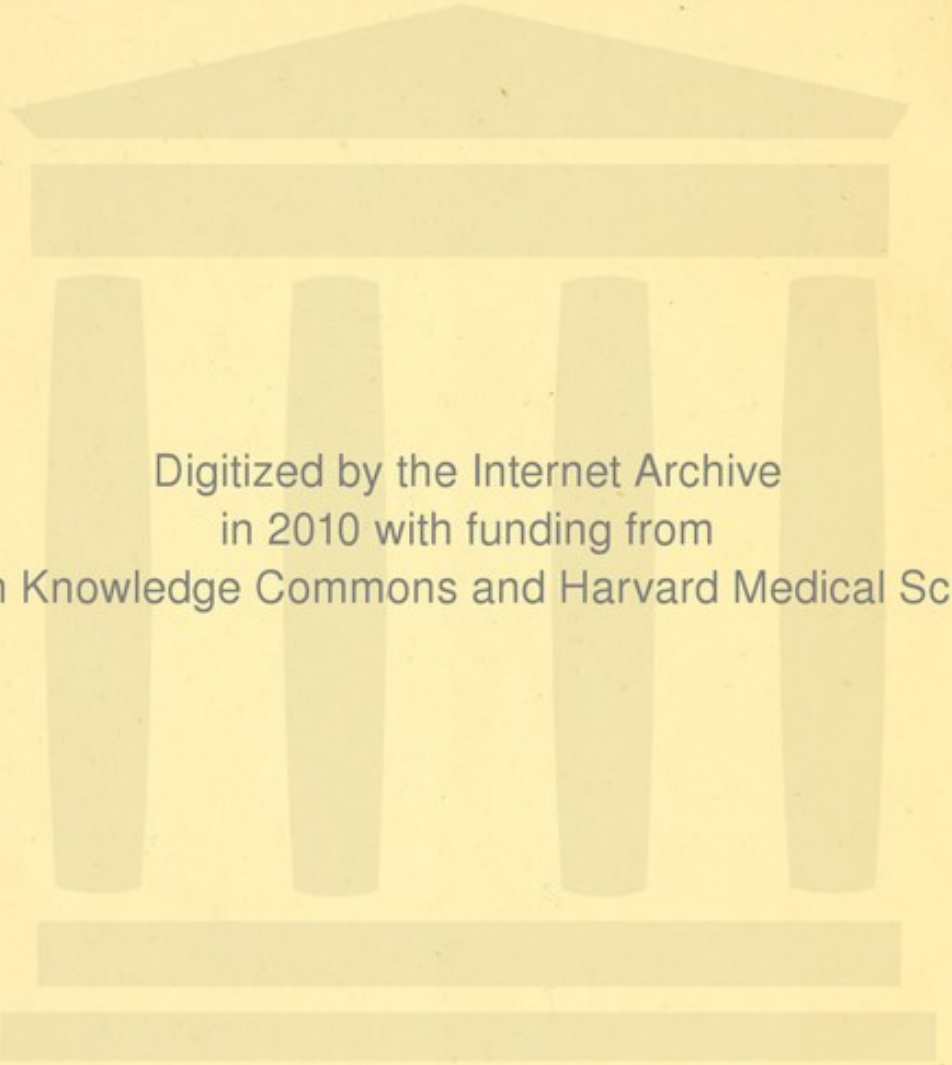
A popular treatise on medical electricity : showing the influence of electricity as a remedy for diseases; and plain & practical directions for its application to various disorders / by Henry Woodward.

A POPULAR TREATISE
ON
MEDICAL ELECTRICITY

HENRY WOODWARD



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MEDICAL ELECTRICITY;

SHOWING THE INFLUENCE OF

ELECTRICITY AS A REMEDY FOR DISEASES;

AND

PLAIN & PRACTICAL DIRECTIONS

FOR ITS APPLICATION TO VARIOUS DISORDERS.

BY

HENRY WOODWARD,

Medical Electrician.

WITH ILLUSTRATIONS.

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CONTENTS.

PREFACE.

It is necessary, at the outset, to say that this little work does not pretend to do more than convey, in the simplest and clearest language possible, an outline of the advantages which may be gained from the proper use of Electricity, as a remedy for human diseases; and of the best practicable means whereby those who, from various causes, are unable or unwilling to employ a medical practitioner, may themselves apply this wonderful remedial and curative agent.

Not being intended for the medical profession (who already possess fully elaborate treatises in the scientific works of Julius Althaus, Roberts Bartholow, Moritz Meyer, Allan McLane Hamilton, G. V. Poore, A. C. Garratt, Charles E. Morgan, Herbert Tibbitts, G. B. Duchenne, and Drs. Beard and Rockwell, with others), the use of scientific and technical terms is avoided as far as possible; and where there is no escape from using them, their meaning is sufficiently explained.

The writer is fully convinced that, in many maladies, the symptoms are so clearly marked, and the mode of applying Electricity is so simple, and has been so thoroughly established by experience, that it may be safely employed by persons with a very moderate amount of knowledge, if they will use ordinary care, without recourse to a

medical practitioner. At the same time, he would be sorry to kindle a thought in the minds of his readers that it may be used by anyone who is ignorant, either of the effects produced by Electricity, of the nature of the human frame to which it is applied, or of the particular disease which they may propose to remedy by its use. Some elementary knowledge under each of these heads is absolutely necessary to its safe and effectual use. Such knowledge it is the object of the present little work to supply.

During the course of more than twenty years' successful practice in the United States and Canada, the writer, having experience of various kinds of Medical-Electric machines, has been led to effect certain improvements, in the direction both of efficiency and economy, which will be found fully described in the account of the "WOODWARD ELECTRO-MEDICAL MACHINE" in the pages following, and to which he begs to direct special attention.

20, MACFARLANE ROAD,
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ON

MEDICAL ELECTRICITY.

CHAPTER I.

THE NATURE OF ELECTRICITY (ELECTRO-PHYSICS).

If the question, "What is Electricity?" were propounded in its naked simplicity to the whole body of scientific men of the present day, their candid answer must be, "We don't know." It is not a substance, either solid, liquid, or gaseous. It can neither be handled, poured out, nor dissolved in vapour. It is without weight, and is invisible. For want of a better name it is called "a *force*." The early discoverers of Electricity supposed it to be a fluid, which, they said, permeated all bodies. This idea is no longer entertained, but yet the phrase "an electric *current*," which arose out of it, is still used, although somewhat incorrectly; and the force passes into and through bodies adapted thereto, just as though it actually were a "current" of the "electric fluid" as it was supposed to be. It is well, however, to understand at the beginning that although these terms

are still used, they no longer represent the actual scientific view of what electricity is.

The force is one of the most wonderful which comes under the view of the philosopher. It makes its presence known everywhere, it circulates through all the organs of animals and plants, and has such a close resemblance to the nervous force which makes up life itself, that some have even supposed it to be identical with life. This is a speculation, however, which the present state of our knowledge does not confirm. But the experience of the last thirty or forty years has, in spite of much prejudice at first existing, led to a very general admission by the most eminent medical men that this wonderful force may be so used as to be one of the most valuable helps to the physician, both in the examination of diseases and in their treatment and cure.

The power or force to which we give the name Electricity is one which can be perceived or described only by the effects which it produces. It has, however, been sub-divided in the nomenclature of science, according to the sources from which it may be derived, and the continuity, or want of continuity, of the "currents" through which it operates. A very brief description of the various kinds is the utmost that can be attempted within the limits of this little work. The first is :

A. *Frictional Electricity.*—This is also sometimes called "static" and "Franklinic" electricity, or simply "Franklinism," in honour of the philosopher, Benjamin Franklin, who did much to

advance the knowledge of it. This kind of electricity is ordinarily produced by the friction of a glass tube, or a flat disc of glass upon silk or other substance; the electricity thereby developed being communicated by wire conductors, or a brass chain, to the person who is to be "electrified." Occasionally, the patient used to be made to receive a "spark" from the apparatus, directed to a particular part of his body. Or he was seated upon a glass-legged stool, and "charged" with the electrical force, a spark being drawn from his body by the knuckle of the operator, or a rounded metallic knob, in the same way that it might be drawn from the inanimate jar, or conductor. Franklinism is, however, very little, if at all, used now in medical practice, and may be left out of practical account.

The two kinds now in use are the Galvanic current and the Faradic current. Both of these have their prime sources in the chemical action of acids upon certain metals, so connected with each other as to form what is technically termed an electric "battery."

B. *Galvanism.*—The peculiarity of the Galvanic battery, as distinguished from the Faradic, to be described presently, is that its action is *continuous*, that is to say, the current induced by it is produced without any interruption so long as the battery continues to act. It exerts powers of attraction and repulsion, it will charge a Leyden jar, it will decompose water, deflect a magnetised needle, magnetise soft iron, melt thin metallic

wire, or send a shock through the arms if the two poles are touched with the fingers. Hence the necessity of precautions in its use, which it is the object of this work to convey. It is sometimes spoken of as "the continuous current," "constant current," or "battery current;" and again as "Galvanism," or "Voltaism," in honour of Galvani and Volta, who made the first and deepest researches into its nature. It is the only form of electricity which has a powerful influence upon the electricity inherent to the nerve, producing the so-called electro-tonic effects; and its superiority over other forms (according to Dr. Althaus) in the treatment of certain nervous affections must be put down to this circumstance. It is invariably produced by the action of a liquid upon two *different* metals; for example, water, or an acid, upon copper or zinc.

