaline, except in the stomach, where it is acid, and there it indicates positive electricity. The stomach was found to be in one electric state, the liver in the other, the chemical nature of the secretions of each organ always according with that character which should result from the peculiar electric polarity in which the organ was found by the galvanometer to be.

We are led, by the experiments of Dr. Philip, of England (on the identity of the nervous influence and electricity), and the amply proved existence of hydro-electric currents circulating between the organs of secretion (as shown by Le Donne, Marianina, Orioli, and Becquerel), to see that the processes of secretion and digestion are hydro-electric phenomena, and thence to appreciate the importance of judiciously administered electricity of low tension, in restoring a healthful condition to the secreting and digestive organs, and to witness the greatly increasing probability, that in all cases of secretion, digestion, sensation, and motion, electricity is the great natural agent, and is identical with the nervous influence.

We have reason to believe that the vital electric current, which M. Prevost has shown to accompany motion in the living animal, is really the cause of all human motion, and are led to look with confidence to the use of artificial electricity, as a means of restoring the powers of voluntary motion, to such parts of the human body as have become partially and recently deprived of it, in consequence of paralysis of the motor nerves, arising from either slight structural alteration, or deficient power of setting into motion the natural electric fluid at their origin.

But we now come to apply this principle to disease. And first, may not health depend upon an equal distribution of this fluid? When it is lost or suppressed, or in any respect injured, the stimulus imparted to the secretions is measurably withdrawn, and they become incapable of performing their offices, by which excrementitious materials are retained by the system, and the blood becomes determined to different organs, causing congestion and inflammation. And does not this theory accord with our pathological views? For, under these circumstances, we can restore these suppressed secretions, by the application of heat or vitality, which is synonymous with electricity. Then, if the theory be true, that acute diseases

arise from the excess of electric fluid, and chronic diseases from a deficiency, are we not instinctively led to apply it for the removal of disease? And although it has been so highly extolled, and so frequently recommended, has not the partial benefit only been derived from the want of a judicious and skilful application of it? We have been inclined to believe this; and great light has been cast upon the subject by my friend, Dr. Miller, of this city. By a judicious and extended course of experiments, he informs me that he has been very successful in a great variety of diseases. He has discovered a method of applying magnetism different from anything I have seen or read of. By using the common small magnetic apparatus, he isolates himself and passes the fluid from himself to the patient, and also by the direct application of the machine to the naked surface of the body. He forms his diagnosis of disease by the same means, and its application produces the most peculiar and increasingly painful effect over the region of organs which are diseased.

This subject deserves further investigation, and every student should have a small cheap machine, and use it as an auxiliary, with other remedies.

Water is a fine conductor of electricity, and it may be owing to this, that when the body is bathed with it in fevers, the superabundance of heat or electricity is rapidly thrown from the body through this medium, whereby the bodily temperature is equalised. This fluid penetrates every organ and tissue of the body, and by its subtle and permeable influence is well calculated to remove obstructions. An artist in this city is now constructing an apparatus by which he intends to force medicines into the system! Mesmerism, which is now so often indicated, exerts an influence on the system, and its application has and may control disease. We have some well authenticated cases, wherein this principle has been successfully applied for the cure of disease, and it is a subject which merits further investigation.

The following remarks on the subject of electro-magnetism are contained in a letter from Dr. Edward S. Clarke, of Dublin, to Dr. Graves:—

"The results of electro-magnetism in the Meath hospital cases, include amaurosis, ptosis, complete paralysis of right lower extremity, partial paralysis of both lower extremities, complete paralysis of right arm, lumbar rheumatism, sciatica,

neuralgia, femoral and brachial, œdema, catamenial suppression and irregularity, spinal irritability. In fine, even in the short time I have had the honour to act under the guidance of the physicians of Dublin (only three months), I have verified nearly all the efficacy which has hitherto been attributed to this science; and great as I have shown its importance as a medical agent, to be even in the narrow limits as yet assigned to it by the profession, I feel assured that it will soon be found applicable to a far more extensive range of diseases, and that higher triumphs await its progress, when it shall have been employed by the profession, to stimulate the functional performance of more important organs than those to which it has as yet been applied. This opinion I found, on a deliberate consideration of the theory which has led to its adoption as a medical agent, namely, its identity with the nervous influence.

"With reference to the facility with which electricity removes various forms of disease, I believe I may remark, that I have found it to act more quickly in neuralgia than in any other, as it occasionally cures some varieties of this disease in two or three applications, but in others it often requires a feeble electrical current for many successive days.

"Next, in order of facility, come rheumatism and sciatic cases, then cases of deafness. After these come some varieties of catamenial suppression. It also acts readily on some curable forms of amaurosis, then in partial paralysis, and with greater difficulty in hemiphlegia than in almost any other form, as this requires many weeks of daily and perhaps constant application, by means of the sustaining battery. And here I may mention, as an instance of the value of electric treatment, that in this disease I have always found those muscles soonest restored to voluntary power to which electricity had been the more constantly applied."

In the remarkable illustration given by Dr. Beach, on the connection of electricity with the human organism, and its therapeutical virtue for the cure of disease, we have but to admire the skill and conciseness with which the author has developed the virtues, power, and wonders of the electric fluid. We beg, however, to observe that, in common with those who have written on the subject, Dr. Beach has fallen in the same error, while he presents at the head of his article, *galvanism*, as medical electricity (chemic electricity), he begins, as Mr. Palmer Tyke has done in the preceding quotation, by giving

a description of the phenomena of atmospheric electricity, so far, a very correct and beautiful one; then, further on, he tells us that Volta has unfolded to the world a new form of electricity; here then is the inconsistency, because, if it is new, it must be another thing, not like the old one. It is logically evident that an electric fluid manufactured by particular means, and presenting a particular order of phenomena, cannot be identical with the ever existing, free, atmospheric electric fluid, to which it is compared. We are very anxious, on our part, to establish the distinction existing between these two kinds of electricity, not for the mere purpose of pointing out the mistake of our predecessors, but because of the resource it would afford to the medical electrician, in the choice of that electricity, which should, in reality, be better applied for the prevention or cure of a certain class of diseases. We must, however, repeat, that in entering on this subject, our intention was merely to treat of this class of phenomena, which were illustrative of the *modus operandi* of the electro-chemical bath, and that we have been carried on further than we expected, being prompted to do so, in consequence of the discrepancies to be met with in the works of those writers who have preceded us in the same career; and as almost every one of them is a man of repute, and deserved consideration, we did not see any other way to substantiate our opinion, but by being sufficiently explicit in our remarks, so as not to remain under the jurisdiction of an acknowledged scientific authority, but to take our place amongst that portion of the community *who can, and will reason.*

Neither was it our intention to treat of the science of electricity in general. We have thought it desirable, for the information of the reader, who may previously be unacquainted with it, to give the development of our own system as fully as our space would permit; also, the acknowledged facts relating to electricity, elicited by various citations from authors of repute, and shall terminate our quotations by the following, taken from the *Dictionnaire Pittoresque, d'Histoire Naturelle et des Phénomenes de la Nature.* We translate from Vol. 3, p. 10:—"Friction is the most ancient and more common way of producing electricity; however, it is not the only means by which it is elicited. It is known to result also from the fusion and melting of bodies, from their pressure, their chemical reaction, their change of temperature, their passage from the solid state

to liquid, and from liquid to the gaseous condition; also, from the contact of their surfaces. In fact, all bodies, either simple or compound, solid, liquid, or gaseous, are equally susceptible of acquiring electric properties." We find again, in one of the last numbers of the *Cosmos, Revue Encyclopédique Hebdomadaire, des Progres des Sciences, &c.* "That even the mere friction of running water along the bank of a river, is one cause of the production of electricity. This fact was the subject of a paper read at the Academy of Sciences, in Paris. If I have been well understood in my previous observations, it will be conceived at once that the electricity by friction, is the atmospheric electricity, either produced by the motion of the electrical machine, or by the friction of water or anything else. It may be breathed with advantage, and be beneficial to the system, whilst the electric fluid, arising from the fusion of bodies, chemical reactions, and the like, must prove injurious to the lungs.

We shall try now to define the relation of chemic electricity with the organism, and how it is produced, as well as its physiological action. The living body is a congeries of atoms from the smallest hair to the toe nails. The whole assemblage of the human structure is but a composition of the smallest particles the mind can conceive of; every one of them being but a portion of the substances introduced into the body. Should these molecular substances be immovable, it is evident that when the body is entirely formed and complete, not only should we not require to eat any more, but that we could not do so. However, we do eat. Then comes this simple question:—how is it possible to admit more substances into a receptacle which is already full, unless we take out a portion of what it contains? We need not answer the question. We have only to explain how, by the wise provision of nature, this wonderful phenomenon is accomplished. The first cry of a new-born child is, as it is well known, the result of the introduction of air into the lungs, and with it the atmospheric electricity it contains. Such is the first impetus of the human machine. At the same moment that the air rushes into the respiratory organ, the chest heaves, and circulation begins. The great spring of life is wound up: the pendulum moves, and the beating of the escapement of the heart is heard. At the same moment again, organic chemistry begins its work. The milk sucked is decomposed and turned into blood; the blood is metamorphosed into the vari-

ous tissues of the body. The glands draw from the sanguineous fluid the various secretions of the organism, even the calcareous substance drawn from the blood, or deposited in the cartilages, intended to form the bones. Motion, friction, decomposition, transformation, organisation, go on; each of those actions, as we have demonstrated before, evolve and generate electricity. When once produced, it becomes by itself an agent of decomposition, distinct in its action, and whilst atmospheric electricity contributes to the introduction of new elements, chemical electricity removes the old ones, so far as is consistent with the condition, development, age, and nourishment of the child. We shall pass over all the phases of the vegetative life of the half-formed being; we want only for the present to point out that the admission into the organism, of atmospheric and the generation of chemical electricity begin with life; that at its commencement it is intended for its development, and hereafter for the repair of the organism. We wish to inculcate, that without this wise provision of nature, by which the change and renovation of the whole system is kept up, no repairing process could exist in the organism; that a broken bone could never be repaired with new materials, nor the accumulation of the new substance employed for its repair reduced to its natural size and shape.

We wish to impress our readers with an idea of the beauty of the chemistry of nature, which, as we know, is the generator of chemical electricity, to which we might again give the name of *organic electricity*, in order to make the expression more comprehensive.

