attributed much efficacy to the inunction of mercurial ointment in his case, for when this treatment was commenced the induration, which had up to then been extending, began to recede. When, however, we turn to Dr. Barlow's case we find that a similar arrest and recovery were observed although no mercurial treatment was employed; and in my case the improvement had certainly commenced during the week which preceded the inunction of mercurial ointment. After the mercurial inunction was stopped the improvement continued uninterrupted, but it is my impression that it was not quite so rapid as during the four weeks of mercurial treatment.

Chandos-street, Cavendish-square, W.

A CASE OF STRANGULATED OBTURATOR HERNIA IN A WOMAN AGED SEVENTY-EIGHT YEARS TREATED SUCCESSFULLY BY LAPAROTOMY.

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THE number of cases recorded of recovery after strangulated obturator hernia is comparatively small. The following case presents certain points of interest which seem to justify its publication.

A woman seventy-eight years of age was admitted into St. George's Hospital under my care on March 29th, 1895, with a history of having been fairly well, occasional attacks of colic excepted, until four days previously, when, after making a hearty meal of mutton chops, she was seized with violent gripping abdominal pain. Nausea followed almost immediately, and in a few hours vomiting set in. The vomiting continued up to the time of her arrival at the hospital, and for twelve hours it had been stercoraceous. No action of the bowels had occurred for four days. On admission the patient was emaciated and very feeble. There was a strong faecal odour about the breath; the face was "pinched" and had a marked "abdominal aspect." The pulse was weak, and the temperature subnormal. Acute intermittent gripping was complained of, principally below the umbilicus. There was an ill-defined desire to defæcate, but inability to do so. No blood or slime had been voided. The abdomen was only slightly distended, and upon manipulation violent, erratic, and painful peristalsis was excited. Examination by the rectum and vagina gave a purely negative result. Beyond the pain mentioned there was no other severe discomfort of any kind. As the case was clearly one of acute intestinal obstruction, and as no hernial tumour could be detected at any of the abdominal rings median laparotomy was performed at once. Upon opening the abdomen the small intestine as far down as the middle of the ileum was found to be distended; below that point the intestine generally was collapsed. The collapsed portion was traced down deeply into the left side of the pelvis, where it was tightly nipped under the arch of the pubes. Gentle and steady traction served to disengage a strangulated knuckle of gut about two inches and a half long, much congested and in parts ecchymosed; at one spot there was a laceration in the peritoneal surface surrounded by lymph. The damaged part was carefully cleansed and returned into the abdomen. No irrigation was used. Upon examining the left obturator foramen subsequently, it admitted readily the tips of two fingers, which passed through into a smooth sac of about the size of a pigeon's egg. The abdominal wound was united by fish-gut sutures in the usual way. Recovery followed and was uninterrupted. For the first two days there was some weakness, which rapidly passed off. The bowels acted with the aid of an injection of warm water on the fourth day after the operation; the stitches were removed on April 4th, and the patient left the hospital in her usual health on April 17th—i.e., less than three weeks after her admission.

It will be seen from a perusal of these notes that, as often happens in such cases, all the specific signs of obturator hernia mentioned in the text-books were entirely wanting in this instance. There was no fulness in Scarpa's triangle, the characteristic obturator nerve pain was absent, and nothing abnormal could be detected either by rectal

or vaginal examination. The symptoms were, in fact, merely those of acute intestinal obstruction, clearly due—judging from the characteristic, erratic, and painful peristaltic action—either to internal hernia, strangulation by a band, or to volvulus. The absence of distention after so long a period of strangulation and vomiting was a sure indication that the constricting medium was not of the sharp-edged kind. The diagnosis of obturator hernia was quite impossible, as is generally the case, although I mentioned it as being one of the possible conditions existing in the case before operating. The ease with which the hernia was reduced was—considering the time it had been strangulated—noteworthy, but was fully accounted for by the large and round-edged ring. Perhaps the most interesting part of the case is the recovery of a patient seventy-eight years of age after laparotomy under the circumstances described, especially when the damaged condition of the gut and the long period over which vomiting had extended are taken into account. Strangulated obturator hernia is very uncommon, and recovery after operation is rare. I have no recollection of any recorded case of recovery at so late a time of life as this patient's. Recoveries after laparotomy for the removal of ovarian tumours have of course been recorded up to a much greater age; but such cases, I need hardly say, are not comparable with a case like the one now described, in which the patient was suffering from the collapse entailed by strangulation of gut with peritoneal lesion, together with the exhaustion and depression caused by long-continued vomiting, which for some period had been feculent. The case affords, I venture to think, a striking instance of the great vital powers sometimes met with in old people who at first sight would appear to be too feeble to resist any great call upon their strength.