C. *Faradic Electricity.*—This is the latest and most important form in which electricity is now used in medicine. It is sometimes called "electro magnetism," "magneto electricity," or "Faradisation," in honour of Faraday, the great philosopher, who first discovered the induction current in 1830. Other names applied to it are the "interrupted," and the "intermittent" current. Its primary source is the action of a battery current upon two copper wires, this so-called current passing directly to the first wire, producing an instantaneous electric action in another wire, placed parallel with and near the first wire. This secondary action is what is called the "induction" current,

because it is induced, or led to, the second wire from the action of the first. It being usual to form the wires for this purpose into a coil, that part of the mechanism is called "the induction" coil. The largest induction coil ever made was that constructed by Mr. Apps for the late Royal Polytechnic Institution in London. This was of enormous power, and its effect upon the animal organism was publicly demonstrated by Dr. Richardson, who instantaneously destroyed a sheep with the powerful spark—eleven or twelve inches in length—which it emitted. The coils, however, which are used in Medical Electricity, are, of course, only of sufficient power to effect the purposes for which they are intended.

As distinguished from the Galvanic or continuous current, the action of the Faradic current is "intermittent," or "non-continuous," that is to say, it takes effect, not during the whole period of its circulation, but at the two moments when it begins to circulate through the wires, and when it ceases to pass through them. It gives, in fact, a series of little shocks, in place of the continuous action of the Galvanic current. The Galvanic current may be compared to the gentle flow of a continuous stream of water, while the Faradic current is like the successive pattering of the drops in a shower of rain. But for medical purposes it is necessary to regulate the rate at which these successive shocks may succeed each other. In some cases they may be required so rapidly as to be almost practically continuous, whilst in others they

may be required to occur at such intervals as to give a distinct sensation of small blows, or shocks, succeeding each other. For this purpose Faradic instruments are furnished with what is called a "rheotome," or contact breaker, by means of which the flow of the Galvanic current (which, it must be remembered, is the source of the induced current) is interrupted more or less rapidly, so as to yield a more or less frequent succession of the instantaneous currents. The action of the contact breaker produces a slight musical sound; but in purely Galvanic instruments the action is perfectly silent.

Faradisation has a great effect upon the muscles of motion and sensation. It produces a state in which these organs are active according to their physiological functions, and if judiciously applied, it has the power to re-establish or improve their decayed or impaired state. It produces contractions of the muscles, augments the chemical changes going on in their substance, causes a more abundant supply of arterial blood to these organs, and increases their nutrition in a very remarkable degree.

CHAPTER II.

THE INFLUENCE OF ELECTRICITY ON THE HUMAN BODY (ELECTRO-PHYSIOLOGY).

"THERE is nothing new under the sun," wrote the wisest of men ; and this is true in a sense of electricity. The attempt to employ electricity in medicine dates, in fact, as far back as the knowledge of the appearances of electricity itself. The ancients, we are told, occasionally ate of the raja torpedo, or electrical fish, on account of its supposed curative properties ; and a thousand years ago the women of Western Africa are said to have placed their sick children in pools of water containing these fish. Scribonius Largus, a physician of the time of the Emperor Tiberius, employed electrical fishes for the cure of gout; and Pliny and Dioscorides speak of electricity as a remedial agent in several diseases. It was not, however, till about the middle of the eighteenth century that much else was done in the way of its practical use for medical purposes. At that time frictional electricity was the only kind known (except of course the almost forgotten and unconsidered phenomena of the electrical fishes), when a German, named Kratzenstein, is said to have restored the use of a paralyzed finger by electricity, and experiments were made in the Vienna Hospital, under De

Haen, with great success. In France a favourable report was made on the subject to the Royal Society of Medicine in 1773. The discoveries of Galvani and Volta gave it afterwards a great impetus, but it must be said—for it would be impossible, though highly interesting, to trace its history in detail in this little work—that its progress has been retarded very much through the extravagant expectations and pretensions of many of its advocates. It has been lauded as a certain panacea for all diseases, and as almost capable of restoring life and preventing the natural processes of dissolution and decay. When these pretensions were seen to be futile, the practice of electrical-medicine was looked coldly upon by even great men, from whom a more philosophical attitude might have been expected; and it has had to win its way by the slow but sure and certain process of experiment and induction, whereby it has at length been placed upon an acknowledged and unshakeable basis of scientific demonstration. The eminent physicians whose names are mentioned in the preface have patiently studied every property, not only of the agent itself, but also of its specific action upon the different nerves, muscles, and other organs of the human body; and the general result of their researches is that the medical profession now generally admit, not as some absurd fanatics assert, that "Electricity is life," but that it is an agent which, if properly used, may be made to produce tonic, stimulating, or sedative effects, without the intervention of the stomach, or even of the circulation; and that it

fulfils a function in the cure of disease of which neither drugs nor any other known agent is capable.

It would be a mistake to suppose that the human body can be treated as though it were one simple mass, sensitive in all parts to the same degree. It is not homogeneous like a copper wire or steel bar, but consists of a great variety of differently-conducting substances, moulded into one, each of which has a definite influence upon the resistance of the whole. For example, the skin, hair, and nails are found to offer great resistance to the passage of the currents; and again, the skin differs much in thickness in different parts of the body, so that a current which would be felt plainly in the face, where it is thin, would not be perceptible in the palms of the hands or the soles of the feet, where its thickness is considerable. Mucous membranes conduct better than the skin, and the resistance of the skin may be reduced by moistening, and this is why sponges moistened with warm water, or the moistened hand of the operator, are generally used in medical electricity. Nerves, muscles, bones, blood, mucous membranes, and other substances, differ not only in chemical composition but in shape and bulk, all of which have to be taken into account in estimating the relative conductivity of each, so that it has been a very complicated problem which our physicians have had to solve. It is not pretended that all is known, but much *is* known, and that with pretty considerable certainty. For example, as Dr.

Althaus says: "It has been proved that when the current has once overcome the resistance of the skin and the bones, it will spread almost equally through all the organs which are interposed between the two poles of the battery, and that the greatest effect is always produced in the immediate neighbourhood of the two poles. It has likewise been shown by experiments on dead bodies that the brain and spinal cord are accessible to electricity. The eyes conduct almost better than any other organ, and positive results have also been obtained with the tongue, ears, lungs, heart, liver, spleen, intestines, &c."

These facts are absolutely necessary to be borne in mind if we wish rightly to understand the course which an electric current takes when it enters the body. The structures of the body consisting of a series of organs widely differing from each other, of irregular form, and unequal capacities of conducting the current, it occurs that when the two poles of an instrument are placed upon any two points of the surface, the current which starts from either pole divides into innumerable branches, and forms what are called "derived currents." These at last converge to the other pole, and thus the whole space intervening between the two poles is traversed by the electric curves of these currents; and the intensity of the current in each substance through which it passes,—be it bone, muscle, nerve, or other substance,—is inversely proportional to its resistance; because the greater the resistance the less must

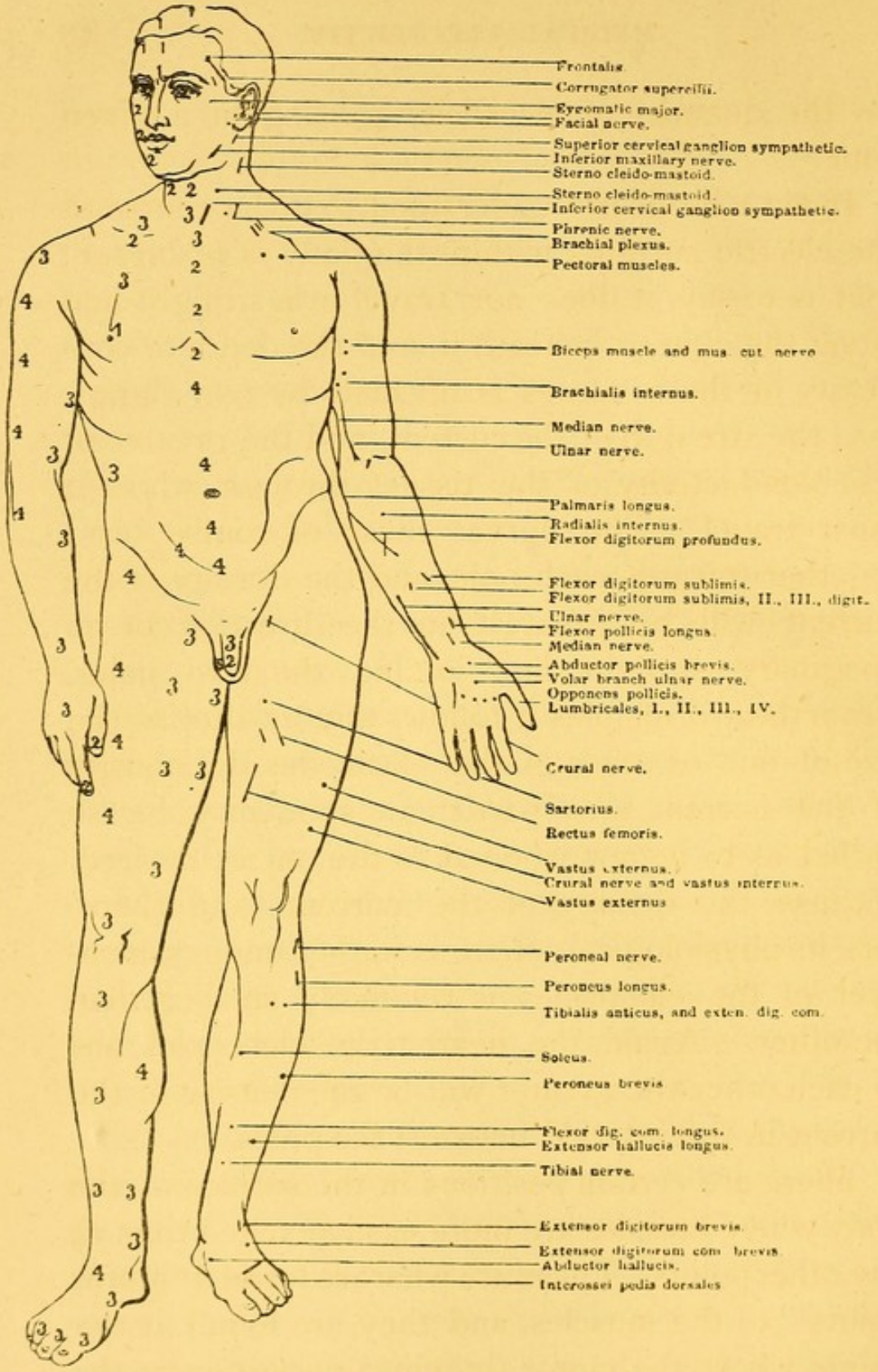

FIG. 1.—Electro-physiology of the Human Body. Anterior view. The marks on the left hand of the figure indicate the positions of the motor points. The numbers refer to the relative strength of current which may be applied to the respective organs.

