

enable the radial or ulnar nerves, for example, to convey, in an imperfect manner, the sensory impressions, the direct and normal routes of which, to the nerve centres, would be the median nerve. In this respect, we conjecture, the arrangement at the periphery of a sensory nerve is much the same as at its central termination, where a nerve fibre connects with a nerve cell; and this, in its turn, with many others: so, that if the direct route of transmission is interrupted in the centre, provision is made for a more circuitous and less perfect one; and an opinion not far from this seems, at least, to constitute the main feature of M. Letievant's theory of nervous substitution.

Though we do not remember to have met with the idea of substitution, in the action of the peripheral nervous system, so definitely stated as it is by M. Letievant, yet the idea is not a novel one in the physiology in the nervous system, and we cannot share fully in the enthusiastic expectations of its author as to its value in nervous pathology.

As to the remainder of this first part of M. Letievant's book, it consists in a detailed account of the effects following division of the nerves of the face and of the inferior members. They relate to changes in the motility, sensibility and nutrition of parts dependent on the nerves in question, which are essentially the same as those related as following division of the median nerve.

The work is especially of interest to the surgeon, but contains many facts relating to the effects of nerve sections on the nutrition of parts which are of interest to the neural pathologist. But phenomena of this latter class it is our design fully to discuss in a future number of the JOURNAL, and so we pass them by for the present.

As regards the last two monographs, they relate to purely intrinsic nerve changes, rather than to the extrinsic effects of nerve lesions. They are highly important. But the present article has so much exceeded the limits intended at first that we must postpone a consideration of them until a future number of the JOURNAL.

## II.—RECENT WORKS ON MEDICAL ELECTRICITY.

- I. PRINCIPES D'ELECTROTHERAPIE. Par Dr. E. Cyon. Paris: 1873. 274 pages. (*Principles of Electro-therapy.*)
- II. NERVENPATHOLOGIE UND ELEKTROTHERAPIE. ZWEITE AUFLAGE DER ELEKTROTHERAPIE. VON Dr. Moriz Benedikt. I. Abtheilung. Leipsic: 1874. 395 pages. (*Nerve Pathology and Electro-therapy. Second Edition of the Electro-therapy. Part I.*)

- III. DR. A. ARTHUIS. TRAITEMENT DES MALADIES NERVEUSES ET DES AFFECTIONS RHEUMATISMALES PAR L'ELECTRICITE STATIQUE. Paris: 1873. 162 pages. (*Dr. A. Arthuis. Treatment of Nervous Diseases and Rheumatic Affections by Static Electricity.*)
- IV. DIE BEHANDLUNG DER NERVENKRANKHEITEN MIT ELEKTRICITAT; EINE UEBERSICHT DES GEGENWAERTIGEN UMFANGES DER ELEKTRISCHEN BEHANDLUNG, UND DER ANZEIGEN FUEER DIESELBE. Von Dr. Friederich Fieber. Wien: 1873. 66 pages. (*The Treatment of Nervous Diseases with Electricity; A Survey of the Present Scope of Electrical Treatment, and the Indications for its Employment.*)
- V. GALVANO-THERAPEUTICS; A REVISED REPRINT OF A REPORT MADE TO THE ILLINOIS STATE MEDICAL SOCIETY FOR 1873. By David Prince, M.D. Philadelphia: 1873. 63 pages.

Of the works whose titles appear at the head of this chapter, the first two are in all respects the most noteworthy. The second, however, the treatise of Benedikt, though included here in our rubric, will, for the most part, receive but passing mention, as we hope to review the completed work at a future time. We can, indeed, hardly expect, within the limits allowed us, to more than briefly go over the principal points of the subject as it is treated in the other works; and must, therefore, content ourselves with perhaps an inadequate and partial notice.

Electro-therapeutics, as a recognized weapon against disease, in the hands of the regular physician, is of comparatively recent introduction. Notwithstanding this fact, the popularity which it has already attained is extraordinary; and at the present time there is no department of therapeutics that is looked forward to, by the progressive members of the medical profession, with more interest, as promising to develop a truly rational and scientific treatment of morbid processes and conditions, than is this. Certainly, no other seems to offer more from the alliance of physical and physiological laws, or is more suggestive in view of the important questions of psycho-physics and biology, which are occupying the attention of the scientific world at the present time. Nor have its cultivators been inactive. Since the first appearance of the classic works of Du Bois Reymond, and Matteucci, on electro-physiology, and those of Remak and Duchenne on the application of electricity as a healing agent in disease, many works have appeared, some scientific and accurate, others less so, but practical, and containing valuable clinical facts and suggestions; and, in the medical press of the present day, the literature of the subject is more than ever voluminous. Still, the practice of electro-therapeutics is yet largely empirical; and the amount of professional ignorance on the subject, even among otherwise well-informed practitioners, is something astonishing. And not only this, but this empiricism is even commended as