Chemic electricity differs, therefore, from atmospheric electricity in this respect, that it is the result of the decomposition of substances previously existing, and without which, this fluid could not be manufactured, whilst atmospheric or free electricity exist by itself, entirely independent of any other conditions. We have explained already in the preceding chapter how it is introduced in the organism; how it acts as the medium between spirit and matter; how it is the instrument of volition; how it forms by itself the fluid, formerly called "nervous fluid;" and how its functions are direct and confined to the nervous system. We have also philosophically demonstrated the necessity of its circulation, and have now to demonstrate by experiment that this kind of electricity, when received from without, combines with the living tissues of whilst it

increases the chemical decomposition, and in this resides its therapeutic and medicinal value. We have now to inquire into its mode of action. What becomes of this fluid, and where is it located in the body? Strange to say, that on this subject, we are indebted for our best information to M. Beckensteiner, already cited, for his application of atmospheric electricity in the cure of diseases; and who, with striking inconsistency, repudiates galvanism in his treatment. We beg, sincerely, pardon of these gentlemen for the remarks we are compelled to make on their works: we can assure them that we are not prompted by the love of criticising, nor the intention to diminish, in the public opinion, the credit they deserve for their labours, and the light which they have thrown on this branch of scientific researches; but should we, for the sake of decorum, restrain our own ideas, it would, as a matter of course, prevent us from substantiating the facts we have advanced.

The first thing we have now to bring forward is the great discovery of *Pacini's Corpuscules*. M. Beckensteiner, who has carried further than any one else, we believe, the investigation of this subject, furnishes us with the most interesting details concerning it, but as they occupy forty-eight pages of text, to which the reader may refer for information, we shall content ourselves by relating merely such extracts as bear more particularly on the matter on which we are treating. Dr. Pacini, of Pistora, in Italy, appears to be the first discoverer of small bodies; they have been noticed also by other physiologists, but were in the first instance considered by some as being abnormal pathological productions, some others took them to be nervous ganglia; amongst the observers who have acknowledged the existence of these little bodies, are Drs. Andral, Camus, Lacroix, Cruveilhier, Blandin, and other distinguished gentlemen; the small bodies are known now by the denomination of Pacini Corpuscules; they are found not only in the human body, but also in mamifarous animals; they differ entirely from nervous ganglions, and are found dispersed over the body, but particularly in the members, and in greater number near the articulations. M. Beckensteiner, who is indefatigable in his researches, found by microscopic dissection, that these corpuscules exist in the cat, the dog, the ox, the sheep, the goat, and the ape, and that they resemble in their structure the electric apparatus detected in the torpedo, the electric eel, and other fishes of the same kind. Now, if there are animals who are possessed of the faculty of collecting elec-

tricity, and if for the purpose, they have particular organs to keep it in, is it not consistent and logical to conclude, that when we find organs of the same construction in man, to conclude that they are intended for the same purpose? If it is therefore granted, as in fact it is, that there constantly exists some electricity, this fluid must be located somewhere; and as it is not admissible to contain something without having a receptacle to contain it in, we have good reason, therefore, to conclude, that the corpuscules of Pacini are the receivers of chemic electricity. We have a right, again, to draw this induction, that decomposition producing chemic electricity all over the body, the reservoirs destined to contain it must be scattered over the body, as we find to be the case in the distribution of Pacini's corpuscules. The proof of what we advance results from the following experiment, related by J. O. N. Rutter, F.R.A.S., in his valuable work on Human Electricity, in which he proves that no muscular contraction can take place without electricity being evolved out of the organ contracting. The ingenuity of the instruments he has contrived for the purpose of demonstrating this phenomenon, consist of two bowls filled with water. In each bowl is a metallic handle, connected by wire with a very sensible electrometer, which he calls galvanoscope, as being intended to demonstrate the production, or rather presence of galvanic electricity, viz., chemic-electricity, the experimenter puts his hands in the water and holds the handle without contracting the hands, and no sign of electricity is evinced; but if the experimenter contract one hand, there is immediately deflection of the needle on one side; if the contraction ceases, the needle resumes its previous position if the contraction is performed with the other hand, the needle deflects in the contrary direction and returns again to its original position, when the contraction ceases. This experiment, we think, is a sufficient evidence of the presence of electricity in the musóles. The experiment has been repeated with the same result in Paris, and is reported *Dans l' Almanack de la Chimie*. In the work of a competent writer on matters relating to electricity, the "Elements of Electrobiology," by Dr. Smee, there is a very interesting remark, which seems to be the keystone of our edifice, the author has established the fact, that human electricity was evolved from two points, viz.: the central battery residing in the brain, and the peripherical battery existing on the surface of the body. This idea, which is not defined, according to our own views, is, however, the link which completes the

chain of our theory. We explain it in this way, the central battery, the brain, is the reservoir, as we have already said, of atmospheric electricity; this electricity is the medium between the will or spirit and the material body; it is the instrument of volition, the substitute of the nervous fluid, and the will sends the atmospheric electricity through the nerves, its conductors, to the hands. The fluid, accumulated at their extremities, become the stimulus which makes the muscles contract, causes a pressure on the electric reservoirs (Pacini corpuscule) forces out, more or less, in proportion to the power of contraction, the chemical electricity they contain, which is evinced externally, as it is proved by the experiments of Rutter. Thus is the problem solved in accordance with our first premises, viz.: that there exists in nature two kinds of electricities, atmospheric and chemic, destined for two different purposes; that these two kinds of electric fluids exist in the living organism; that they are located according to their destination in different organs, for the purpose of producing different phenomena; that one, the atmospheric electricity is free from any obstacle, existing individually by itself, coming simple and pure out of the hands of the Creator, for the accomplishment of the highest functions, as a medium between the mind and the body; that chemic electricity is the result and product of matter, and re-acts on matter; that it is subservient to the first, and only appropriated to the organic functions; that one cannot replace the other in any case, and that they are both medical electricities, always infallible in their action, whenever applied in accordance with the wise dictates of nature; that atmospheric electricity is particularly applicable to all affections in connection with the nervous system, and in relation with the principle of vitality and free motion; that chemic electricity is attached to the matter and the organs of molecular mechanism; that the functions it accomplishes within the organism are the same, and follow the same laws as those produced out of the body; and that the apparent anomalies which may occur in the mind of those who have closely studied the matter, are the result of preconceived ideas, or want of due examination.

CHAPTER VII.

MODUS OPERANDI OF THE ELECTRO-CHEMICAL BATH.

We have in the preceding chapters shown that the organism is constantly under the influence of two kinds of electricity, namely, the atmospheric and chemic, each of them performing different and specific functions. The first thing which we have to inquire into, in speaking of the operation of the electro-chemical bath, is to know what kind of electricity we use. This is explained by its denomination, the meaning being chemical electricity. Its action, therefore, is limited to a peculiar kind of phenomena, so extended, however, that it embraces a long range of affection, all which influence the organic functions. This kind of electricity is generally called galvanism, a name which will convey to the mind of many the use of various apparatus distinguished by the appellation of electro-magnet, or magneto-electric machines, and giving electric shocks; the use, the various coils, single or double, producing the phenomenon of induction, discovered by our great chemist Faraday. Now the electro-chemical bath has no such complication of means. It is merely the battery in its simplest form, and as we have said at the beginning, absolutely similar in its arrangement to the mode employed in electrotype, the whole being confined to the production of the electric fluid, by chemical decomposition.

Before entering into details with respect to this mode of applying the electric fluid to the organism, we must take a previous glance at the processes of nature herself. It is of daily occurrence when a patient consults his medical adviser to ask him, do you think you can cure me? The medical man may answer affirmatively, and in reality bring the patient round; but if the truth must be told, we must confess that it is neither the physician nor the medicine which cure the patient—it is nature who cures herself! and this is true of both the animal and vegetable kingdoms: let us choose an example. The branch of a fruit tree is loaded with fruit above what its strength can bear; the weight causes it to split along the trunk, and a large wound is the result. What does the gardener do? He props the

branch, brings the fibres carefully in contact, and bandage them firmly with a band of strong canvass, which he covers over with tar or anything that will prevent the air and moisture from penetrating into the wound. He may also, by prudence, lighten the branch in due time, in order to prevent a similar accident for the time to come. In the spring he goes to the tree, takes off the bandage, and oh! miracle, the wound is healed. Let us ask now, who it is that has restored the tree. Is it the gardener, the prop, or the bandage? Neither! it is Nature! Still, it must be allowed, that the gardener has helped her; but, if instead of assisting nature, he had cut some of the roots, and shaken it otherwise, thereby depriving the plant of its nutrition; if he had tapped the trunk to take the sap out, if he had poured into the wound any kind of substance incapable of being assimilated with the texture; had he poured vitriol on the root, or plastered the trunk and stopped its natural functions, the branch would not have been cured; and if the tree had not died, it would never have recovered its previous vigour. The physician who assumes more than to be handmaid of nature, deceives himself. If he presumes to improve nature, and deviates from her dictates, and violates her laws, he kills rather than cures. Nature possesses an inherent sanative power, the *vis medicatrix naturæ*, the vital or moter principle which we may term vitality. When this principle is exhausted nature then requires assistance, but the object of that assistance is to restore her strength, and when this is performed, she will fight the battle and gain the day on her own account. Nature requires three things, power to prevent disease, power to contend with disease, and power to continue her operations.

Amongst the attributes of the principle of life, *heat* has been represented by some authors as the most important; although others have held quite a contrary view, and the antiphlogistic system has prevailed amongst a great many practitioners, amongst whom we may reckon the illustrious Broussais. We shall not take part in this controversy, but as the principle belongs to our subject, we shall treat it as the rest, in a common sense point of view. We are daily surrounded by phenomena of various kinds, which become so familiar to us, that we scarcely notice or observe them. One of the commonest and most extraordinary depending on heat, is the boiling of water, which requires 212 degrees of caloric, not a fraction less; and it is only when water has arrived at that temperature that vapour is produced. Steam

is concentrated vapour: the consequence is, that for want of a fraction of a degree, we should not have boiling water at all, nor steam, nor railways, nor steamers, nor steam power, nor the means of cooking our food, making our tea, or obtaining medicinal extracts; in fact, for lack of a fraction of caloric, the whole world would be changed at once. Have we no right, then, according to the same principle, to believe that the phenomena of the organism depend equally on a fixed amount of caloric? without which the functions of the body must be immediately disturbed; and we may conclude that animal heat is one of the principal requisites of life and health. It is to be noticed, that whenever we are indisposed, we feel chilly and become colder as we get worse, and quite cold when we are dead—even fever is hardly an exception to this. Heat, therefore, is the barometer of health—we speak of its equilibrium. The heat, however, must pervade equally the whole body; keep up the liquidity of the blood without which its circulation can be but imperfect, and all the secretions will be impaired. But animal heat may be disturbed and diminished by a thousand means; and therefore the possibility of restoring it must be of paramount importance. We need not say, that taking the blood from the body will not restore the heat of the remaining portion; that internal medicine by being introduced in the stomach will not promote the heat of the limbs; that the immersion of the body in hot water, will only act on its surface. Artificial heat, not even the solar caloric, will at once restore the equilibrium of natural heat; but when a patient is put in an electro-chemical bath to a proper temperature, acting on the periphery of the body, while an electrical current coming from a battery strong enough to produce sufficient caloric to melt a piece of iron wire, and that caloric passes at once and is diffused over the whole body, pervading every atom of the whole organism, it becomes evident that the problem is solved, and that we are for the future in possession of the means of restoring animal heat at pleasure, without danger or inconvenience, by a method qualified by those who have tried it as most luxurious. So much for the *modus operandi* of the electro-chemical bath with regard to the promotion of animal heat.