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be the quantity of electricity passing in a given time.

It must be clearly understood that the course of the electric currents within the body is *in curves*; that is to say, it does not travel in a straight line along the skin or beneath it, and the depth or convexity of these curves is affected by two things, viz., the strength of the current, and the greater or less conductivity of the tissues through which it must travel. The curves must of course bend together towards each pole, and the density of the current will be greatest in the direction of an imaginary straight line joining the two poles. From these principles it follows that by altering the size of one or other of the electrodes the density of the current in a particular spot may be so varied as to be apportioned to the object desired, because the density of the current, and therefore its physiological action, is higher under whichever of the electrodes is relatively smaller than the other. Again, the nearer the electrodes are to each other the greater will be the density of the current in the interval between the poles.

There are certain positions in the surface of the body where muscles are more easily excited than at any other points. These are what are termed "motor points" of the muscles, and they are found at the points where the motor (moving) nerves enter the muscles. The discovery of these exact spots on the exterior of the human body was the object of long and systematic study, in which Dr. Ziemssen, of Berlin, took a most distinguished part. The

points as first indicated by him, but corrected from numerous subsequent observations, are shown in the two accompanying illustrations (Figs. 1 and 2) of the anterior and posterior parts of the human body. A full exposition of them would be too technical for this little work, but a careful study of these two drawings will be found sufficient for most purposes.

It is wonderful to observe with what accuracy the experienced practitioner can, by means of his knowledge of these "motor points," bring into action even the most deeply-seated muscles of the body without exciting any neighbouring muscle. For example, the muscle which enables us to bend our forefinger (*extensor indicis proprius*) is one of the most deeply-seated muscles in the arm, and may be brought into action while every part around is in perfect quietude; and it is also equally easy to pick out every one of the four muscles of the ball of the thumb, and show their individual action without engaging the other, and similarly with those which move the toes.

It is not to be understood that a strict regard to all these motor points is necessary in every application of electricity, although such may be the case in special circumstances. In the normal condition most of the superficial and many of the deeper muscles and nerves may be easily excited by ordinary applications with large sponge electrodes. Some of the muscles have two or more motor points, and are therefore more readily affected by large than by small electrodes. A large

sponge electrode of from three to six or eight inches in diameter, folded over a brass ball, such as is used in general electrisation, causes full contraction of a majority of the superficial and deep muscles, when rapidly passed up and down the limbs.

But in the case of diseased muscles it is, however, necessary to ascertain the situation of the motor points very carefully. It must be understood that it is not possible to make any drawings whatever more than approximately correct, because the exact anatomical structure of individuals varies, in like manner as do the forms of their features, and the many other points which differentiate one person from another. A method of ascertaining their exact position for himself is therefore essential to the successful operator.

The best method of verifying them is to place one large sponge electrode, well moistened, on some indifferent point, and to press firmly a small negative electrode, also well moistened, over the spot where the nerve or muscle should be affected. The negative is to be preferred, because it is the stronger, and acts more powerfully in producing contractions. If the right place is touched, and the strength of the current and the pressure be sufficient, the proper physiological action of the part affected will at once appear. That is to say, in the case of muscles they will contract, accompanied with a feeling of contraction; in the case of nerve branches and plexuses (crossings of nerves) there will be sensation, more or less painful, along

the branchings of the nerves, and, if the excitation be sufficiently strong, contraction of the muscles which they supply. Very many muscles have no exterior or accessible motor points, and must therefore be electrised interiorly. Practically, this is done in the majority of cases.

The accompanying illustrations (Figs. 1 and 2), besides showing the motor points, as above explained, are marked with a series of figures numbered from 1 to 5, intended to indicate the relative degrees of sensitiveness of different parts of the body. The most sensitive portions—that is to say, those to which the weakest current, relatively, should be applied, and which, therefore, require the greatest amount of care—are marked with the figure 1; and those which are less sensitive in their order up to 5.

A knowledge of the relative sensitiveness of the different parts of the body is indispensable both in the examination of diseases and in the effort to cure them by electricity. It is plain that we should be unable to judge the amount of insensibility to pain, or the loss of sensibility of muscle in paralysis, without a previous knowledge of what should be the normal sensitiveness of the parts examined. From a want of this knowledge very important mistakes are frequently made in the diagnosis of diseases by electricity. But knowledge on this point is not useful only for particular and special purposes, it is useful also in general application. In general Faradisation a knowledge of the relative sensitiveness of different parts of the

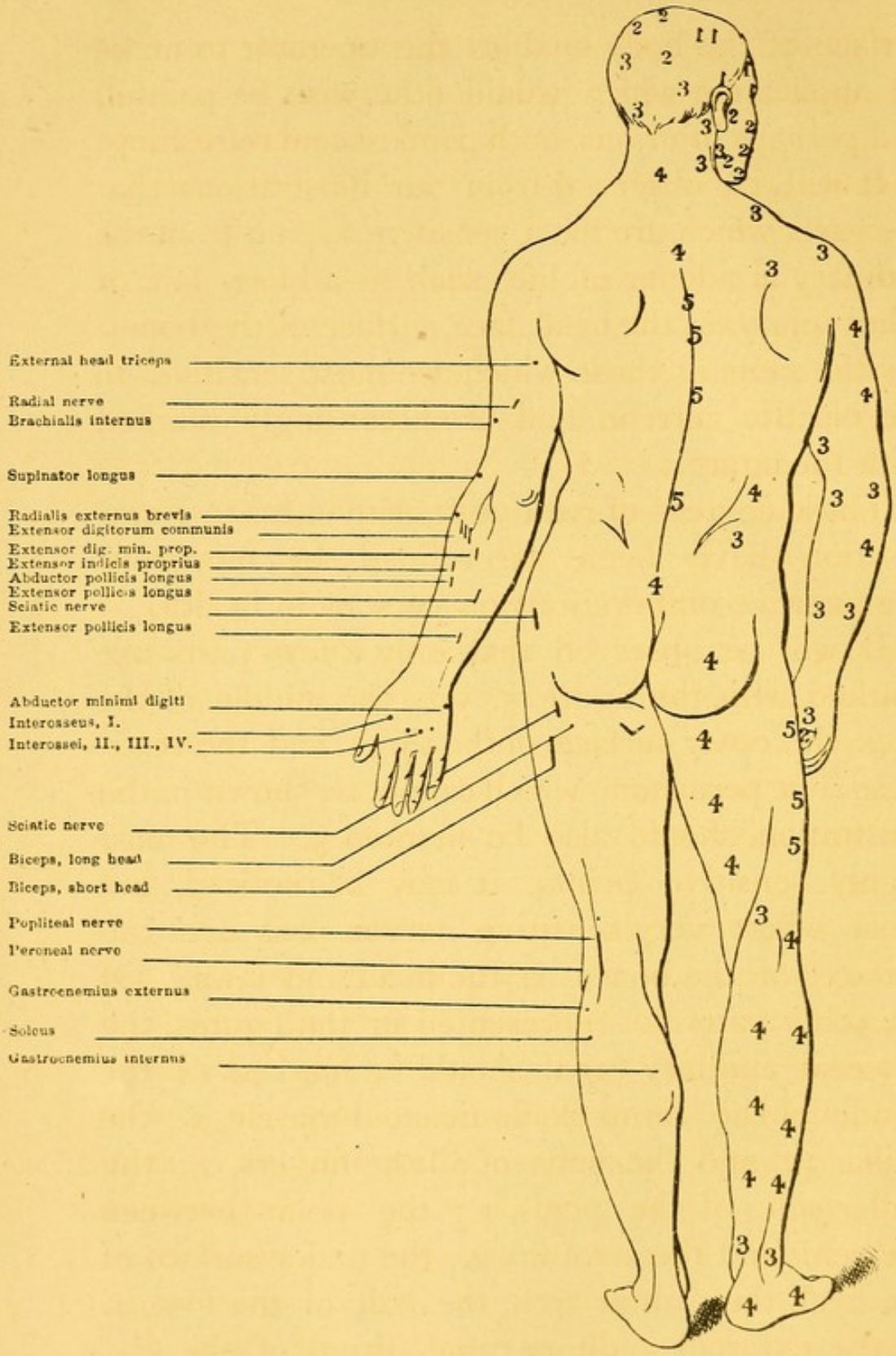

FIG. 2.—Electro-physiology of the Human Body. Posterior view. The marks on the left hand of the figure indicate the positions of the motor points. The numbers refer to the relative strength of the current which may be applied to the respective organs.

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surface of the body enables the operator to make an application which would otherwise be painful, and perhaps injurious, both painless and refreshing.