the only true route of progress in this direction; and a distinguished authority has recently advised that the practitioner should make no attempt to master the principles of electrophysiology, and has expressed the opinion that practical electrotherapy is independent of, and in advance of, physiology. We always regret such utterances on the part of educated physicians. They are too much like the cant of narrow men, who would deny the value of the very labors the results of which they utilize, and without which any other than the merest haphazard progress is impossible. We would not wish to be understood as undervaluing the results of practical experience. They are often our only sure guide; but inquiry must not be satisfied with them alone. The charge of pure empiricism is too often made against the practice of medicine, to make us reconciled to anything which might appear to give it justice.

We have been led into this line of remark by reading the introduction of M. Cyon's memoir, in which he laments and condemns this neglect and ignorance of physiology among electrotherapeutists. We cannot do better than quote his own words. After speaking of the advance, in recent times, in the department of ophthalmology, and in the diagnosis and treatment of the affections of the abdomen and chest, he continues as follows: "It is certain that a similar transformation may be produced in neuro-pathology, and, consequently, in the science of the application of electricity to medicine. It is certain that there can yet be given to that branch of medicine a basis rigorously scientific, founded only in physics and physiology. I am convinced, for my own part, that, with the exception of ophthalmic medicine, no department of pathology can comply as well with the application of the laws of physiology, or can put to as immediate profit every acquisition made by it, as the pathology of the nervous system. The question now is, whether, in the actual state of neuro-pathology, it is yet possible to base the application of electricity to the cure of nervous diseases on veritable scientific truths? The response will be either affirmative or negative, according to the limits we assign to this scientific basis.

"At the present day, the reply would certainly be in the negative, if we were to demand the scientific and rational indications for the treatment of each particular case of nervous disease, or if we ask why electrical treatment is sometimes useful, sometimes completely inefficacious. But if we ask if it is possible, at the present time, to elaborate the general principles on which we may base a rational application of electricity for the healing of diseases, then our answer will be in the affirmative. We are now in a condition to seek out what effects the electric current may cause when applied to the human body, its nerves and muscles; and to say what modifications these effects undergo by the use of different sources of electricity; by alterations of the intensity, the duration, and the direction of the current; to indicate, finally, the parts of the nervous and muscular systems which

are accessible to these electric agents, and those which are not.

"It is useless to insist at length on the proofs which show the necessity of first establishing the general principles before undertaking a rational application of electricity for the cure of nervous and muscular maladies."

The last paragraph of this quotation expresses the task to which M. Cyon has applied himself. His work is confined to the general principles of electro-therapy. He gives no clinical histories or tables of cases, nor treats of any special indications for the different ailments. His whole book is filled with solid matter pertaining to the general subject in all its bearings. He evidently aims to supply a treatise which shall be free from the errors which have characterized the works of so many of his predecessors, and which he unsparingly criticises. He brings to this somewhat difficult task an eminent reputation as a physiologist and an investigator; and his competency for the work will scarcely be doubted. Neither can it be questioned that he has, in a great measure, succeeded in giving us the best short epitome of the general scientific principles which underlie all rational electro-therapeutics, that has yet appeared. If we have any criticism to make on his work, it will be, that he falls, perhaps, too much into the opposite error from that we have mentioned; that he has too little respect for deductions made from the experience of the profession, and not absolutely based upon received scientific principles. His language may also, at times, appear too harsh; as, for example, when he speaks of the present state of electro-therapeutics as presenting, in fact, only a "chaos of statements, in great part false, of extravagant hypotheses, and theories often void of sense." It is no doubt true that, as he says, electro-therapeutists have too much neglected the true scientific methods, and have too exclusively depended upon the experience gained from purely empirical essays. On the other hand, there may perhaps be some room for doubting whether we are to follow even so able a physiologist and clinician as M. Cyon, in all his views, when they are at variance with the practical experience of the great mass of those who have treated of the subject of electro-therapy. Until theory and scientific experimentation have entirely cleared the ground, and shown us all the relations in which electricity may act upon the system, in health and disease, practical experience, unscientific though it be, is yet our guide in very many cases.