We may now inquire what takes place with regard to the waste of the body. We have said already, that the organism was constantly renewing itself, and that nature has provided means for the purpose of constantly throwing out the old material; without

which, now could not be admitted; but this process requires for its existence, vital force, and if that power be wanting, the function cannot be performed. Nature will exhaust herself entirely in the attempt, and if efforts do not prove available, disease will soon follow; what we have to do, is to help nature to do her own work, until she can do it herself. Here again, the electro-chemical bath is all we want, as it will act chemically on every heterogeneous substance in the whole system, eliminate it from the tissues, and throw it out, without excitation or disturbance of any kind, and even without the patient being aware of it, except by a feeling of well-being, which cannot be described.

When we consider that the substances above mentioned are sufficient to be the cause of the most serious affections, and that through weakness, they produce the most deadly results, although from their form, nature, and quantity, the uninitiated might hardly suppose that such would be the case. What then, if we consult the action and dictates of nature, shall we expect from the presence in the system of mineral and metallic substances, which, by their form and weight, will be more difficult to remove, and, in consequence of their chemical affinity,* will offer an obstacle, almost insurmountable to their elimination. I say an obstacle, because nature has provided no means for expelling from the organism such substances as were never intended to enter it. Thus, whilst certain elements, such as those we met with in the small lymphatic vessels, as far as related to organic substances, will be carried along and fulfil their natural functions, but when inert matters are introduced in the lymphatic system, where circulation is naturally slow, when such matters remain dormant, as it has been demonstrated in the remarks of Giacomini, Raspail, and Jahr, cited before, as well as by other physiologists, this will not take place. Numerous cases are recorded of extraneous matter having remained hidden in the body for a number of years.

* Our learned friend, M. Poey, has alluded in his letter to the power of chemical affinity as being an erroneous idea. Such may be the case, but, having no other word to convey our idea, we wish to explain our meaning on this subject. We understand by affinity, that aptitude or disposition by which two different bodies can unite or combine together with more or less readiness. We consider, therefore, that metallic substances have more affinity for the bones than for the other tissues of the body, per example:—Why can a bone be gilded, silvered, bronzed, or covered with metal; in preference to all the other tissues of the body, unless there exists a peculiar kind of attraction?

A case of salivation, which we have cited from Raspail's work, reappeared twelve years after the mercury was taken, is a proof of it. Another instance not less extraordinary has been reported to us by one of our patients, Mr. G., whose case is related in another chapter. It was of a young man, who, in consequence of numbness felt along the left side of the whole body, was rubbed from head to foot with mercury, as a means of preventing paralysis. During the space of seventeen years, he did not experience any inconvenience from it, but under the influence of a fever, ulcerations appeared on all the surface which had been rubbed with mercury. The medical man having tried to heal the sores, caused an internal repercussion, from which the patient died shortly afterwards. But how is it that mercury remained so long in the system? Has the patient been seventeen years without perspiring and throwing out the natural effetes of the body? Has the capillary circulation been suspended during this long period of time, or is it, that those substances which are not intended to enter in the composition of the organic tissues, nor to be elaborated by the circulatory process of the absorbents, remain, when forced in the vessel adherent to their coats, till some surexition of the system comes to throw them out of it, by tearing the skin, and forming what we call mercurial pustules, eczema ulcers, and psoric wounds. We are aware that metallic substances act in different ways on the organism, and that when introduced internally, either by the lungs and through the stomach, they are carried into the blood, and produce pathologic phenomena of another character. We are aware also, that it is through the circulation that they are conveyed to the internal organs and to the bones; but we consider that the adhesion of their particles to any portion of the organism, depends on the same cause, namely, their specific gravity, their form, and their so called chemical affinity. It is evident, that whatever the cause which keep them in the body, it is a particular power which prevents them from obeying the law, by which nature rids herself of the animal matter and wastes of the system; and that those substances which refuse to obey the ordinary action, by which the animal economy is relieved, require for their extraction to be submitted to a power greater than that by which they are retained. We discover that power in the electro-chemical bath, and on that account its value is unparalleled, as there is no means equal to it, either in any other kind of baths, or in medicine of any description to produce the same effect.

We have already explained how heat is introduced into every particle of the body by this process, but it is well to observe, that in this instance the heat produced by electricity, is electricity itself, acting with all the virtue and power which this fluid possesses. Heat, there is no doubt, one of the greatest agents in contributing to chemical decomposition; we know it by common experience: the melting of iron and other metals; the conversion of ice into water, and water into steam; the mere melting of fat are of daily occurrence, which demonstrate the effect of heat. Mercury itself is volatilised by heat, and thereby removed from other metals; and as metallic substances are the best conductors of heat, it may be understood how they absorb into the body a greater portion of caloric, and consequently act with more power than the living tissues; thus, dilated by caloric, their disintegration is achieved by virtue of the electric fluid, which, according to the direction of the currents, carries them out of the body. Such is the rationale of the *modus operandi* of the electro-chemical bath with regard to metallic substances. If its application is poh poh'd, and its result ignored, then the sceptic must attribute it to the deviation or frolics of natural law.

We must confess, however, that we have seen some articles extracted from American papers by parties unacquainted with the matter, which are sufficient to discredit the value of this important discovery altogether. They are indeed real puffs, which cannot be but despised by the learned, and destroy the confidence of the honest inquirer. It is stated in this report that the metal is found in a conspicuous form in the bath in its pure metallic state; this is not correct. We must, therefore, for the information of the reader, dwell a little on this part of our subject. First, it is absurd to suppose that the effect of chemical electricity should be to pick out the metallic molecules without acting at the same time on the substance contained in the matter of perspiration. We said previously, that the electro-chemical bath spread its action on every molecule that the organism is composed of. Let us see, therefore, what the effetes of the body are. We find in the best work on the skin that has been published in England, namely, that by Erasmus Wilson, that the substances alluded to are animal matter, gases, acids, alkalies, calcareous earth, metals, salts, and probably a simple body, sulphur. Among the animal matter occurs a small quantity of fat. The gases are the carbonic acid, which is more

abundant after a meal of vegetable food; and nitrogen, which is more largely given off after animal diet. The acids are butyric, lactic, acetic, hydrochloric, phosphoric, and sulphuric. The alkalies are soda, potash, and ammonia; the calcareous earth, lime—in combination with phosphoric acid. The metals, peroxide of iron, and possibly, copper and lead in minute quantities; and the salts, a long list formed by the combination of the acids with the alkalies and lime. The principal salts are, the chloride of sodium, carbonate, phosphate, and sulphate of soda; chloride of potassium, and acetate of potash; lactate and hydrochlorate of ammonia; and phosphate and carbonate of lime. Thus, there are thirty-two different substances, including copper and lead, that the author says may possibly be amongst the others. Not perhaps natural products of the body, but introduced through the use of our culinary utensils or otherwise. If such are the matters of perspiration which are or ought to be thrown off daily, we may say constantly, out of the body by a natural process and in a large quantity, since it has been proved that including the urine and the exhalation of the lungs, we throw out daily more than two pounds' weight. How is it possible, then, that mercury or other metallic substances should come out by themselves without forming new compounds with the substances here enumerated. And again, if mercury be taken medicinally in the shape of salts as proto or deutochlorine, how is it possible to admit that these oxides may be thrown out in a different form than that in which they were thrown in? Here is the mischief of those who want to prove too much, and in doing so, prove nothing but their own ignorance.

We must say, however, that we have in our possession thirty-four grains of an amalgam of mercury and tin in its pure condition which was extracted from the body of Thompson (see his case), exactly in the same form as it was introduced in his system during his work; partly through the lungs, and partly through the skin.

It is often the case when some new discovery takes place, that for want of due reflection some will ask you to prove more than it is possible to perform. One of our patients now radically cured from a protracted affection resulting from mercurial treatment, wrote first to us from the country where he resides for one of our small pamphlets; he communicated it to some medical friends who thought it advisable that the liquid of each bath should be analysed. I did not object that

each analysis would cost twice the amount of my fee, but practical chemists have declined to do it. The operation is not so simple as it may appear at first sight, when a small quantity of compound salts is diluted in fifty gallons of acidulated water.

I have, however, acquired by experience the means of detecting the presence of the metal; but suppose that I could not account for it, in that case I should be but placed in the situation of all medical men who employ specifics without being able to account for their mode of action, but with which they still cure certain affections, and so long as a patient is cured it is no matter how. My patient did not require more than to be cured, a thing I expected to be able to do, for the simple reason that I had cured others who were aware they had taken mercury and had been labouring under its baneful effects; they had tried everything during many years for getting rid of it without success, and had been cured by merely taking a course of baths, without the use of any kind of medicine. This gentleman is now ready to give his testimony to the efficacy of the treatment; but, notwithstanding, as our object is not to ask for a blind confidence, and that it is quite natural and reasonable for a patient to inquire about the method of treatment he is going to follow, we are most happy to furnish those who may require our assistance with the following particulars:—

We have observed various kinds of phenomena in the application of our bath, depending on the nature of the affection, its origin, its duration, the character of the morbific matter, the region where it is seated, the temperament of the patient, his habits, and the state of his general health; all these are matters of interest. We begin with an example of mercury, when the patient is much reduced.