It will be observed from our illustrations that the parts which are most sensitive to pain from the ordinary accidents of life, such as a blow, fall, or other injury, as the head, face, surface of the bones, are the same as those which are most sensitive to the electric current, and are accordingly marked with the figure 1.

These degrees of relative sensitiveness to Faradisation have been ascertained by numerous comparative observations on persons in health.

It will be observed that only a few parts are marked with the figure 5, viz., the middle of the back, the outer surface of the thigh, and the testicles. The perinæum, which cannot be shown in the illustration, should also be marked 5. The most highly sensitive points, it may be noticed, are those where very sensitive nerves pass over the surfaces of the bones, as the head and jaws. Of the other parts not represented in the figures, the external auditory canal should be marked 1; the middle of the sterno-cleido-mastoid muscle, 2; the axilla, 3; and the ends of all the fingers, 2; the under side of the penis, 2; the point between the penis and the scrotum, 4; the under surface of the heel, the plantar arch, the ball of the foot, 4. If the external auditory canal, drum of the ear, conjunctivæ, nasal mucous membrane, tongue and larynx were represented, they should be marked a degree or two higher than 1, since they are more

sensitive than any portion of the surface of the head. The best point to test a current of extreme feebleness is the tip of the tongue.

These indications, it must be distinctly remembered, refer only to the Faradic current applied with electrodes sufficiently moistened to transmit the current readily below the skin. In dry Faradisation the results are somewhat different, and the pain at all parts is far less. The Galvanic current causes a burning sensation, which is most felt at those parts which are abundantly supplied by sensory nerves.

The greater sensitiveness of the bones to the Faradic current, as compared with the Galvanic current, is due to the greater mechanical action of the former. An interrupted Galvanic current, of sufficient strength to produce muscular contractions, produces the same sensations as the Faradic current, with the addition of the burning feeling at the surface beneath the electrodes. The fact that the Galvanic current is less painful to the surfaces of the bones gives it a certain advantage in making applications to the head, although the pain of the Faradic current, when applied to the head by the moistened hand, may be reduced to a minimum.

CHAPTER III.

GENERAL RULES FOR THE APPLICATION OF MEDICAL ELECTRICITY (ELECTRO-THERAPEUTICS).

In the early days of electricity there was a great amount of ignorance, even among the medical profession, as to the methods in which it should be applied. Medical men, wedded to old theories, neglected the study of this new agent, and as the late Dr. Golding Bird, of Guy's Hospital, pointed out, they too often contented themselves with the general direction, "Let the patient be electrified;" and electrified he was accordingly, by the first hospital porter, or ignorant nurse (for this was before the days of trained and properly qualified nurses), who had leisure to perform the operation. Now the ideas of such ignorant operators, for the most part, ran in favour of long-continued and powerful shocks; the more the patient seemed to wince under the process, the more effectually they thought they were performing it. And, sooth to say, at that epoch most of the medical practitioners were but little wiser. Things have changed now. Electricity as a remedial agent has won its way in spite of prejudice, neglect, and ignorance. It is systematically practised and studied in our great hospitals; and last year St. Mary's Hospital, in London, distinguished itself

by being the first, in this country, to establish a special department for electro-therapeutical treatment and study. (See *Lancet*, July 21, 1883, p. 119.) These old notions are here referred to by way of caution to the reader, lest any remains of them should be lingering in his or her mind. Nothing has tended to hinder the advance of medical electricity more than its indiscriminate and ignorant application by those who once assumed to practise it. There is no excuse, however in these days, for any of the mistakes of former times. The experience of our best physicians—and the writer ventures to add his own experience of more than twenty years—has led to the establishment of a set of rules and cautions, by observing which alone success may be expected. These may be briefly stated as follows :—

1. Always keep every part of the machine *perfectly clean.*

2. When about to administer electricity, while your patient is preparing, get your instrument ready and *set it at the lowest power*, so that no inconvenience is felt. Most people who are unaccustomed to electrical remedies fancy they are very painful or even dangerous, the fact being on the contrary, that, if carefully and skilfully administered, they are absolutely free from danger, and are pleasant and refreshing tonics.

3. As to the *dose* which should be administered. —In this, as in other departments of medicine, several things have to be taken into consideration. For example, in the administration of a shower

bath we have to consider the temperature of the water, the weight with which it falls, and the length of time it is to last. In like manner, in the administration of electricity we have to consider, (*a*) the strength of the current, (*b*) the thoroughness of its application, and (*c*) the length of time for which it is applied. Here are a few directions under each of these heads,

(*a*) *The strength of the current.*—It has just been said that, in beginning, the instrument should be always set at its lowest power. The first applications should invariably be of the gentlest nature possible. If the patient be particularly sensitive it will be an advantage if the electricity be administered with the hand of the operator, rather than with an artificial electrode. When the patient has become used to the treatment, the strength of the current may be gradually increased, but only to such an extent as to make it, so to speak, *pleasantly painful.* This rule, however, must be applied with caution. The operator must watch the patient, and if he observes any symptoms of painful suffering, likely to lead to a reaction, he must moderate the strength of the current accordingly. There are some patients who, from peculiarity of constitution or other causes, can bear only very slight currents indeed. On the other hand, there are some so constituted that, after long use of electricity, they become, so to speak, insensible to the strength of ordinary gentle currents, and these may often receive benefit from much more powerful currents.

As a general rule, the sensations of the patient are a safe guide as to the strength of current which may be employed. But even here care must be employed, for there are known cases of persons who have felt no pain at the time of application, but who on the day following have experienced a most unpleasant reaction. These, however, are but exceptions to the general rule.

(*b*) *Thoroughness of application.*—There is a large class of patients who are so timid of the action of electricity, owing to the memory of frightful "shocks" they have received from "shockingly" incompetent persons, or the accounts instilled into their minds by friends, that they enter the operating-room with fear and trembling. Such patients must be handled at first very tenderly, and the full measure of treatment must be approached only by slow degrees. In such cases it is by no means necessary that all parts of the surface of the body should be touched by the electrode at every sitting; nay, it is not always necessary, in every case, to make the applications to all parts of the surface of the body, even in a prolonged course of treatment. It will be often found enough to make the first application only around the neck, shoulders, and on the upper portion of the spine. When the patient has got over his or her nervous fears, and learned by experience that the general application of electricity is agreeable on the whole, or at most causes only a very mild feeling of discomfort, the operator may make his application

increasingly thorough. It is possible to attain the general tonic effects of electricity without touching either the upper or lower extremities; but it is at the same time to be borne in mind that the electrisation of the arms and legs reacts favourably on the whole system, and is of great value in aid of the treatment.

The ordinary rule is that *where the local disorder is associated with general weakness, the applications of electricity, while having special reference to the part affected, should be made all over the body.* Such is the general rule, but deviations from it are necessary sometimes, and each case should be studied by itself. Thorough applications to the head, or at least to all portions of it, are not necessary in half the cases which require general electrisation. It is generally sufficient to place the hand of the operator over the forehead, on the top of the head, and over the back of the head (the cerebellum), without wetting the head all over. In some cases great benefit is derived from applications over the head, in others the results are negative.

In all cases, except during the first trial applications, and that of patients unusually susceptible, the neck, spine, and abdomen should be treated. But during menstruation, unless it is wished to increase the flow, it is generally better to avoid the abdomen and lower part of the spine, or to suspend the treatment altogether, except in those cases where it is desired to increase the flow.

(*c*) *Length of time of application.*—This may

range *between five minutes, and a half or three-quarters of an hour*, according to (1) the constitutional strength of the patient; (2) the strength of the electric current employed; (3) the stage of the treatment, and (4) the results of previous applications.

Experimental applications should always be short, but patients who have long been accustomed to the treatment may sometimes receive most powerful currents for even an hour over any part of the body, *except the head.* Real or apparent strength of constitution is a most deceptive criterion by which to determine the length of the sittings.

A proportionate amount of the time of every sitting should be devoted to the applications to different parts of the body, the spine occupying the largest portion, next the spine and abdomen, while the head should be electrised the shortest portion of time. The following table shows how much of a fifteen-minute sitting should, on the average, be occupied by each of them :—

Head	1 minute.
Neck, sympathetic, and cervical spine	4 ,,
Back	3 ,,
Abdomen	3 ,,
Upper and lower extremities	4 ,,
	15

This is, however, a very general estimate. In general Galvanisation, or Galvano-Faradisation, the time should be reduced one-half.

4. *Repetition of Applications.*—General electrisation may be repeated daily, every other day, once or twice a week, or at still longer intervals. The full tonic results of the treatment may be attained by an application every other day, but patients who from any cause can be submitted to treatment for only a short period at a time, may receive an application daily, except in cases of unusual debility, or exceptional sensibility to the current. Some of the best results have been attained with patients who have received daily applications, for a number of weeks in succession. At the outset of the treatment of any patient it is not well, however, to give thorough applications every day, unless previous experience has given the operator a knowledge of the patient's constitution. For patients who are nervous or susceptible, especially for those who complain of reaction, or secondary effects, it is well to allow intervals of several days, until the permanent tonic effects begin to show themselves.

Patients who are specially susceptible to other tonics are also susceptible to general electrisation, and accordingly need longer intervals than usual between the sittings.

5. *Persistence in Treatment.*—In the majority of cases liable to electric treatment, some considerable persistence is necessary. One reason for this is that most of the disorders amenable to it are of a chronic nature, and it is an axiom that "chronic diseases demand chronic treatment," whatever method be adopted, whether electrisation or other-

wise. It is also a law of disease that those disorders which have been long in progress must be correspondingly long in their cure. To these reasons, it may be added, that electrisation being a tonic remedy, is, like all remedies of the same nature, more or less slow in its action.