M. Cyon divides his treatise into six principal chapters. In the first of these, he gives a general view of the present state of electrical physics; explaining, in a clear and readily comprehensible manner, the general laws of electricity; showing the practical application of the law of Ohm as to electrical resistances; and giving, what is usually left out of works of this kind, but which is of the highest importance for the understanding of the action of the agent in the tissues of the body, a full exposition of the

laws of the ramifications of currents in different conductors. This part of the chapter is the most valuable. The remaining portion, in which he describes and discusses the different kinds of electrical apparatus for medical purposes, is necessarily much less complete; and much of the matter can also be found in other works. As in nearly all European works, most of the arrangements described are different from those in general use in this country. We will merely mention, that the author recommends, after the Siemens cell, the battery of Grove for medical purposes, and considers the Stohrer modification of the Bunsen element as too unreliable and otherwise inconvenient; an opinion which, as far as regards the comparative merits of these two forms, we will venture to say, is not in accordance with that held by the majority of practitioners in this country.

The second and third chapters are devoted to the consideration of the general principles of electro-physiology and their applications to the human subject. The subject of electrotonus and the laws of nerve and muscle currents are clearly explained in the second chapter; and, in the third, the author gives an account of his own researches on the phenomena of electrotonus in man, which prove the applicability of Pflüger's law in all essential particulars. Next he gives the results of a series of experiments as to the relation which exists between the excitant force and the degree of irritation, made by means of a simple myograph of his own devising, and which indicate that all the laws of nervous irritation deduced from experiments on animals, are valid also for man. The other modifications of the condition of the nerve by electricity, the alteration of its irritability, etc., are briefly mentioned; and in regard to its effects on the nerves of special sense, the author cites Helmholtz's observations on the electrical excitation of the optic nerve, as being perfectly in accord with the laws of electrotonus. As regards the direct irritation of the auditory nerve, he holds, with Erman and Weber, that no direct acoustic phenomena can be produced, thus rejecting, completely, the views and therapeutical theories of Brenner, which have excited so much attention. In a note at the end of the third chapter, M. Cyon alludes to the experiments of Wreden and Loewenburg, which seem to indicate that the sounds described by Brenner and his followers are due to excitation of the tympanic muscles, and not of the auditory nerve; and states that he has satisfied himself of the exactness of the experiments of the first-named observer.

In the fourth chapter, the author treats of the effects of electricity on the different organs of the body. The distinction is carefully dwelt upon between the effects of currents on the nerves themselves, producing molecular change, and those due to the special physiological modifications produced by this excitation. The failure to appreciate this difference is, according to him, the principal cause of the confusion which exists among therapeutists in regard to the subject; and in this light, the

emphasis which he places on it in the commencement of the chapter is fully justified. The great principles which apply to all localized electrization are fully explained, and the details of the application to different organs are given in a general way. M. Cyon disagrees with Remak, Benedikt, and others, in rejecting, entirely, all galvanic treatment of the brain, considering that currents feeble enough to be safe have too little intensity to overcome the resistance offered by the bony envelopes. The cases related are discredited as being due to faulty diagnosis and hasty assumption. Galvanization of the sympathetic is also discouraged; and anatomical and physiological reasons are given why it should not be practiced. It is impossible, according to the author, to act on the sympathetic in the manner usually practiced, without also affecting the pneumogastric and depressor nerves, the excitation of which has a counteracting effect to that of the sympathetic. The effects desired, he thinks, may be better obtained by other methods of applying the agent. If, for instance, the object is to produce an excitation of the vascular nerves of the extremities, the points corresponding to the location of the dorsal sympathetic, governing the vascular supply of those parts, should be sought, and the electrodes so placed that the current may traverse them. Although M. Cyon is at variance, in this regard, with the great majority of electrotherapeutists, yet it seems that his points are well made; and that, especially in the light of recent utterances by so eminent a neurologist as Dr. Brown-Sequard, as to the danger of this procedure, great caution should always be exercised in the application of electricity to the cervical sympathetic.

The author discards the hypothesis that the excitation of the special sensory nerves is due to reflex action, and maintains that the laws of the ramification of the current, given in the first chapter, are sufficient to prove that the luminous phenomena sometimes perceived are due to direct irritation of the optic nerve, and not to any reflex influence transmitted from the trigeminus. The question as to the duration and intensity required for the currents, is discussed at the close of the chapter, and general directions given. As a rule, M. Cyon recommends applications of the constant current of ten to twenty minutes' duration, to the spinal cord, or to affect the vaso-motor system.

In his preliminary remarks in the fifth chapter, which treats of the subject of electrical diagnosis, M. Cyon calls especial attention to the distinction between muscular excitability and contractility, the latter depending entirely upon structure, and not at all on the exciting agent. The same is the case with muscular sensibility, which may be resolved into two factors—one the sensation of the contraction, and the other the pain due to the direct irritation of the sensible nerves—neither of them in any way dependent on any special action of the electric current. In other words, properly speaking, there are no such things as specific electro-muscular contractility and sensibility; and the

erroneous use of these terms has, according to the author, hindered the profession from fully appreciating the true value of electricity as a diagnostic agent.