If the skin is of a dead white colour, and its function much impaired, and the capillary circulation languid, the first bath generally does not present any conspicuous character. The patient feels only comfortable, the face becomes more animated, sometimes it is covered with perspiration—the electric current is slightly felt. The surface of the water presents a squamy, turbid appearance, with matter from the periphery of the body. It is, in fact, but a preparatory operation, which, however, is not without result. The patient always feels better, he moves more freely, and he is invariably in better spirits. At the second bath a slight white covering comes over different parts of the body in the form of bubbles, which accumulate on the hairs as

better conductors of electricity than the skin; I have called this emanation *frost*, as it looks much like the hoar frost noticed on the grass. Sometimes an itching is felt in various parts of the body, followed by a pricking sensation. As the patient progresses, the discharge from the skin increases. When scraped with a spatula, the bubbles rise in the water, sometimes so close and so thick, that the fluid is quite troubled, appearing as when plaster or flour is sprinkled in it. By closely examining these bubbles, you notice that some are larger than others, and rise more rapidly to the surface of the water, where they break. These bubbles contain gas, and disappear entirely; and others follow, forming a cloudy mass, some touching the skin; whilst others, almost connected with the first, seem as a body rising more or less slowly in proportion to their specific gravity. The uppermost contain fatty and animal matter, those underneath the alkalies, salts, and earthy matter: they dissolve in the liquid. The last are those containing metallic substances, and take their direction at different depths from the body to the walls of the bath, forming the negative pole, and there fix themselves, adhering firmly in the shape of small pearls, hard enough to be felt by the finger if you press lightly upon them. Sometimes the whole bath is studded with these bubbles, which are not all metal, as some parties pretend. When the patient gets out of the bath, which causes the lowering of the level of the water, several lines are perceived all round it, offering some radiating colours. If mercury predominate, the second or third line is bright or silvery, the top one almost black, the others of various tints. When the water is let out, instead of running down all at once, some spots of a cloudy shape remain here and there; the moisture evaporates, and leaves some crystallisation of the finest character, of various hues, according to the compound of the salts, the form and the quantity of metallic particles which they contain. Some spots are perfectly bright. If perchance the patient has had his feet in contact with the copper during a certain time, the shape of the feet and toes are impressed on the metal of the bath. If he has been moving, confused spots are observed. If the baths are taken daily without interruption, the action is increased each time, and when the morbific matter is stirred in too great a quantity to pass freely through the pores of the skin, red spots make their appearance in several places and various forms, where the poisonous substances are located.

Small conic-pointed pimples burst out, the apex gives way, and a very small ulcer is formed, receding in the centre, and containing a thick yellow matter, which dries up in a short time after the patient has left the bath. The next bath they may appear again if the whole morbific matter is not discharged; then the ulcers increase in size, the edge is red, rather inflamed and prominent, having all the appearance and character of mercurial eczema; or they may die away at once, leaving only a red spot, which disappears slowly; this always happens when the case is not severe. We have had a few cases, when some of the ulcers have increased to the size of a shilling, and discharged so as to oblige us to dress the wound. These symptoms, as medical men will notice, are those observed in mercurial diseases when they are spontaneously manifested, and in these circumstances the electro-chemical bath seems to have an effect similar to vaccination when employed to prevent the small pox.

We have given this cursory sketch of the various phenomena we have observed; medical men will agree no doubt that they are consistent with physiological laws, and in accordance with what we know of the character and symptoms of mercurial pathological phenomena.

For the sake of experiment, and in order to collect the mercury in a visible manner, we have used the electro-chemical bath locally as a foot bath, putting merely a plate of copper as a negative pole round the legs. The same phenomena have been produced, but with more intensity; the mercury was seen in a more conspicuous form, and was volatilised by heat. Such has been the result of our observations on a number of patients, too numerous for giving the details of every case separately; and so far as our experience goes, we think we are authorised to state, that those who pretend to have seen more, except in cases of wounds and denuded skin, when a negative electric plate may be applied locally, exaggerate and falsify the facts, and injure the system by destroying the confidence that any reflective mind ought to have in the efficacy of this sovereign remedy.

The remarks we have made in cases of lead palsy are in some measure similar to the above, with this difference, that the ulcers do not increase to so large a size; that the marks left on the bath are dull and blackish, and that the spots remaining on the copper are more angular than those produced by mercury.

Although the phenomena related with regard to the forma-

tion of bubbles and their deposit, bear a similar general character in all cases of metallic origin, we found a vast difference in the mode of ulceration. Zinc and antimony brought on at once red spots, covering large surfaces, such as the greater portion of the chest, which open in ulcers of a square and parallelogram form, of a certain extent, without swelling of the edges or depth. The part denuded is of a brownish hue, and they heal rapidly and leave no mark.

In scorbutic affections we found very large portions of the human body covered almost immediately with vivid red confluent pustules, and large discharging inflamed ulcers are produced immediately, which show at once that the virus is spread more particularly in the subjacent tissues, the absorbents, and vascular system, and that the specific gravity of the morbific matter is a great deal less than the minerals just alluded to. This fact explains how scorbutic patients, whose mere appearance tells of their constitution, may enjoy good health.

In slight cases of indisposition, we find always a little emanation over the skin of small bubbles, which are but the throwing out of the effete of the body. In rheumatism, and particularly in gout, the emanation is of a striking character, particularly over the parts affected.

The size of this work will not permit us to enter into all the details of the various cases we have treated, and it is already more crowded than we expected. But we presume that we have said enough to support the fundamental principle on which we stand in our doctrine, viz.: *that all diseases whatever may be their character and names*, are the result of morbific matter and obnoxious substances of some sort retained in the organism, and that their cure depends on the extraction of this obnoxious substance, and that there are no means of eliminating them from the system equal to the *electro-chemical bath.*

Had we sufficient room to enter into all the particulars of our investigations, we venture to say that we could substantiate every point we have advanced, and we trust that if the reader bears in mind the contents of the third and fourth chapters, he will not hesitate to adopt our opinion. Is it to be concluded, from the above statement, that the beneficial effects of the electro-chemical bath are only confined to the cases we have related and experimented upon? We may, according to our conviction and experience, affirm that it promises a great deal more, and that the only thing wanted is to have the opportunity

of testing its efficacy in organic and chronic diseases to appreciate duly the value of this great discovery. We have shown in our previous chapters, the marked difference between the two kinds of electric fluid. The point now under consideration is not less potent as a medical agent—the link which unites animal to organic life does not prevent the both together from forming a chain of phenomena so close and compatible with each other, that on all occasions one forcibly influences the other either in a prejudicial or beneficial manner. The passage of one system to the other being like the imperceptible capillaries which unite the stream of the arterial blood to the veinous, forming thereby two kinds of circulation, so connected together, that one cannot be impaired without having a reflex action on the other. From this general statement of the operations of the agents which we employ, we come now to consider the *diseases in which the electro-chemical bath may be employed with advantage.*

We are not quite prepared as yet, to give a decided opinion on the whole of the diseases in which the electro-chemical bath may be relied upon by itself alone as a curative agent. Time, experiments, and a minute investigation are requisite, before the real value of any discovery can be appreciated; facts only being the true test on which we have a right to depend. However, as one fact leads to another, and induction may lead us by reasoning further than our senses will permit us to penetrate, we may predict what must happen when our reasoning is based on known and indisputable natural laws. Thus it is, that we anticipate that the electro-chemical bath will prove, in course of time, something like a universal panacea. Our reason for believing so is, because we are convinced from observation and experience that, except in case of accident, there is no disease which does not begin by a mere disturbance of organic functions. We should like this truth to be well understood, because if it is so, and people would act accordingly and take the trouble of stopping at once the disturbance, nothing would remain of disease but the name. The organs, which we may consider as the seat of any indisposition, are five, viz.:—the skin, the stomach, the intestines, the lungs, and the brain.

Their primary derangement is not a disease, it is a mere disturbance of their functions; restore the functions, and the health is restored at once. It should be understood that diseases grow on the body, like ill weeds grow in a garden; if, as soon

as the first leaf appears over the soil, you are able to detect it, you take it with your finger and pull it out without effort, root and all. The evil is then eradicated. If you wait a few days, the root strikes deep into the ground, and the weed grows with increased power; the same is it with a disease; when a person feels indisposed and calls in a medical man he is not able to give it any name, but indisposition; if he inquires into the primary cause and finds it resulting from a disturbance of the functions of one of the organs named, he prescribes the proper remedy to restore the functions, and there is nothing more to fear. But if he puts it off for a few days to tell you the name of the complaint, then he waits till the organ is particularly affected, and you may depend on it that the evil is not to be removed at once.

If we take, for example, one of the daily occurrences of life, our meaning will be all the better appreciated. You find a gentleman returning home, who does not feel inclined for his dinner or tea. The wife inquires what is the matter—when he will say, I don't know, I feel queer. He goes to bed with the expectation of rising well the next morning, but when he gets up he still complains of feeling no better. However, he does not require, as he thinks, medical advice; days pass over in the same way till at last he feels worse, and is unable to attend his usual avocations. Then the medical man is called in. There is a disease with a name, according to the seat of the evil and the organ particularly affected. If a name is wanted to convince the patient that he is ill, it is easily found in Cullen's Nosology, in which we have counted 149, besides new-born ones which are daily introduced in this list of human calamities. At all events, the patient is ordered to bed; bleeding and blistering, antiphlogistics and evacuants, are prescribed, and after many weeks of suffering he gets up weak and debilitated. Change of air is necessary for a few weeks to regain his strength, and then there is a large bill to pay, besides what he has lost by absence from his business.

We are of opinion that, when any one feels unwell, which is always a proof of some organic disturbances, they should immediately take means to re-establish the normal functions, and then they would not know what disease is; and we are, moreover convinced, by experience, that a few hours only are sufficient to accomplish this. The following anecdote is an instance of it. When in Manchester, my son, a boy ten years old, was brought

to my bed room early in the morning, by the nurse, who told me he had been very ill all the night, vomiting, and relaxed in his bowels; the child looked very bad and dejected; his face was as white as linen; the blood vessels were congested, so that their ramifications appeared distinct, like the branch of a tree. The matron of my establishment came up and asked me what I thought was the matter. I said, 'I don't know.' 'Well,' she said, 'it appears like a scarlatina; I have seen many cases in the school where I have been during fifteen years, do you not think it is it?' I replied, 'I do not know what it is, and I do not want to know. She stared strangely and significantly. Meanwhile, I ordered a vapour bath immediately, and gave the child a good sweat; his face was no longer pale; he was put into my bed, and an emetic administered, when the nurse exclaimed: 'But the poor child has been vomiting all the night.' 'Yes,' I replied, 'because he had something to vomit.' He returned very little, however, from which I concluded that nature had done the work. After a proper rest, a gentle purge was administered, when the nurse again observed, that he had been purged all the night, which was a proof that the bowels wanted to be relieved. Scarcely an hour after this operation, the boy asked to be allowed to get up; he wanted his breakfast, and desired to join the pupils in the gymnasium, which was granted, and I have never yet known what kind of a disease he would have had, if I had not at once re-established the equilibrium of the vital functions. The primary cause of the disturbance I did not know; the child might have eaten some unripe fruit in the garden, or got a chill besides, from wet feet, and taken improper food afterwards; it is no matter, the natural functions of the skin, stomach, or bowels, were deranged; the vapour bath re-established the normal condition of the skin, by throwing out the effete which was retained. The capillary circulation was restored, the natural heat equalised, and all the secretions excited; the stomach relieved from any noxious substances, and the bowels cleansed. What could remain in the system as a germ for a disease? Scores of times we have obtained the same favourable results by adopting the same means.