Great and beneficial effects may, indeed, be derived from two or three applications, but a complete, or even nearly complete, cure of long-standing disease can only be gained by persevering treatment, with care on the part of the operator to vary the strength of the electric current, and the frequency of applications, according to the progress observed.

The length of treatment may range from one week to several months, with longer or shorter intervals, according to circumstances. In all long-protracted cases there should be occasional intervals of one or more weeks where the sittings are held as often as every other day; and it will, indeed, be often found that the cure advances more rapidly during the intervals than while the treatment is in actual progress.

Mild and recent attacks may often be cured be one, two, or three applications. It has been observed in a large experience that the average number of applications to each successful case was about ten to fifteen, and the length of time over which the treatment extended was from three to six weeks.

6. *Use of the Moistened Hand as an Electrode.*—It is found that the moistened hand of the

operator possesses great advantages over the sponge or other artificial electrodes in general Faradisation, especially in applications to the head and other sensitive parts of the body. No form of electrode that the art of man could devise can ever compare with the human hand in flexibility and power of adaptation. The great variety and delicate combinations of movement of which the hand is readily capable, the softness of the skin, and the lightness with which it can touch, press, or handle, render it superior for all the nicer processes of general electrisation to any artificial arrangement whatever.

The hand is sometimes more effective than the sponge. This is partly because it allows the use of a stronger current with less pain, and partly because the fingers can press firmly but painlessly, where the simple mechanical pressure of metal or sponge would be painful.

Many patients find the hand much more agreeable than even the softest sponge on any part of the body. The application of the Faradic current to the forehead and crown of the head, with the softest sponge and largest possible surface, is, even under favourable conditions, unpleasant for a strong man in perfect health, and for the delicate invalid is often intolerable, but when the hand of the operator is used as an electrode, the operation becomes not only tolerable, but positively agreeable.

The use of the hand as an electrode in certain cases has also the advantage of keeping the operator continually informed of the strength of the

current, and so enabling him to carefully graduate it according to circumstances. As the current passes through his own person, his own sensations enable him to judge whether it is too strong or too weak, and so by increasing or diminishing the grasp of his *other* hand on the sponge, he can modify the strength of the application without disturbing the apparatus, and this can be done instantly, and to any various degrees of weakness and strength. It also enables the operator to suspend the passage of the current at any instant without shock or violence. Of course most, if not all, of the tonic effects of general electrisation can be obtained by the use of the sponge, but it is a convenience, and oftentimes a positive assistance, for the operator to be able and willing to use his hand in applications to sensitive parts and nervous patients, although in the majority of cases it is sufficient to use a large soft sponge. In general Galvanisation or Galvano-Faradisation, the hand is never employed.

When the operator uses his one hand as an electrode, the current must necessarily pass through his arms and shoulders, from the hand which grasps the sponge to that which is applied to the patient. If the current be strong, the operator must have had long and persevering practice to maintain perfect control of his hands and fingers against its force; but any operator can easily bear the mild current which, as above stated, should alone be used for the head, and for very sensitive patients.

Applications to Different Parts of the Body.

In general electrisation the applications are made over the entire surface of the body, but since—as pointed out in the preceding chapter—the various parts and organs differ considerably in their sensitiveness to electrisation, it is necessary to study in some detail the methods and degrees it will be proper to apply to the different portions of the human organism.

1. *The Head.*—One of the best tests of the skill of the operator, and of the general effect of the application of electricity, is to be found in the treatment of the head. The head, and more particularly the forehead, is the most sensitive part of the body, because, firstly, the bones of the skull (the cranium) occupy the largest portion immediately below the outward integument, and bone-surface, as previously observed, is always peculiarly sensitive to the electric current; and, secondly, because the nerves which ramify all over the head, especially over the forehead, are among the most sensitive in the body. The brain itself is also more or less sensitive to the current, especially to the Galvanic. Applications of electricity over the cranium also directly affect the brain itself, though without pain unless a very strong current is used. The current used should always be of an extremely mild nature, and applied in the most cautious manner. Some individuals cannot bear even mild applications to the front and top of

the head, receiving even injury rather than benefit, while others, on the contrary, find it very agreeable.

Dry hair, it must be remembered, is a non-conductor, and it must therefore always be freely moistened before electrising the head. It is not usual, however, to compel lady patients to let down their hair, or to thoroughly moisten it, and in their case it is usually found sufficient to electrise only that part of the cranium which can be readily reached. The continuous current should generally be used in electrising the top and sides of the head. A very important centre for reaching the brain is the crown of the head, between the ears, over the spot which phrenologists mark as the organ of firmness, the cranial centre. If the hair at this spot be sufficiently moistened to admit the passage of a mild current with any convenient form of electrode, the patient will experience a peculiar and slightly painful sensation, seeming to proceed from the brain itself, certainly very different from that which is felt by the ramifications of the nerves on the forehead.

In treating the forehead the operator should first press his moistened hand firmly over the head, and then making the connection with his other hand on the sponge and brass ball of the positive pole, should allow the current to pass steadily without interruption for one or two minutes. When the Galvanic current is used, the treatment should be still milder. It is particularly

desirable that the hand should be used by preference as an electrode for the forehead ; but if an artificial electrode is used, the best is a large, soft sponge, and this for all parts of the head.

In some exceptional diseases the head will bear rather strong currents. The back of the head, over the cerebellum, will usually bear very strong applications, the current being felt through the ramifications of the nerves in the head, not only painless as a general rule, but sometimes absolutely agreeable.

2. *The Eye.*—This organ is much less sensitive to electrisation than either the face or the forehead. Very striking relief is often afforded to the eyes when in a state of weakness (*asthenopia*) or exhaustion from overwork. The best electrode to use is the hand or the fingers of the operator, as in the case of the forehead. The operator should slowly draw his moistened fingers towards each other, over the closed eye, with a light and gentle pressure. The Faradic current is preferable to the continuous, or at least equally good, and as a rule it will be found that considerable strength can be borne.

3. *The Ear.*—In general electrisation all that is necessary or advisable is the application of a strong current, just below the auricle or over the tragus, *i.e.*, the conical eminence in front of the orifice of the ear, in which some hairs are usually found. In special diseases of the eye and ear, a peculiar method of treatment is required with special instruments adapted to the purpose, for

which recourse ought always to be had to the professional practitioner.

4. *The Face.*—Unless the patient be suffering from paralysis depriving the facial organs of the power of motion or sensation, or both, it is not advisable to make any applications to the face beyond a slight pressure over the fifth pair, on the tragus, as described above. A mild current at this point will produce thorough contractions of all the muscles on one side of the face.

5. *Neck and Throat.*—The back part of the head and upper portion of the spine will usually bear powerful applications. Very marked effects may be produced by general electrisation, even when the applications are made only to the back and sides of the neck. The reason for this is that the most important and sensitive nerves of the body proceed from the upper portion of the spine and the base of the brain; the pneumogastric (those of the lungs and the belly), the brachial plexus (the meeting of those of the arm), and the phrenic nerves (those of the diaphragm).

The sympathetic, or ganglionic, system runs close by the spine, near to the carotid artery, and may be reached or affected electrically by pressing firmly with the fingers at those points where the pressure of the carotid is most readily felt.

It is also probable that the cephalic ganglia (nerve-centres near the head) of the great sympathetic nerves,* which extend over the greater

* The sympathetic nerves are two nervous cords, or chains of ganglia (nerve-centres), which descend from the base of the

part of the body, are more or less influenced when the electric currents are passed through the head.

If the sponge be firmly pressed on the cerebro-spinal centre, over the sixth and seventh cervical vertebræ, and moved slightly on both sides of the spine, while a powerful current is passing, the electric influence may be communicated in a perceptible manner, not only to the spine, but also to the larynx in the throat, to the stomach, to the lungs, and to both arms and hands; in short, to the most important nerves and organs of the body. The sympathetic nerves are also directly affected at this point. In fact, there is no single place on the surface of the body from whence the electric influence can be communicated to so many important nerves as at this centre. But, in order to reach them all effectually by Faradisation, it is necessary to use a powerful current, and to press the sponge very firmly against the skin.

In corpulent patients it is sometimes necessary, in order to reach the network of nerves which branch out into the arms and hands (the brachial plexus), to employ a stronger current than the patient can conveniently bear through the negative pole at the feet and ankles. But in cases where it

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cranium, through the neck and thorax along the heads of the ribs, into the abdomen along the vertebræ of the back, then into the pelvis, close to the sacrum, down to the very lowest joint of the backbone known as the *os coccyx*, and terminating in a final ganglion (nerve-centre) called the *ganglion impar*. Another name for these nerves is "the internal ganglionic nerves."

can be borne, this method of application is often not only painless but positively agreeable, nay even delightful to such a degree that the patient requests to have it repeated. In patients who can bear it the application may be varied by sudden interruptions of the current.

The application of electricity to this part of the human frame is extremely important in general electrisation, and it will produce very pronounced tonic results through the whole system, even when other parts of the body are left untouched. It, however, produces sensations by no means the same in all patients. Some nervous and sensitive subjects experience a very marked and peculiar sensation in the stomach, conveyed by the pneumo-gastric nerve; but strong and vigorous patients rarely, even when the current is of great strength, experience any such sensation. Some patients it causes to cough spasmodically, and even violently, although the current employed may be comparatively mild; while with others no such effect is produced, even though the most powerful currents and the firmest pressure of the sponge be used. A tingling and pricking sensation in the fingers can nearly always be produced even in the very corpulent.