The electric examination of the sympathetic as a method of diagnosis, is rejected as altogether unfounded on any true physiological understanding of the real conditions and functions of the nerve; and the phenomena supposed to be due to its electrical irritation are attributed to reflex action from the neighboring sensitive nerves, the vagus, laryngeal, etc. The author is especially severe on the view, which has been held by some, of the pathological sensibility of the sympathetic. To quote his own words: "The doctrine of the pathological sensibility of the sympathetic nerve, is one of the saddest evidences of the scientific methods of certain electro-therapeutists; this nerve, of all the rest, is the one which has been most maltreated in recent times."

In the sixth chapter, the differences between the physiological effects of the constant and induced currents are discussed at length, and shown to be due to the differences in their intensity and duration. The indications for the employment of the two kinds are given at considerable length; and, at the close of the chapter, a few pages are devoted to the theory of Duchenne as to the different effects of the induced currents from the primary and secondary spirals on the muscles and nerves, which the author explains, in the usual way, by the difference in the length and fineness of the two wires.

If M. Cyon is, perhaps, too little inclined to give his assent to any methods not based on the most rigorous scientific principles, as much cannot be said of the author whose work we have next to notice. Dr. Arthuis pays very little attention to scientific principles; and the treatment which he here exposes does not appear to be at all dependent upon them. The title of his book is in a measure deceptive. He does not employ static electricity in the same manner as such eminent practitioners as Russell Reynolds, Schwanda, and others; but his method consists, rather, in a kind of homœopathic medication by various substances, which, he assumes, he is able to introduce into the system through the "pores of the skin," by means of the electric current; his ideas being a modification of those of Beckensteiner, more fanciful, even, than the original.

A few quotations will give a better idea of the character of the book than can be otherwise conveyed. The following gives the author's idea of the manner in which his medical agents enter the system: "It is, therefore, by these pores that the electric fluid passes into the interior of the various organs, and to the smallest organic parts. It is by this route, also, that the infinitely minute molecules which escape from the surface of the exciters, and for which the electricity serves as a vehicle, are carried into our organism." The exciters are not usually applied, even to the surface of the body, but are held in the hand

of the operator, at some little distance. Not only the different metals, to each of which he gives different virtues, are employed, but also vegetable substances are made use of in the following manner. M. Arthuis says: "When a plant has been designated to be employed in the electrical treatment of a nervous disease, nothing is more easy than to administer it. If the stem or root is sufficiently large, we make of it an exciter, which is employed in the same manner as the metallic exciters. We have so used exciters of a great number of vegetables. If the plant is minute, we reduce it to powder, which we place in a glass tube, closed at one end, presenting, at the other end, a cork pierced with a hole, through which is allowed to pass a minute root of the vegetable, which fills the tube, and in the powder of which it is plunged. With this apparatus we obtain no sparks, but have a sufficiently strong current. By the aid of this simple instrument, there is no vegetable which cannot be used in electro-therapy."

It is unnecessary to comment on the above extracts. The work is noticed here merely because it offers, better than anything else that we have recently seen, an illustration of the unscientific or empirical method carried to extremes.

Dr. Fieber's little pamphlet is what its title indicates, a brief survey of the various affections in which rational electrical treatment has been found to be of benefit, with some judicious general remarks as to the value of electricity as a healing agent in nervous affections.

Dr. Prince's report is confined, mainly, to the subject of the uses of the constant or galvanic current. A number of useful practical hints are given; and the book will doubtless be found very useful and suggestive to those who, from want of time, or from other reasons, have been unable to consult the larger works on the subject. The author gives a list of some of the principal American treatises and reprints, with some judicious recommendations as to a course of reading on the subject. In only one point would we offer criticism. From the accounts of the cases given for illustration, it appears that Dr. Prince is accustomed to frequently employ the full power of his battery of one hundred and twenty Hill cells, or a very large proportion of it, in the treatment of very many nervous affections. While this is good evidence of the comparative harmlessness of galvanism, even of very great intensity, in experienced hands, it yet appears to us as rather heroic treatment, and is in striking contrast with the views of so high an authority as Benedikt, who considers a well-furnished battery of twenty Siemens elements as amply sufficient for all the needs of the physician, excepting only when powerful electrolytic or cauterizing effects are required. From our own experience with galvanism, we should hesitate to recommend, even by implication, such methods to the general practitioner previously unaccustomed to the employment of the constant current in disease; and we have some doubts as to its absolute necessity in any but very exceptional cases.