It is generally the case, that a sudden indisposition begins by a chill; if it is immediately removed, there is an end of the matter, but if not, it may turn into a cold in the head or a stiff neck, or may terminate either in consumption or paralysis. A chill, which is but the symptom of some disturbance, may come

from the skin, when exposed to a low temperature; or from the stomach, when, by some cause or other, it becomes irritated, and by bringing the blood internally, deprives the periphery of the body of that portion required for the capillary circulation; or it may originate from the intestines, and, in course of time, the chill may assume the form of gastritis, enteritis, peritonitis, carditis, or pneumonia. All these evils may be prevented by the same means we have mentioned, the whole requiring only two or three hours to be carried out. But the misfortune is, that the means of applying it are not at hand, and it is consequently neglected. The above means, simple as they are, imply, however, a certain amount of trouble. It is then that the electro-chemical bath proves to be invaluable, as it supersedes the vapour bath, whilst it produces the same effect with regard to the skin, but in a much more agreeable manner. It possesses, besides, the immense advantage of acting internally in the most favourable manner; if it does not cleanse the stomach, it increases and promotes its natural functions; it acts, besides, on the substances which it contains; decomposes it, so to speak, by separating its molecules, and moving them towards their intended direction. The intestines equally submit to the same influence; receive the same benefit; the whole organism is stirred, and the equilibrium of organic functions re-established. One hour, during which the patient experiences the most congenial feelings, is all that is required; and, on leaving the bath, the patient feels fresh, light, comfortable, and may attend to his business without inconvenience of any kind. If it is therefore granted, that prevention is better than cure, we have in the electro-chemical bath the best preventive which can be thought of. Such is the first step of this invaluable agent, a single bath being sufficient to stop at its beginning any disturbance of organic functions. But its beneficial influence does not stop here; when repeated, its action increases, and then, as it has been demonstrated in the preceding chapter, on its *modus operandi*, the electro-chemical action produces a series of phenomena which embrace every function of the animal economy. Thus, it is as well adapted to the cure of the most inveterate chronic disease, as it is to their prevention.

This statement of the virtues of the electro-chemical bath may, perhaps, at a first glance, appear exaggerated; but as we do not wish to impose our opinion on others, our assertion shall be accompanied by the facts on which it is based. Everyone knows the comfort and luxury of a plain warm bath, how refresh-

ing and soothing it is, how it cleanses the skin and makes it soft and pliable. No one will deny the advantages of this precious remedy; it dates from the most remote antiquity, and is said to have been invented by the enchantress Circe, who secretly used a kind of bath with such decidedly beneficial results, that she was supposed to make new bodies out of old ones. Notwithstanding the salubrious effects of warm baths, they have, however, but a very limited action comparatively to the electro-chemical bath. The mere immersion of the body in warm water acts only on the surface from without. Inwardly, the fluid is absorbed to a certain extent through the pores of the skin, which on the one part produces a certain relaxation, whilst on the other it equalizes the natural heat of the body, and contributes according to its temperature to the increase of the capillary circulation; but it cannot be repeated often without weakening the body, and predisposing the patient to catching cold. The electro-chemical bath affords at once the same advantages as the above, but not only it does not prove to have the same inconvenience, but it possesses over the other incalculable virtues, because although it acts as the former on the periphery of the body, its greater action is from within. The electric fluid as may be well understood, is unparalleled in nature for its subtleness, does not act merely on the surface of the organs, it penetrates their tissues, envelopes and saturates every atom they are composed of, and slides gently amongst them, giving to each a portion of vitality, of which it is the very essence. We know nothing of electricity itself, we are merely acquainted with its effects. Electricity, so to speak, is an imaginary being that no one has ever seen, nor ever conceived its power; its actions are beyond our comprehension, but as we know it to exist, and conceive it to be an active and motor principle, it cannot be anywhere without producing an action. Electricity might, therefore, be understood to be the physical soul of matter.

We have spoken of the primary causes of disease, and explained how they might be stopped at their origin. Let us now understand what health and disease are. Health is nothing else but the perfect, regular equilibrium of organic functions; disease is the result of the irregular or imperfect performance of one or several of those. The disturbance of any of those functions always comes from without. The diseased state is not natural nor inherent to the body; that is to say, that if a child is born healthy and sound in every part, none of those parts will

ever become diseased of themselves. It always requires an external agent to trouble the harmony of internal functions; and if external means carry the disease internally, external means also have the power to restore the internal harmony; and this power is in proportion to the extent of the surface. If we consider the principal resource of the allopathic treatment, it resides in derivative or revulsive principles. If we consider the homœopathic treatment, we find that it resides in the virtue of specifics. If we consider the electric treatment, we perceive that it combines both in its *modus operandi*. It is derivative, because we may direct the current from the head to the feet, or in any direction that we please; because we may apply it to any extent on the surface of the whole body as the case may require; and it is specific, because we can direct its action on specific organs as may be necessary.

Colby, in his Guide to Health,* says: "The healing art consists only in six points, namely—relaxation, contraction, stimulating, soothing, nutrition, and neutralization." This simple description embraces, in fact, all that medical men have to do or can do, if the meaning of the word neutralization implies also elimination. The means of producing these effects may be variously stated—nothing, however, but electricity, when employed judiciously can at once meet all the exigencies of the case. We do not mean the electro-chemical bath alone, but the various kinds of electricity which we have defined in the preceding chapters. We have alluded before to nature's first requisite, which, in all circumstances, is the power of performing its functions. Ask a man, whose power is exhausted, to perform his wonted duties, or expect an organ, weakened by excess of work or want of nutrition, to perform its functions, and you come to the same result with both. On what does power depend? on rest and support!

These remarks lead us to consider the nature of chronic disease. These affections begin either by an acute disease, or general debility—if it is by the last, it is a general want of power brought on by bad habits, bad regimen, and the violation of nature's laws. How then are we to restore the strength? Can we tell a patient to eat more than his stomach will digest:—to pour into this viscous substances which cannot assimilate with the living tissues of the body? Can we give heat and stimulus to the organism by

* See "Guide to Health," p. 43.

internal medicine? We generally fail in our endeavours where we try it. External heat, as it is commonly applied, is very far from being readily transmitted from the external part inward. We have a daily proof of it in roasted meat, which may be burnt, even carbonised outside, whilst the internal part is raw. We take common example, because they are under every one's eye and cannot be therefore denied. But if, as we have said before, heat is one of the motor principles on which life and health depends, how is the organism to be supplied with it when the above means are unavailable? In this case, again, we may offer the electro-chemical bath as the only agent to convey caloric internally to every organ at once, and as far as the action of caloric is wanted in the animal economy, supply it accordingly. When the fire is low, the kettle does not boil; when natural heat is low, the circulation, secretions, and excretions, are languid; the matters of perspiration are not thrown out, the blood becomes contaminated, forms deposits in various parts of the body which concrete in course of time, as we see so often in the articulations, and in this case again, we find medicine powerless. Before concrete and stony substances can be removed from the pores of the body, we must decompose them and resolve them to a liquid condition, and that cannot be done but by the agency of electro-chemistry. As to metallic substances, their specific gravity presents a still greater difficulty than the natural effetes to be thrown out from the system. We find, as we have already explained, that in consequence of their chemical affinity for the osseous matter and other tissues, such as tendons and cartilages, not only do they require being dissolved, but that they must be carried out by force, and this is done by the electric current which takes hold of the metallic particles and convey them through the pores of the skin, or even opens outlets through its tissues, in the shape of eruptions of various kinds. Not, as it has been said by some, in the form of pure and bright metallic substances, but in double compound salts, appearing plainly on the surface of the whole body, which, when removed, may be seen by the patient himself. This frosty mass of particles continues as long as the patient is in the bath. This statement is a pure fact, which may be witnessed daily, and is the best argument to offer to the sceptics of every creed.

We must apologise to our reader for not following out this train of thought, but we are in haste to throw out our ideas,

being already a month behind the time appointed for publication, and have no time to revise our work at leisure. We are obliged, therefore, to return to our first idea concerning the nature of chronic disease. When it comes as the result of an acute disorder affecting any particular organ, then the functions of an organ are impaired, and it becomes diseased. When diseased, it is in a state of weakness, it has not the power of assimilating the substances for its nutrition; it is starved, and would die by itself, as it happens in mortified limbs, if it was not surrounded by other organs, which give up a portion of their own vitality for the support of their neighbour, and by depriving themselves of their quantum, they are brought in their turn from a state of vigour to one of infirmity, and thus ultimately, the whole organism is reduced to a state of weakness, which constitute chronic debility; a sad condition for the poor invalid who is doomed to vegetate the rest of his life on a bed of suffering. Life seems to give way progressively and vanishes daily, without either resource or hope; everything has been tried in vain; and it is in those cases that external treatment is the only available means. The derivative and revulsive practice is not admissible, where there is no portion of the organism powerful enough to admit the experiment. The specific medicine of homœopathy cannot be applied with more advantage, unless we suppose that a compound of all the known specifics could be administered at once, and that they could from the stomach, take each of them, their direction on each particular organ requiring their aid. And again, as those remedies have their primary and secondary actions, it is most probable that their operation will prove a destructive one. It is then, as we have premised, that external treatment is the only one admissible. We take the whole periphery of the body at once, and when necessary, we reverse our process, and pass from without, inwardly, the principle of vitality. It is a physiological fact, that the soundest parts of the organism, are those which will first receive the greatest action. We begin, therefore, by the skin, which we always find of a dead white hue, dry, and the pores clogged, with the capillary circulation impaired. The chilly patient is put into one of our baths with a very gentle electric current (and however feeble a patient may be, he can be put into a bath), and is lightly rubbed whilst in the water. This always does him good, which proves that the capillary circulation is improved, and it is also evident, that by bringing the blood to the surface, a great change has taken place in the whole circula-

tion. The patient feels warmer all over, the appetite is a little better, the sleep is more refreshing, and there is less nervous irritation. As soon as the condition of the skin is restored, the effetes of the body begin to make their appearance, and soon the teguments assume a healthy character. It is then time to produce a reaction by reversing the poles, and by composing the bath with ingredients of a tonic nature, transmitting thereby an action to the subjacent tissues and muscles. As the development of muscular fibre takes place, manipulations and passive movements are given to the limbs, the synovial liquor is secreted in the articulations, they acquire flexibility and strength; and thus, by adding constantly a new vitality to the external envelope of the body, it is conveyed internally through the superficial tissues to the internal organs by a natural process, in accordance with the law of physic and physiology. Thus, nature's power being restored, the functions of the organism are performed, and health re-established.