In a healthy condition of the spinal cord no painful sensations are transmitted along its course with the kind of application just described, but if the patient be suffering from organic disease of the spinal cord, or even from simple spinal exhaustion, the application, even to a mild degree, over the

upper portion of the spine will cause painful sensations through its entire length, and down the legs to the feet. A recollection of these facts is of great value in the examination for diseases by electricity.

Another very important part of the body to the medical electrician is in the posterior triangle at the back of the neck, just by the posterior border of the sterno-cleido-mastoid muscle. This muscle, as its formidable-looking name denotes, appertains to the sternum, or breast-bone, the clavicle, or collar bone, and the mastoid process of the occipital bone, which forms the back part of the skull. If the operator use his moistened fingers as the electrode he may empty a current of considerable strength at this spot, but if he use a sponge the current should be comparatively mild. A firm pressure should be used until the posterior border of the scalene muscle at the side of the neck (*scalenus anticus*) is reached. The result will be that the patient will immediately experience a tingling or pricking sensation in the arm and hand on that side, caused by the excitation of the brachial plexus, and in some cases a thrill is conveyed to the stomach and the diaphragm, through the pneumo-gastric and phrenic nerves. This application is of great service in cases of paralysis or loss of feeling (*anæsthesia*) of the arm, and in all cases of general debility.

Another important locality is the part just above the sternum (breast-bone), from which the lower cervical ganglion can be affected. Applications

should be made at this place in all cases of general debility, and more particularly when the patient suffers from chronic bronchitis.

In addition to the above special applications the electrode should be passed rapidly, thoroughly, around and over the entire surface of the neck, behind and in front, and should be pressed firmly and thoroughly near the anterior border of the sterno-cleido-mastoid muscle, above described, until the beating of the carotid artery is felt, so as to reach the sympathetic nerve.

6. *The Arms and Hands.*—The sponge, or the hand of the operator, should be passed thoroughly over the surface, with sufficient force to produce agreeable contractions of all the exterior muscles. A mild current will be found sufficient except in the case of infants or corpulent females. When the limb is paralysed, or feeling is lost through its whole extent, or in any portion, it is well to follow the course of the principal nerves.

7. *The Spine.*—Stronger currents of electricity may be applied to the middle of the spine than to any other part of the body, the back being the least subject to irritating sensations owing to the absence of any very sensitive nerves in its periphery, and the thorough protection of the spinal cord by its bony covering. When the electric current is painfully felt in the back, it may be taken for granted that it is greatly exhausted, or in an organically diseased state. When it is in such a condition the continuous Galvanic current should be preferred, but for ordinary purposes the con-

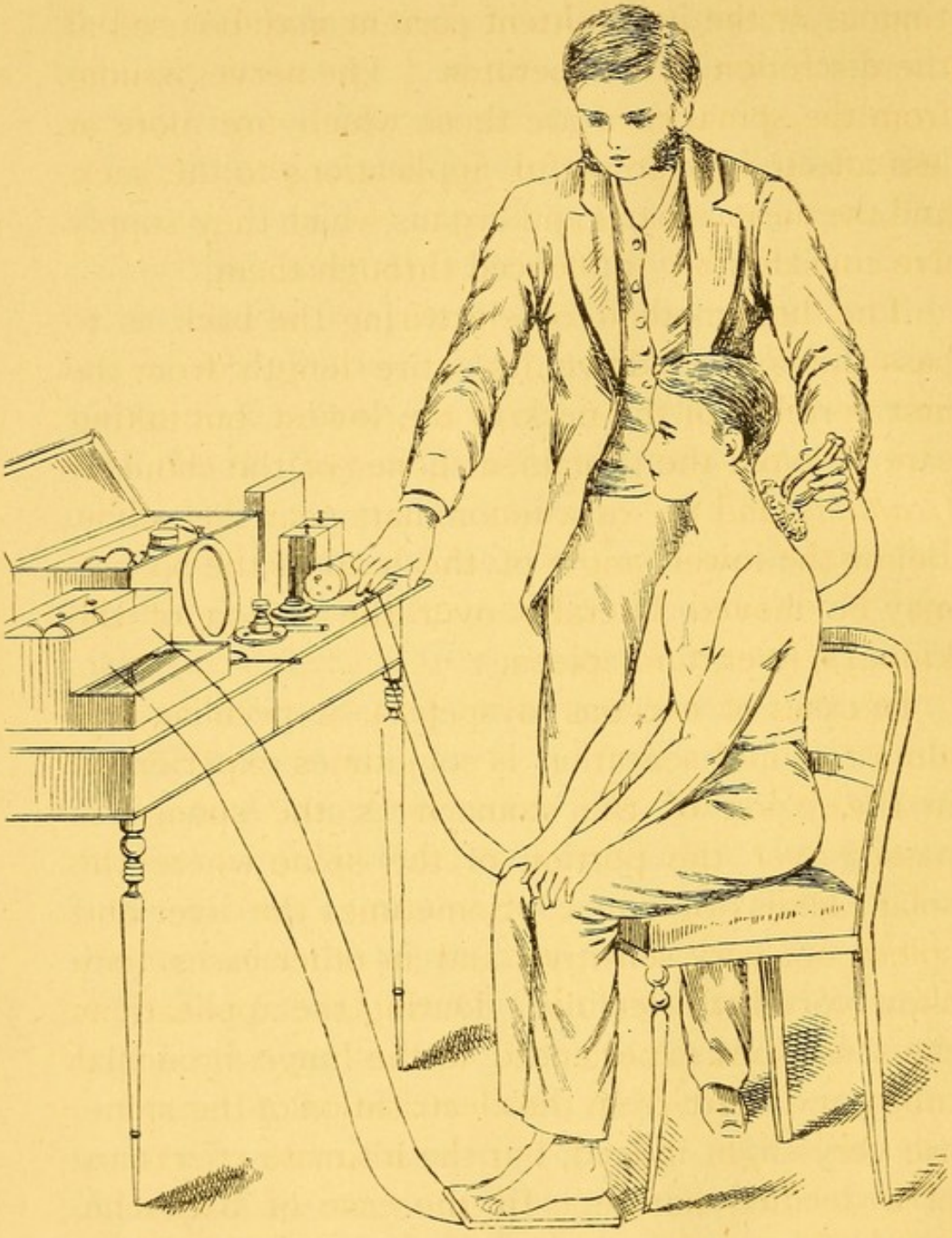

FIG. 3.—GENERAL GALVANO-FARADIZATION.

By the Woodward Apparatus.

A double electrode is used, one part of which is connected with the galvanic and the other with the faradic apparatus. The copper plate is also connected with both currents.

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tinuous or the intermittent current may be used at the discretion of the operator. The nerves issuing from the spinal cord are those which are more or less affected by powerful applications to the back, and the various parts and organs which they supply are considerably influenced through them.

The best method of electrising the back is to pass the sponge down its entire length from the first vertebra of the neck to the lowest, but taking care to avoid the prominent bones of the shoulder (*scapula*), and the ossa innominata near the pelvis. Below the lower angle of the scapula the sponge may be moved laterally over the region of the kidneys, liver, and spleen.

In cases of nervous dyspepsia, a peculiar and almost painful sensation is sometimes experienced in the region of the stomach as the sponge is passed over the portion of the spine where the solar plexus originates. Sometimes the liver and spleen are very sensitive, and in other cases they show very little feeling. During the applications the sensations experienced in the lungs, bronchial tubes, and heart, from the electrisation of the spine, are very slight indeed, but the ultimate effects are of a decided nature. In the case of backache, which frequently accompanies nervous disorders, and is often associated with spinal irritation, the sponge may be pressed with moderate firmness over the painful spot, and allowed to rest for a few moments until the patient feels relieved.

If a strong current be applied over the lower portion of the spine, between the upper borders of

the ossa innominata, a slight sensation is sometimes communicated to the rectum and the male genital organs through their spinal nerve supply, although this result is by no means uniformly attained.

A strong current over the lower part of the cauda equina very sensibly affects both of the sciatic nerves and their branches. Sudden and interrupted shocks, in cases of paralysis of the lower limbs, may be given with advantage at this point.

As a result of the above conditions it may be taken as a rule, that particular attention should be given to the spine when general electrisation is desired, if even it be necessary to neglect other parts of the body.

8. *Lungs and Heart.*—The ribs, with the muscles and ligaments occupying the space between them, form a sort of unyielding wall, which render the heart and lungs less accessible to electrical influence than any other of the prominent vital organs. For this reason, and also through the further obstacle to the direct passage of the current, arising from the fact that the pleura and pericardium—membranes which contain the lungs and heart, as it were, in a sac—do not closely adhere to the inner wall of the chest, but lie loosely over the lungs and heart, the diseases of those organs are less subject to electrical treatment than the corresponding diseases of other organs.

The best place to affect the lungs and heart is

FIG. 4.—GENERAL FARADIZATION—*Application to the Stomach.*

(To face page 43.)

by applications above the sternum (breast-bone), around the neck, over the upper half of the spine, and by direct application of the vagus in the neck.

There is, however, an advantage to be gained by applications to the chest itself, which will assist in developing the muscles of the throat and those which lie between the ribs. But it should be remembered that, like all other bones, the surfaces of the ribs are peculiarly sensitive to the current, and, therefore, the chest will not bear as strong currents as the spine, neck, or abdominal regions. Thin and nervous patients are also more sensitive than the stout and phlegmatic. The greatest amount of sensitiveness—so great as sometimes to be mistaken for actual disease of the organs beneath—is on the inferior ribs on the right and left side of the body, over the liver and spleen.

9. *Stomach and Digestive Organs.*—It has been stated above that these organs can be influenced by electrical applications to the lower part of the spine; but to apply electricity thoroughly, the sponge or the hand of the operator should be applied directly over the regions of the stomach, liver, spleen, and bowels. The anatomical structure of the abdominal region is exactly the reverse of that of the chest, above noticed. The chest has outwardly an unyielding wall, partly composed of bones and ligaments; the abdomen, on the contrary, has a loose external skin, loosely lying against the peritonæum within, that covers the viscera beneath. The conditions being thus

reversed, it becomes easy to electrise the stomach just in proportion as it is difficult to electrise the chest. Moreover, it being a characteristic of the electric current that its conductivity through the tissues of the body is in direct proportion to the saline solutions contained in them, and no organs of the body containing so large a percentage of water as those which are situated in the abdomen, it follows that when once the resistance of the outer skin is overcome by the moisture of the sponge or hand, and the peritonæum and viscera are brought into mutual action, the current will directly travel through all the parts desired to be affected. In making applications to the anterior surface of the trunk below the diaphragm, particular attention should be given to the epigastric region.

The solar plexus, from which the stomach receives its nerve supply, is the most important plexus (or nerve centre) in the body, and the stomach itself participates more or less in nearly all the nervous disorders for which general electrisation is employed. To reach this great nerve centre, and to influence the stomach, the operator should place the sponge or the palm of his hand below and under the breast bone, and as far back as possible. The pressure brings the peritonæum and stomach into mutual action, and forces the current to pass through them. With feeble or dyspeptic patients it is necessary, at first, to use very mild and short applications over the stomach ; and in such cases, if a strong current is used, it

is almost indispensable that the operator should allow it to pass through his own person

The spleen and liver may be treated in the same way as the stomach, or by gentle passes from side to side.

The bowels may be treated either with the Galvanic or the Faradic current, and in cases of obstinate constipation by sudden interruptions or shocks.

Much stronger currents may be passed over the abdomen in the case of corpulent, pursy patients, than in that of the thin and emaciated. In fact, it is more likely that very corpulent patients may be treated for electrisation of the intestines more effectually from the lower part of the spine than from the surface of the abdomen. Adipose tissue is a comparatively imperfect conductor, which renders it very difficult to affect the bowels of very corpulent patients through the walls of the abdomen, unless currents of considerable strength and a firm pressure be employed. But in the vast majority of cases currents of moderate strength, applied lightly over the surface of the abdomen, with either the sponge or the hand, will be sufficient.

10. *The Legs and Feet.*—The electrical current is not applied to the lower limbs directly—except where there is weakness or paralysis of them—in more than half of the cases. The reason for this is, that when the copper-plate is at the feet, the muscles below the knee are more or less exercised during the whole treatment.

Before making applications to the legs the patient should be required to stand up, still keeping the feet on the copper plate. If the clothing during the earlier portions of the operation has been removed from the upper part of the body it may be replaced, in order to prevent unnecessary exposure and to protect from the cold. Applications may be made to the lower limbs of female patients—except in paralysis—under the clothing, and without exposure.

The surface of the outer portions of the thigh, like the back, is not supplied by very sensitive nerves, and is, therefore, very little sensitive to the electric current. The inner surface, on the contrary, is very sensitive, and in nervous persons especially is very susceptible to electrisation. Great pains should be taken in passing the sponge or the hand down the lower limbs carefully to graduate the current according to the sensitiveness of each locality. In this operation the peculiar properties of the Woodward machine are of great advantage, because they enable the operator instantly and at pleasure to modify the strength of the current. It is well for the operator to keep his hand all the time on the apparatus so as to be able to graduate the current at any moment. This is more necessary in treating the lower limbs than the upper, because the contrasts in relative sensitiveness of the different localities are much greater than in the arms, and because if suddenly severe shocks be given to he legs, the patient is liable to be thrown down.

FIG. 5.—GENERAL FARADIZATION—*Application to the Lower Extremities.*

(To face page 46.)

In cases where there is no paralysis of the lower limbs, the superficial muscles can be reached by comparatively feeble and painless currents. But where there is paralysis of motion or sensation, it will be found expedient to reverse the direction of the current, so that the positive may be at the feet, having special reference to those points where the principal nerves lie most superficial. These points are, for the *sciatic nerve*, between the head of the femur (thigh-bone) and the tuberosity of the ischium (pelvis); for the *anterior crural nerve*, just below Poupart's ligament, and in the middle of the thigh by the border of the sartorius; for the *popliteal nerve*, in the outer portion of the popliteal space, by the tendons of the biceps muscle; for the *anterior tibial nerve*, the point by the border of the tibia, from five to seven inches below the knee-joint; for the *posterior tibial nerve*, just posterior to the internal malleolus.

In cases of paralysis it is advisable to allow the patient to sit in a chair, or recline on a bed or lounge, so as to allow the operator to apply strong applications to these sensitive points.

CHAPTER IV.

ELECTRO-MEDICAL APPARATUS.

JUST as there are several sub-divisions of the electric force itself, as pointed out in our first chapter, so are there corresponding sub-divisions of the kind of apparatus in use, according to the kind of electricity which it is desired to employ. The practitioners of the old school employed Franklinic or frictional electricity, and therefore used the plate-glass machine, in which the electricity arising from the friction of the rotating glass plate against the upper and lower cushions was collected by two brass arms, and distributed to the brass conductor. In use, the practice with this machine was to give the patient what was called "an electrical bath," that is, he was placed upon a glass-legged stool, so as to secure perfect insulation, then, being placed in connection with the prime conductor, shocks were passed to any part of his body by means of a Leyden jar, or the current was passed through him at pleasure, until he was, so to speak, thoroughly "bathed" or saturated therewith. This method is not without its advocates in the present day, but practically it has passed away.

After the Plate machine had had its day, the simple Galvanic machine and the Voltaic-pile

machine came into use. The characteristic of these machines, distinguishing them from the Faradic machines, is that the source of the electricity is chemical action, unmodified by anything else. Then came the Magneto-Electric machines, in which the induced, or Faradic, current was the principal characteristic; and, finally, those in which both Galvanic and Faradic currents may be employed, either singly or in combination with each other, to which the Woodward apparatus belongs. It would be impossible within any moderate compass to describe the many varieties of instruments which have been offered in competition with each other. Of many of them it may be said that their makers are skilled mechanics, who, however well qualified to construct a machine, are quite without the medical skill which,—as a slight perusal of the preceding pages will show—is absolutely necessary to understand its working. As to the so-called "Directions" which accompany these cheap pieces of mechanical ingenuity, it is a duty to warn the non-professional reader to beware of them. It would be as reasonable to expect a Sheffield cutler to be a skilful surgeon because he makes good lancets, or an iron founder to be a good cook because he makes kitchen-ranges, as to expect the mechanical maker to give trustworthy directions for the use of a medical machine. Of course the professional man can take care of himself, yet even to him it may not be amiss to whisper the classical warning, "Caveat emptor."

The experience of the author of this pamphlet during a long practice has taught him that the imperfections of the battery and machine are some of the greatest difficulties which the practitioner has to contend against. Frequently he has found the success of his applications completely frustrated by them. Even in the batteries of most recent invention he has found them so soon exhausted that it has been utterly impossible to keep the machine two minutes at the same strength, a requirement absolutely essential to success. All acid batteries are objectionable, both on account of the strong fumes emitted, and from the necessity of frequent attention.

Long observation and careful study, founded upon the actual practice of nearly a quarter of a century, has therefore led him to the construction of the apparatus known as the WOODWARD ELECTRO-MEDICAL APPARATUS, which he confidently offers as possessing the following peculiar and special advantages, namely :—

1. *A wide range of power that may be increased or diminished at pleasure.*

2. *Smoothness and equability of current.*—In every battery yet framed, the power is, from its very nature, a decreasing quantity from the moment it commences action. But in the Woodward apparatus the battery is so perfected that it will run *at the same strength* from the beginning to the end of any ordinary sitting.

3. *Freedom from obnoxious exhalations.*—The construction and materials used are of such a

nature that no fumes are given off, and attention is required only about once a year.

4. *A number of variable powers at the control of the operator.*—This apparatus is so constructed that from it may be obtained three distinct currents, each of which will keep running evenly, and which may each be strengthened or diminished to suit the patient, and at the will of the operator. These currents may also be applied singly or in any kind of combination, and may be altered, added to, or diminished, during actual operation, and without interruption of the action or disturbance either of the operator or the patient. These are advantages which the inventor sought for in vain in any other machine which came under his notice, and their importance in actual practice can hardly be over-rated.

Full directions for the proper maintenance of the battery, instruments, &c., will be found inside every box sent out.

CHAPTER V.

DIRECTIONS FOR DOMESTIC USE OF THE WOODWARD APPARATUS.

ALTHOUGH it is best in Electrical Medicine, as in all other departments, to have recourse where possible to a skilled practitioner, yet since there must necessarily be many situations where this is impossible, in our colonies, and even at home, it is thought advisable to give here a few plain directions, whereby this wonderful curative agent may be safely applied if ordinary care be used, and the person who applies it has paid intelligent attention to the general principles laid down in the preceding chapters of this book, which, for the purposes of general information, have been expressly made as popularly intelligible as the nature of the subject admits.

GENERAL DIRECTIONS.

Direct applications of Electricity to the brain, lungs, or heart should not be made without professional advice, but for many diseases which directly affect those great polar centres Electricity can and may be used with perfect safety, and is a certain cure: for instance, most forms of headache and congestion may be cured by application to the medulla-oblongata, at the base of the brain; and also for Asthma, Bronchitis, and all affections

of the lungs Electricity will be of great benefit. No spasmodic shocks or sudden stoppages should occur.

Let the Operating Room be pleasantly warm; all outer garments and tight bands or strings should be removed.

A foot tub full of warm water, to which may be added a little salt or saltpetre, in which place the Px, and with the N... chafe the whole body downward. This will be found an excellent tonic.