We need not say that the above remarks are but a mere sketch of the process, that they are intended only to give an idea of the *modus operandi* of the means which we employ; we should not have entered even into so many details were we not aware that without a sufficient explanation we should be exposed to the ridicule of those who do not understand the matter. We recollect having laughed heartily at Punch and Dickens's Wit, in their criticism of Kinesitherapy; nevertheless, we have the moral courage, in spite of their sneers, to confess that Kinesitherapy is one of our resources, and that the portion of Ling's system, which relates to the passive movements, is one of the best adaptations that the healing art can boast of.

We have stated at the beginning of this chapter, that the electro-chemical bath will prove to be a sort of universal panacea, and have explained theoretically our reason for believing it; but if this assertion was not corroborated by positive proofs, it might be rejected at once as one of those Utopian dreams that system-makers are apt to indulge in. We shall therefore, give the following cases as a proof of what we advance.

Mrs. W—— had been labouring during nine years, under spinal disease, with intolerable pains in the lumbar region, which sometimes prevented her almost from moving at all. The functions were impaired; she had been bled, blistered, had setons, moxas, and was cauterised along the spine with a red-hot iron, besides taking internal medicine of every description. The first bath

relieved her, and after the fifth, she was able to walk home, five miles distant, and to enjoy her dinner, a thing which had not happened to her for many months previous.

Mrs. M——, a professional lady of high intellectual capacities, had been, through mental anxiety, deranged in her general health; she was emaciated; in a great state of despondency and disgust of life; she had a great pain in the chest, and a bad cough; her friends told her she was getting consumptive and she believed it herself. She felt relieved after the first bath; after four, the pain in the chest and cough have vanished, hope is revived; she is in good spirits and able to attend the exercises in my gymnasium.

My assistant, Dr. M——, came one morning very unwell with the headache, and felt not able to do anything; he took a bath, which restored him at once; he entered my study, looking well and in good spirits, and saying: "I am now ready for anything you like."

Mons. G——, a French solicitor, went to Ireland for the prosecution of a chancery suit; he got a cold on board ship, and was taken very ill, even in danger of his life; kept his bed more than a month; was subject to palpitation, and intermittent pulse; it was found by oscultation, that he had an enlargement of the heart, and paralysis of the valves; during seven months he was under treatment, and had a blister applied over the apex of the heart. Obliged to come to London, he applied to me; besides the palpitation, he complains of general debility, want of appetite, and no taste; his palate feels cold and dry, his throat stiff. He followed a course of baths; every symptom disappeared one after the other; the blister healed while taking the bath; whilst, during the same time, eruptions have succeeded one another, the palpitation is gone, the pulse regular, appetite restored, sleep good, has gained strength, and attends his business from morning till night without the least inconvenience.

Mr. T——, a friend of mine, a solicitor in Manchester, is a gouty subject, his father was so too; he came to London on business, after a paroxysm of gout; his right foot is very painful; he walks with great difficulty, he took a bath, during which, a considerable emanation came through the pores of the skin, particularly from the toes of the bad foot. He felt immediate relief, and walked with ease after the bath. A few days after I received a letter from him, with the following P. S.:—"You ask if I am better; I reply, I am; and I really think your baths

would cure me if I had an opportunity to take a series of them. I mention them whenever I have an opportunity."

Mrs. H——, a fine built lady, has, for seventeen years, been a constant invalid, and tried everything she heard of. She became a patient of mine at the beginning of the year, and derived much benefit from frictions, local electricity, and Kinesitherapic movements; she went to the country, thinking the change of air would do her good, but came back much worse; the whole system in a state of languor; she was in such a despondent state that she could not help crying, when speaking of her sad condition. The first bath gave relief; she felt better, dined with a good appetite, and had a good night's rest. The second bath, a redness appeared on the chest, round the neck, and over the liver. The third bath caused the skin of the upper region of the chest to become of a very high red colour and break in patches. The walls of the bath surrounding the trunk, were covered with a coat of bubbles, a thing which always occurs when metallic substances are present in the body. She told me that she had taken a great quantity of zinc. In a few days the eruption began to die away, and she felt relieved, but was obliged to leave off.

A man from Cubitt's works, Vauxhall, came to me with a great pain in the left side and stiffness in the joints, arising from a draught, his bench being placed near the door of the workshop. He had been suffering for several months, and was cured with six baths.

T——, a young man twenty-three years old, a painter and grainer by trade, received a sun stroke three years and nine months before coming to me; he had lost the entire use of the left shoulder, arm, and hand, with atrophy of the anterior portion of the trapezius, deltoide, and pectoral muscles; the shoulder on that side is three and a-half inches lower than the other. After six baths, he was able to rise his arm perpendicularly over the head, and to button his shirt with the bad hand.

Mr. R——, a man six feet high, of a bony structure, came to consult me about a pain in his right knee; his face highly coloured and rougious, has a particular appearance as if he was addicted to drinking; however, such was not the case. He said he had never been ill before. After three baths, he was covered with a confluent eruption, which formed into ulcers and spread over the dorsal region, the chest, and a portion of the arms and legs. The body has the appearance of psora. I was obliged to dress

the wounds; it was then that he told me that from his infancy he has been of a scorbutic constitution. As the wounds prevented him from attending to his avocations, he gave up the treatment, but called in less than a week to tell me that he was better, and that the eruption was dying away.

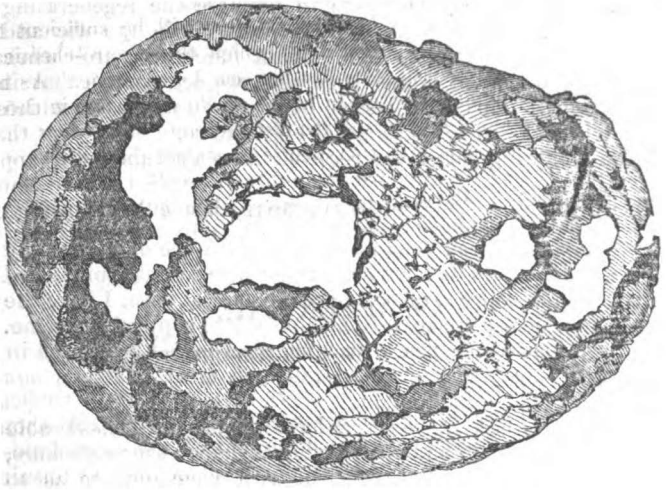
The few examples we have mentioned, will be sufficient to illustrate the variety of diseases in which the electro-chemical bath may prove of great benefit when employed alone. As no kind of medicine has been given in the above cases, nor in those related in our chapter of cases, it must therefore be evident that as an adjunct to a rational therapeutic treatment the most happy results ought to be anticipated—either if applied at the same time, or as after treatment in all cases, when either metallic or mineral substances have been used medicinally.

CHAPTER VIII.

PRACTICAL TEST OF THE ELECTRO-CHEMICAL BATH.

EXPERIENCE is the final test of everything relating to medical science; for, however apparently correct the theory, or scientific the practice, unless the human organism attests its fitness by getting well, the treatment should be abandoned as unsuitable in that particular case. It was with this feeling that we commenced, and have continued, with the electro-chemical bath. We were prepared not only to encounter difficulties, but to meet with disappointment, and in some cases with failure as to the re-establishment of the general health, and that quite independent of the circumstance of the metallic poison being eliminated from the body. In some cases that have presented themselves to us, there has been a complete organic derangement, which would require months, and perhaps in some cases years, to regain its normal condition. We have not, and never should hesitate, to speak of cases of this sort, because they are common to every medical practitioner. It is only in accordance with this feeling that we say that there have been some cases presented to us that we had no hope whatever of curing, the utmost that we could do was to administer a little relief. We have had applications from many poor sufferers of this kind, and from some whose system was so saturated with mercury, that their very bones were rotten. It seems almost incredible that any human

being should survive under such disorganization, but it is a fact that some do. Here is the drawing of a skull, from a mercurial patient, taken from Dr. Beach's large work, "The Reformed American Practice of Medicine."



We have seen *à l'Hospice du Midi à Paris*, when it student, a specimen of the same character; it was a skull perforated by thousands of small holes. We have now, in our museum, several bones equally destroyed by mercury. A femur (thigh bone), whose covering (periosteum) is entirely destroyed as well as the superficial earthy coat, showing the fibrous cancellated structure exposed. A tibia (leg bone), attacked by exostosis, the body of the shaft being reduced to the thickness of wrapping paper broke under the pressure of my finger, showing inside the cancellated texture of a brown colour; this bone, quite deformed, is twice the usual size—the two extremities spongious, with some portion eaten away. An illium (hip bone), with holes big enough to pass the extremity of the finger through.

Now, we have received applications from people whose bones were in a similar condition as those above described. To give hope to such patients that the electro-chemical bath will re-make destroyed bones would be a great deception. Nature repairs the organs under certain conditions, when some

living portions exist to convey animalised material, but when dead substances are entirely separated from the living ones, there is no resource. As far, therefore, as the requisite conditions of repairing still exist, the electro-chemical bath will do more than any other means to promote the regenerating process of nature, by removing the obstacles in the way and giving a new impetus to the general functions; and when used in good time, if a case is curable, we are certain that it will be done. This will be seen by the following cases which we give in addition to those already alluded to.

The following letter was received from Captain ——

DEAR SIR, HAMPSTEAD ROAD, *March 24th*, 1856.

Having noticed your advertisement in one of the weekly papers, which refers to a little work you have recently published on the origin and use of the electro-chemical bath, I have the pleasure to inclose six stamps for a complete copy of the same.

I have long since heard that such baths had been used in Paris, with most satisfactory results, but until now was not aware they existed in London.

During the last six years, I have undergone considerable mercurial treatment; and after having explained the particulars, perhaps you will kindly favour me with your opinion as to whether a sufficient quantity of mercury has penetrated into the system to be injurious, and to justify my going through a course of your treatment.

About six years ago, I was affected by a complaint which required a strong mercurial treatment to check it, and my mouth was touched and became sore. After this, mercurial pills were continued for a considerable time, and on their discontinuance, Plumber's pills and a quantity of potass were taken for a considerable time.

In 1854 I was much troubled with rheumatic pains, and was persuaded to try Dr. G——, in Great Marlborough Street, and took twelve of his mercurial baths successively. I was never less than twenty minutes in the bath, and sometimes much longer, according to my ability to bear it. My head was also closed during the last four or five baths, for five minutes each time, at the end of the bath, when the heat was greatest; whilst taking these baths, I was likewise taking mercurial pills night and morning.

By this treatment my gums and the roof of my mouth

became so salivated, that after taking any food of the softest and most delicate nature, the pain maddened me to such an extent as often to wish myself dead. I asked Dr. G. to give me some sulphur baths to counteract the effects of the mercury, but he thought that if I could do without them it would be better. Ever since, I have been extremely liable to take cold, and have suffered very much from violent coughs, which do not easily leave me.

When unwell, I became very irritable, which I attribute to the quantity of mercury taken, at different times, having affected the nervous system.

Kindly inform me if the electro-chemical bath weakens the patient to an extent that prevents him from taking considerable out-door exercise, and what length of time it takes to effect perfect results, as I have but a short time to remain in this country, and am going to the East.

Believe me, dear Sir, yours truly,

J. Caplin, Esq., M.D. C. J. S.

Such was the first letter that we received from Captain ——; a few days after receiving our reply he called and took his first bath. The following is the account of his state at that time as entered in the case book.

Captain S——, aged 40, temperament, nervous, sanguine, spare built, looks pale and careworn, is unmarried; says he has been in the army for twenty years, and has spent fourteen years of that time in India. About six years since caught a complaint, for which he was put under a strong course of mercurial treatment; had an ulcerated sore throat, and a painful eruption; in addition to this the flesh of the left thumb came away. A thorough saturation with mercury seemed to cure him at the time, but in 1852 suffered a relapse of all the secondary symptoms. The same eruption returned that he had suffered from previously, attended with a severe case of erysipelas all along the right thigh, where an abscess had previously discharged; was again subjected to a course of mercury, A painful drawing of the sinews of the limbs followed, and he was then treated with iodine internally in a liquid form; taking, during eighteen months, eight doses a day, of three grains each, together with a warm bath once a week.

In 1854 he tried, by advice of the medical officer of his regiment, Dr. G's mercurial baths and a course of mercury

pills. After twelve baths, he was so much affected by the mercury, that he was obliged to give up the treatment, and had not taken any medicine since that time.

At the present time he is suffering from general debility, and was so weak that the medical officer refused to certify him to the regiment the other day, and advised him to sell out as unfitted for service. Has great pain in the back, want of appetite and sleep; is low spirited and despondent, and subject to cramp in the legs and feet; suffers from cold of the chest and difficulty of breathing, and occasional shooting pains in the joints, more especially in the knees; was very comfortable in the bath, and experienced nothing but a slight pricking sensation.

During the second bath, which was administered on the following day, the whole of the copper was covered with an innumerable mass of bubbles, and the sides of the bath were also noticed to be spotted; on the end, the foot prints were visible as though a coating of mercury had passed from them and adhered to the copper. The pricking sensation had also increased.

When the patient applied for his fourth bath, there was a decided improvement in his appearance. His sleep had been calm, appetite had improved, and had been entirely free from cramp since he commenced taking the baths.

The patient continued the treatment for about three weeks; taking in the whole thirteen baths; he was then completely recovered, and was pronounced fit for active service by the medical officer of the war department, and is now on his way to India.

It may be necessary to state, that in this case there was no medicine administered. The bath relieved the organs of the substance which oppressed them, and health was the natural result.

In the preceding case there was great debility, but no absolute loss of power in any one member. The following is a case of lead palsy, in which the affection was local, whilst the bodily functions were upon the whole unimpaired.

Mr. William Easterbrook, aged 39, tailor, temperament, bilious—nervous, strong, and good-looking, says—that about eighteen months ago he was taken with palsy of both hands, which his medical attendant said arose from drinking water that had come through a new lead pipe and cistern, which he had used plentifully. The complaint first made its appearance

in one of the little fingers and extended to the wrists, until the hands were perfectly paralyzed. Was galvanized for a long time, took large quantities of iodite of potassium, and then went to the sea side, where his hands were rubbed with sea pods and salt water. Has taken a large quantity of preparations of iron, which he thought had injured his stomach and eyes; is nervous, stomach weak, and bowels constipated; is also subject to headache, particularly over the right eyebrow. The pain continues sometimes for twelve hours at a time, and he is obliged to lie on the bed for many hours after it has left him.

He took the first bath on the 2nd of April, and continued to take them regularly every day until the 15th, taking in the whole twelve baths. On presenting himself for the second bath, he said that he felt stronger, had slept well, and had a good appetite for his food; there was also a perceptible difference in the strength of the hands. Whilst in the bath, there was a pricking sensation over the body, which was more intense in the affected parts. The whole surface was also covered all over with bubbles, which continued to be the case during nearly the whole treatment. After the third bath, the head was much better and the patient walked easier and with a firmer step.

April 7th.—Mr. E—— says, he is much better and stronger since the last bath, his appetite is very good, has a little pain in the joints of the left hand until he has washed and exercised it a little. An eruption has made its appearance upon the affected parts, but the patient says he is comfortable and improving fast.

On the 15th, the patient had so far recovered as to desire to return home. He was enabled to raise thirty-five pounds with his hands in the gymnasium, and thinks he can now do without any further treatment. We have since received letters from him, stating that he attends his business and can use the shears and the needle and is still gaining strength.

Another interesting case of mercurial affection, of a somewhat peculiar kind, presented itself in the case of Mr. G——, a gentleman who had been for some time engaged in railway operations, and who, in consequence of an accident he met with in the train, had large quantities of mercury administered to him. The following is his case as taken from our note book.

May 7th.—Mr. G——, aged 52, tall, and rather spare built, temperament—nervous, and slightly inclined to bilious, says: he has always followed active out-of-door employment, and that his general health has been good; never had any disease in his life, except measles. Three years ago he met with an accident, which injured his legs seriously, and caused him to be laid up for a long time. The legs were very much bruised and discoloured, and the medical attendant ordered them to be rubbed to remove the bruises, which resulted in developing an eruption. Mercury and lead were then applied to the affected parts twice a day for some months; during this time mercury was also administered internally. Again, last June, the mercurial treatment was resumed and continued for some months, when a mercurial eruption appeared all over the skin. The face swelled to a great extent, and the eyes became almost invisible, a great singing also came on in the ears, and several severe ulcers were formed, and at one time he was unable to move his toes. Wet bandages gave some relief, indeed more than any other application, and were continued for four months. Had also been under homœopathic treatment, but is still subject to mercurial eruptions, which appear on all the surface of the legs in the shape of erysipelas, each change of the weather, or at winter, discharging an ichorous matter, causing such itching and irritation that the patient feels inclined to tear off the skin; pains in the face, debility, and depression, and also to a great liability to take cold, which induces swelling of the face and head and general ill health.

This case, which at first sight seemed slight in comparison to some of the same kind we had before treated, was nevertheless very obstinate. The patient was not suffering much, in consequence of the strength of his constitution, which prevented him from being salivated, in spite of the enormous quantity of mercury he had taken. The legs, which were the parts most affected, were soon cured without any inconvenience, probably because, having been almost constantly wrapped up in wet bandages, the pores of the skin afforded a freer passage to the morbid matter, which passed away in great abundance, without even causing the least eruption. But the other parts of the body, the arms, chest, abdomen, and sacral region, were, by turn, covered with some eruption, which died away and reappeared again in a new shape. After about twenty baths, all appeared eradicated, and it was agreed that he should

return home at the end of the week, when, on the second bath, a new eruption made its appearance, his departure was in consequence postponed; this eruption had almost died away also, when another appeared. He took eighty-four baths altogether, and when no more eruptions would appear, he left satisfied that he was perfectly free from mercury. A thing to be noticed is, that the baths were taken daily, one hour each, at 104 degrees, and that during that time, the patient was getting stronger, and never felt the least inconvenience from the process.

We must observe, about this interesting case, that the reason why so many eruptions appeared successively, is, that the mercury, according to all appearance, had been forced by friction, deep in the tissues, and, in the process of extraction, what came out first, was the superficial strata, while those located in the deepest parts, between tissues of different density, were eliminated in succession. We must consider it therefore, as a fortunate circumstance, that the operation proceeded in such a manner, because, if the eruption, which is nothing else but the matter forcing its way through the tissues of the skin, where it is in too great a quantity to pass freely through the pores, would, if the whole effetes were thrown out at once, destroy all the teguments; thus, we are obliged, on all occasions, to give nature the time for performing her work, and to submit to her dictates.

Another case of great interest, indeed the most remarkable that has presented itself to us during the whole time that the bath has been in operation, was that of a clergyman, who had been suffering severely for thirty-eight years. His case was at once so remarkable and full of interest that we give it in full.

Rev. R. P., aged 58, temperament, bilious—strong and well made frame, says, that he is the son of healthy and long-lived parents, and that his original constitution was remarkably strong. Caught a complaint whilst at college, and took an immense quantity of mercury to get rid of it. Met with a similar misfortune a few month after, and was under mercurial treatment for six months before he was cured. Caught the same disease a third time, worse than ever; took immense quantities of mercury this time, before it took any effect upon the disease; meantime, bad symptoms manifested themselves, and one abscess broke internally. After this he was afflicted

with giddiness of the head, indigestion, and constipation, and became excessively nervous and irritable. Being unfit for active employment at home, he went to India in hopes of improvement, but was much worse, all the symptoms being aggravated, so much so that he became insane, and was treated with calomel and opium for eight months; was obliged to return home with health quite ruined. On the way home, the pain in the head was so great that he was obliged to lie on his cot in a state of passive insensibility, and dared not even think. The religious monomania still continued. After returning to Europe, he spent some months in France, which did him good; lost all confidence in medical men, and met with an officer from India, who advised him to try Morison's Pills, which he did, and took as many as twenty in a day; continued this course for thirteen years. Thinks he has taken as many as 100,000 No. 2 pills. He then put himself under Dr. Coffin's treatment, used the vapour bath, and took immense quantities of capsicum and composition powder; broke down under it. A physician at Leamington advised him to desist, and prescribed mercury and steel for him—this made him ten times worse—was delirious again; was unable to sit at his meals, and felt as though he had a gad-fly in his inside. By advice of a lady he became a patient of Dr. E. Johnson's, in the Hydropathic Institution, for two months, and after this went to the Ilkley Hydropathic Institution for two years; felt relieved, but was never well. After this he became a patient of Dr. Gully, who treated him for chronic inflammation of the bowels for six months, without success; has been three times to Germany to try the hydropathic establishments there, and has also been for two years under homœopathic treatment.

Suffers at present from severe pains on the top of the head, especially if he thinks about religion; also great confusion of mind, uneasiness about the stomach, indigestion, and confirmed constipation, has not had a natural motion of the bowels for many months, and is obliged to use the enema every other day. Suffers also from piles and fistula, and frequent hemorrhage; has great pain in the lower part of the abdomen and groin.