As the operator stands facing the battery the binding screw will be found on the left hand positive (Px) and the right negative (N...). The switch should be placed on the first o, and the cylinder or piston pulled out until the required strength is obtained. This will depend entirely upon the comfort of the patient, for as all organisations differ, so must the strength be graduated to suit them. It is a mistake to make it painful.

The Electrodes.—All manufacturers of medical batteries send out with each instrument a pair of handles made of tin, or other suitable metal, in the shape of cylinders. To these handles are attached a long covered wire cord, the opposite ends of which are fitted with brass or copper tags, to be fastened into the binding screws on the machine. Many forms of Electrodes have been devised applicable to particular parts of the body, but for general domestic purposes the usual handles, a copper foot-plate, and a sponge cup will be sufficient.

The following is a list of diseases which may be

successfully treated by Electricity; but as many of them should only be treated by the skilled practitioner, a selection is afterwards made of those which may, when circumstances require, be treated domestically :—

Amenorrhea (stoppage or irregularity of menstruation), Angina Pectoris (pains in the chest, with a sense of strangulation), Chilblains, Cold, Facial Paralysis (Paralysis of the face), Fatigue Diseases, Headache, Hysterical Paralysis, Infantile Paralysis, Lumbago (rheumatic affections of the loins), Neuralgia (pains in the nerves), Nervous Exhaustion, Pain of all kinds, Palsy (caused by lead poisoning), Paralysis (with unusually rapid *wasting* and *repair* of muscles), Paralysis of the *Serratus Magnus*, Rheumatic Gout, Rheumatism, Sciatica (rheumatic affection of the hip-joint), Spine and General Debility, Strains of the Shoulder, Torticollis (wry-neck), Tinnitus Aurium (ringing in the ears), Tremor, Writers' Cramp.

Directions for Domestic Treatment.

Cephalalgia, or Headache.—So numerous are the causes of this distressing and painful affection that it would be impossible to treat it as a single disorder. Headache may result from a disease of any of the organs of the body. For example, it may arise from affections of stomach, liver, spleen, uterus, or from rheumatism, neuralgia, over-exertion in walking or riding, and many other causes. Fevers of every description, and

even heart and lung diseases, are fruitful sources of Cephalalgia, therefore we shall classify certain forms of headache under a few simple heads and prescribe the proper course of electrical treatment for each.

1. *Sick Headache.*—As the stomach and digestive organs are involved in this complaint, apply Px. in the sponge cup across the loins, and the N... across the abdomen for five minutes; then remove Px. to between the shoulders, and the N... to the upper part of the stomach, where they should remain five minutes. Next apply the Px. to the nape of the neck, and place the feet in a metal foot-bath containing about an inch in depth of hot salt water; immerse the N... in this and keep adding hot water to maintain a constant temperature for ten minutes.

N.B.—Should any disagreeable feelings arise from the application of the plate to the back of the neck it should be at once discontinued; but if it can be borne without inconvenience it is an effective treatment and produces good results in headache, sleeplessness, affection of the eyes or ears, catarrh, &c. &c.

2. *Congestive Headache.* — Treat generally according to the directions in No. 1; but as congestive headache is often aggravated by the application of Electricity to the base of the brain it will be better in using the foot-bath to place the N... between the shoulders instead of at the nape of the neck.

3. *Neuralgic Headache.*—If it can be borne,

apply a plate Px. to the nape of the neck and hold the N... in the hand for ten minutes. Repeat as often as relief is obtained. Or hold N... in the hands while the operator applies the sponge-cup Px. to the nape of the neck, rubbing the sponge upward into the hair at the back of the head.

4. *Nervous Headache.*—All forms of nervous derangement proceed from it exclusively, it is best therefore to rouse up the patient by the systemic treatment, *see* No. 7 below. If for the head alone, place N... in the hands, and brush up from the nape of the neck with the sponge-cup Px.; also rest the sponge on the neck. The operations should occupy in all ten minutes.

5. *Headache proceeding from Uterine weakness with Pains in the Back.*—Place the N... on a chair covering it with a warm wet sponge, and, causing the patient to sit upon it, apply Px. between the shoulders and pass it gently down the spine repeatedly for ten minutes.

6. *Systemic Headache.* — Attach the large copper plate to the N... and let the patient sit upon it. With the sponge-cup Px. rub the spine down for ten minutes, then take a foot-bath with hot salt water in which the N... is, immerse and place the feet in it while the patient sits upon Px. on a chair. This is especially recommended for female difficulties.

7. *Treatment for General Debility and Dyspepsia.*—Place Px. low down on the spine and N... on the lowest part of the abdomen for five

minutes; then reverse the position of the plates for five minutes. Then place the Px. between the shoulders, and the N... on the abdomen across the diaphragm (just along the lower end of the breast bone) for five minutes; once more reverse the current, then place the Px. on the nape of the neck and the two hands upon the N... for six minutes.

8. *Sore Throat.*—Place Px. at the back of the neck and sponge cup N... pass gently over the throat for six to ten minutes. If the tonsils be enlarged they may be gently touched with the instrument made for this purpose; one or two minutes' application will suffice. In Diphtheria, Bronchitis, or Hoarseness, the operator may pass the sponge cup or his hand gently over the throat from top to bottom several times a day.

9. *Asthma, Croup, &c.*—Place Px. at the upper part of the spine, and with the sponge-cup N... rub gently downward the part most affected. In Asthma apply the sponge cup gently down the breast-bone, rubbing downward for ten minutes. This bone, like all those bones which are near the surface, is very sensitive to the Electric current, therefore great care must be taken not to have the current too strong. The fatty portions of the body are bad conductors, and will therefore stand very strong currents with comfort. This should be borne in mind in all applications, as a careless system of using Electricity does more harm than good.

10. *Liver Complaints.*—The systemic treatment

as directed for Debility (see No. 7 above) should be adopted. If the liver is still tender and inflamed apply the Px. between the shoulders, and the sponge cup N... around and below the tender points for two or three minutes, and finish by placing the N... under the feet, and the Px. between the shoulders. When any pain results from the operation, especially immediately under the plate or sponge cup, remove the electrode at once to a point near to, but avoiding the surfaces over the head and lungs.

11.—*Affections of the Kidneys.*—Place the Px. on the lower part of the loins, and the N... on the lower part of the abdomen for five minutes. Apply the Px. across the kidneys, and N... between shoulders; if this does not cure, try sitting upon N... and rubbing down the spine with sponge cup Px. for ten minutes.

12. *Sciatica.*—Place N... under the thigh, on the part where the pain is felt, and rub down the whole side of the leg with sponge cup Px. Also rub gently the loins and hip. Finish by sitting upon Px. and placing N... under the feet.

13. *Paralysis.*—If only one side be attacked, place the N... between the shoulders, and pass the sponge cup Px. over the parts affected. If the spine be attacked, place one pole on the upper part and the other on the lower, reversing the current every minute for five minutes. If the extremities be paralysed, place the feet on one pole and hold the other in the hands, reversing the current every few moments, and then hold one

pole in one hand and place the other under the foot upon the opposite side. Reverse the current frequently, and repeat the operation with other hand and foot.

14. *Deafness.*—Take the N... in both hands, and place the Px. at the nape of the neck for ten minutes daily. If this fail, rub the sponge cup Px. round the ear outside and the N... inside for one minute. (*This should only be done by a medical man.*)

15. *Chorea.*—Place the N... plate under both feet, and with the sponge cup Px. stroke down the back for five minutes; then place the Px. on a chair and sit upon it, the N... still remaining under the feet, for five minutes. Finish by rubbing down the calves of the legs with the Px. without removing the foot-plate for five minutes.

16. *Rheumatism.*—As a tonic for the system, use the systemic treatment also adopted for Gout, but for each local pain of the extremities place the feet in hot water with the N..., and apply the sponge cup Px. above the part affected, and rub downward for ten minutes. If the pain be in the shoulders, breast, or neck, sit upon N..., and stroke the affected parts downward with Px. for a few minutes.

17. *Skin Diseases.*—Place the patient in a warm bath with a little saltpetre added, drop in the N.., and apply the sponge cup Px. to any painful part, after which place the Px. in the two hands. The bath must not exceed ten or fifteen minutes' duration.

18. *Colds.*—The systemic treatment will be found very beneficial in all kinds of colds, but when the patient suffers from shivering fits (fever and ague), resort to this treatment before the attack comes on.

19. *Piles.*—Place the N... on a chair, and cover with a large wet sponge; let the patient sit upon it, then rub down the spine with the sponge cup Px. for five minutes, after which use the systemic treatment for five minutes.

20. *Colic.*—Adopt the systemic treatment, using large plates covered with hot cloths; continue until relieved.

21. *Diarrhœa.*—Place the Px. Electrode close to the Anus and a large N... plate over the bowels. Then place the Px. over the bowels, and the N... opposite to it across the back for ten minutes.

22. *Constipation.*—Take a large sponge wet and hot, place it on a chair, and put the Px. under it, then sit upon it, pressing well against the Anus, and with the sponge cup N... knead well the bowels for ten minutes. Repeat daily until cured.

23. *Boils, Gatherings, Burns, and Scalds.*—If on the extremities, place the member in warm water with N... electrode and hold the sponge cup to a part above the sore for five minutes. If the injury be upon the body, place a large plate N... over it, interposing a thick damp cloth, then place the Px. upon the opposite side and pass a current through. The same treatment may be

employed for sprains or inflamed joints, always bearing in mind that the N... *cools* and the Px. *warms*.

Bear in mind that in severe acute diseases and dangerous surgical cases it is always wise to seek the aid of a medical man.