March 17th.—Took his first bath. A few minutes after he was in the water a violent involuntary shuddering came over him, although the heat was full ninety-eight degrees, felt the electricity in his arms rather strongly, but the trembling continued all the time he remained in the bath. After holding

the pole for a few minutes, the hands felt as if grit or sand were coming from them. On drying some of those particles and submitting them to the stanhope lens, they presented the appearance of longitudinal crystals, and were undoubtedly salts of mercury. Another thing observed in reference to the hands was, that on leaving the bath, they were of a deep purple colour, equally as deep a tint as the hands of a dyer. The next day he told us that he was very uneasy in the evening after taking the bath; was restless, and had flying pains all over his body; slept comfortable, however, and was better in the morning.

March 21st.—Less shuddering in the bath to day. The hands, however, became discoloured as before, and great quantities of what the patient calls sand came from them.

March 24th.—All the symptoms remain as before, but are less painful in every particular. Has had one natural action of the bowels, the first for months, almost for years, slept well and is much more comfortable.

For the next six baths there was very little change, all the bad symptoms gradually subsided, the natural functions of the body were restored, and the patient was progressing well. He was now obliged to leave London, and discontinued the treatment for the time; he had however become completely changed.

A case of muscular rheumatism, which ended in an articular affection, was presented in W. Brooks, working jeweller, 14, Greville-street, Hatton-garden; he says he was very fond of angling when young, and used to stand in the water, in consequence of which, he got an acute muscular rheumatism in the legs and thighs, this happened twelve years ago. The attack was very severe. He used embrocations, and took a large quantity of medicine; does not know what it was; recovered and remained well for four years, when he had another attack, for which he took a great quantity of mercury; was relieved for a time, but has since had several relapses. For the last six years there has been a pain in the joints, which has assumed a chronic character. Has tried various means to get it removed; been twice in St. Bartholomew's Hospital, where he took a large quantity of colchicum, and other medicines; has also been under Dr. G. J——'s treatment, taking his hot air bath and used the wet sheet, which made him worse. Has been under seven or eight medical men besides, and taken a large quantity

of patent medicine, also laudanum, to make him sleep. His hair turned grey at the age of fourteen, never drank spirits in his life, and but very little beer.

When he first called, his appearance was that of a man of seventy, could scarcely walk with the help of two sticks. Stooped much, and his face indicated suffering and wretchedness; has been obliged to give up his work, not being able to use his hands; has pain in the jaw, and difficulty in moving, so that he can scarcely masticate his food; breathes also with difficulty. It required some effort to get him up stairs. A short time after being in the bath felt much relieved, breathes more freely, and can open his mouth better; his feet also are in less pain; does not feel the same cracking in the articulation of the maxilary bones. His countenance was much improved, having a less painful expression, and after getting out of the bath, could walk with one stick only.

March 22nd.—Can get up stairs to-day without assistance, one foot after the other, without using either the sticks or the banisters. Got into the bath at ten minutes past twelve; says; the night after the first bath, felt that he was getting better. Formerly, he had scarcely three hours sleep in the night, but he felt so comfortable then, that he laid in bed until the afternoon, and could scarcely awake. The chills and shakes to which he was subject, have entirely subsided, his joints are more supple, the breathing freer; was manipulated whilst in the bath, and supported the operation without pain or inconvenience, left comfortably and in good spirits.

[Brooks promised to call again, but since that day I have never seen him. My assistant called several times to inquire about him, but he could not see him, and was told by a child that he was at work.]

A case in which electricity was the principal agent, independent almost of any other treatment, in restoring the use of a paralyzed arm, was presented to us soon after the opening of the bath.

Mrs. Thornton, aged 49, cook, sanguine, lymphatic temperament, says: that she met with an accident on the 9th of February, 1855, whilst living at Dr. Cotterell's, Brighton, by which she injured the bone of the left thumb; went into the hospital, and was there eleven weeks under Drs. South and Winter. Had six operations performed on the thumb—the third affected the tongue, by drawing it between the teeth on

the left side, which was only relieved by another operation. After the last operation, she gave several violent hysterical screams, and has been nervous ever since; after this the poultices were removed, and the thumb became stiff and the arm fixed; was unable to do her work and consequently left service. The hand is completely useless; the fingers and wrist rigid and swollen, and the upper part of the arm withering and becoming less. It is occasionally very painful, this has been slightly relieved and the hardness a little softened by rubbing it with neats' foot oil, which she commenced using in August last; the hand however still continued to be perfectly useless. Mrs. Thornton only took the baths for one week, after which she was much relieved, and by the use of simple galvanism for about three weeks longer, she was completely cured.

Although we have, as related in the preceding pages, had some very serious cases under our treatment, still, as a general rule, our patients have been more of that class who move about and appear pretty well—but who, nevertheless, suffer much in secret, and can never be said to have good health. The following is a very fair sample of this class of patients.

May 27th, 1856.—Rev. C——, aged 30, sanguine temperament, had up to 25 good health, but caught a complaint at that time which occasioned his going under a course of regular medical treatment, in which he took large quantities of mercury and potassium which removed the disease; but soon after this a number of warts came on the tongue, and blisters on the palm of the hands, and occasionally discoloured spots on the body, but more particularly on the chest. A medical man prescribed a course of mercurial treatment, which induced salivation and removed the disease. This left him in a state of great debility and nervous irritation, so much so, that the least thing that disturbed the mind, even a mere thought, brought on intense fits of crying. Left off the mercury and took the extract of sarsaparilla until he considered himself cured. Fifteen months after this he began to feel uncomfortable about the mouth—first there was a soreness of the gums, and then spots upon the mouth and tongue which gradually formed into ulcers; was treated with iodine of potassium, but the symptoms invariably returned after the discontinuance of the medicine. Took various preparations of mercury again, and obtained temporary relief, but the symptoms returned with

increased violence. After this he was under various medical men, who changed the treatment, but never succeeded in removing the complaint; was finally under the care of an eminent homœopathist but received little or no relief.

It is unnecessary for us to follow the records of the case day after day. The patient took altogether ten baths; the first four or five seemed to affect him but little—the sixth bath however told powerfully upon the system and brought out an eruption upon the chest and throat, which clearly indicated that a crisis had been arrived at in the curative process. He left at the end of the three weeks with the whole constitution thoroughly renovated.

We regret that a want of space has compelled us to omit a vast quantity of interesting matter which has been written. The reader must therefore take what is given here as a specimen, rather than a detailed account of the operations of the bath.

Our first and principal object in writing this little work, was to illustrate the practical utility of the electro-chemical bath, so as to make it comprehensible to every one, and not merely to speak of its importance, but to clearly demonstrate it. We found in proceeding, that our task would be incomplete, if we had only brought forward our personal opinion, and have therefore corroborated it by indisputable facts, as well as by the observations of men, whose names are a sufficient guarantee to secure attention to their remarks. Carried on by the vivid interest we naturally feel for the subject, we collected more matter and quotations than our little work could contain, destined as it was, from its origin, to be a shilling book, which it is understood implies a book for the millions; but if, as we hope, it proves sufficiently useful to be an object of interest for the public, we shall, in the next edition, insert the matter we are now compelled to abridge, and give a greater development to some other parts of the system that we have intentionally curtailed from the beginning.

In conclusion, we have now to observe, for the guidance of the reader, that we do not confine ourselves to the mere administration of the electro-chemical bath. It is, in fact, but an addition to our special practice, either as a medical electrician, or as a professor of dynamogenesy.* Our knowledge is the fruit of practical experiments, and we use in our estab-

* See "Dynamogenesy; a system of Physical Education, devoted to the culture of Health, Strength, and Beauty." By J. Caplin, M.D.

lishment every one of the means which have been spoken of. It is therefore but consistent to apprize our readers, that we have been assiduously at work for twenty years, collecting on our own premises, that assemblage of means which, according to the opinion of those who have visited our establishment, exists nowhere else.

So far as the small space we have to spare, will permit, we shall describe our system in full. It consists in curing a certain class of diseases without internal medicines; not that we reject physic entirely, that would be an absurdity we are not guilty of, knowing perfectly well, as we do, that there are some cases in which internal medicines are indispensable. But we are always fearful of its abuse, and it is our firm conviction, that the more we dispense with it, the better it will be for the welfare of all. We are daily engaged in removing from the system the deadly poisons which, for the most part, have been introduced medicinally. With regard, therefore, to the use of metallic substances, we earnestly protest, they being, as we have demonstrated in preceding chapters, contrary to the dictates of nature, to the laws of physiology, and consequently of humanity.

Having so far expressed our thoughts and feelings, we may add, that we are far from having the intention of monopolizing the resources we have elucidated. We think that they should be popularized as much as possible, and particularly for the benefit of the working and poorer classes. We contend that they should be adopted in every hospital, and beg to suggest to the benevolent people who support, and the officials who conduct those institutions, that the erection of preventive or hygienic establishments, where the poor might at once be relieved of their sufferings, and rescued, with their families, from the inevitable distress which always follows the unfortunate man who is obliged to sojourn for any length of time in a hospital.

It is a motto, repeated by every one, "that prevention is better than cure;" why then should we not begin by first providing the means of preventing disease; sufficient work would still remain for the hospitals to expend their beneficent resources upon accidental and incurable complaints, and all those surgical cases so common in large towns.

Should our wishes find any public sympathy, we would with pleasure give such information, and render such services as lies in our power, for the purpose of introducing the electro-chemical bath into any PUBLIC institution.

CAUTION.

We have received several letters from parties, who after having stated that they had been suffering for years from the most horrid affections, and had tried in vain every kind of remedies, inquired if *one* bath would cure them. We have had also under our treatment, some patients who did not inquire beforehand, but came to us under the impression that they should be cured in a week of formidable diseases, for which no treatment had proved available. We think proper, therefore, in order to avoid disappointment, and to save ourselves the disagreeable feeling consequent upon not completing what we begin, to say, that we cannot secure that a disease shall be cured in a given time. Some of the cases we have had under our care have been cured in an inconceivably short period, much sooner indeed than we expected; some others have been protracted beyond the time we anticipated. Some patients have described their case as very slight, as if by disguising the character of their affection, they could be cured sooner. Some others have a preconceived idea of the cause and origin of their disease, and deviate so far from the real facts, that notwithstanding the experience and knowledge one may have, there is no possibility of forming a correct diagnostic from the symptoms which they acknowledge to—they want indeed to controvert the original cause of their complaint.

It is not that we attach much importance to the diagnosis, our treatment being nearly the same in every case. Our prognostic is almost invariably correct, because the morbid substances must, and are, always eliminated—it is only a question of time. We have in our last chapter, stated that a single bath will restore at once the general organic functions when they are only disturbed; but between this simple condition, and a state of chronic disease of ten or fifteen years standing, there is a long scale to pass through. As a general rule, we have to take into consideration, not only the duration of the disease, but particularly the condition of the general health of the patient at the time he comes to us—in fact the question of time is particularly subordinate to the question of *power* we have so emphatically spoken of before.

DODD AND CO., FREEMAN'S COURT, CHEAPSIDE.