Chesterfield-street, Mayfair, W.

APOLOGIA PRO ELECTRICITATE SUÂ.

By W. S. HEDLEY, M.D. EDIN.

THOSE who have watched the solid, even brilliant, progress of electrotherapy in recent years acknowledge with regret and not without surprise that there is still a remnant of physicians who seriously doubt its capabilities, who refer to it as a "discredited agent," as something that has been tried and found wanting, or who, falling back upon a favourite phrase, express themselves as "disappointed in it." Of this remnant there is a certain minority even more aggressive in its attitude, more hostile in its scepticism. It is composed of those who roundly assert that neither does there exist any rational basis for the employment of electricity in medicine, nor is there any satisfactory demonstration of its curative effects; that once an agent of undoubted therapeutic promise, electricity now stands forth an admitted failure; that any good results that follow its use are due to psychical influence and rest on the baseless fabric of "suggestion." Scepticism of so pronounced a type is difficult of approach. It is useless to invite attention to the steady evolution of electrical methods in medicine made evident by the history of a hundred years; to point to that first period, the period of static electricity, which, broadly speaking, covered the second half of the eighteenth century, and is associated with the names of Jellabert, Mauduyt, and Bonnefoy; to that second period, commencing with the discovery of the "voltaic pile" (1800), associated with the names of Bischoff, Walther, and Most in Germany, of Sue, Thillaye, and Isnard in France; to that third period, the "period of the induced current," which, springing from Faraday's discovery of the phenomena of electro-magnetic induction (1831), ended with the brilliant work of Duchenne, to a period partly concurrent with the latter, represented by half a century of solid and lasting work bearing on the physiological effects and therapeutic action of the constant current, an epoch which recalls the names of Dubois-Raymond, Pflüger, Remak, Benedict, Brenner, Baierlacher, Ziemssen, Chauveau, Onimus, Legros, Boudet, and terminates about the middle of this century's "eighties" with the epoch-making works of De Watteville and of Erb. Approaching the present time, the apologist points in vain to the milli-ampèremeter, the voltmeter, the coulombmeter, to a period

of improved apparatus, of accurate measuring instruments, of modern currents—to a period, therefore, when the medical man finds himself in a position better than ever before to turn electrical energy into useful work. Equally useless is it, in presence of such a scepticism, to plead for electrical treatment that it ought to be judged by the same standards that apply to other remedial measures; useless to offer demonstrative evidence of the curative results that very constantly follow its efficient application, and to prove that as much at least is known of the nature of electricity and its way of working as is known of the action of many a drug that at the present moment holds an honoured place in the Pharmacopœia. The answer to such an appeal is a shrug of the shoulder or a shake of the head, with the inevitable reference to “suggestion” or “expectant attention.” Now, this theory of “suggestion,” associated mainly with the names of Möbius and of Rosenbach, may be briefly noticed. It announces the doctrine that electrification is merely a branch of psychotherapeutics, a doctrine which, shallow as it is and shortlived as it will doubtless prove to be, is nevertheless a form of heresy of a more or less seductive kind. Its little band of adherents ought to question themselves as to the reason for the faith that is in them. Before committing himself to such a belief the medical student, who is perhaps more than anyone else likely to be attracted by it, is reminded that in the first place he admits the effects of electricity to be physically and mathematically demonstrable, and in the second place he is aware that “suggestion” is as old as medicine, and that every drug has a psychical as well as a physical side to it.¹ He does not, however, say that because a bread pill may sometimes induce sleep if taken under the impression that it contains opium, that therefore opium acts by suggestion, neither does he say that because the actual cautery is sometimes successfully used in the treatment of hysterical paralysis that therefore the red-hot iron always acts by suggestion.² And from neuralgia he may learn a lesson. No doubt he is familiar with the fact that a neuralgia will often yield with surprising readiness to the galvanic anode; why in such cases, if the remedy act by “suggestion,” does a change to the cathode increase the pain?³

The steady progress which a short historical survey makes evident need not obscure the fact that, whatever its position at present and whatever its prospects in the future, the use of electricity in medicine has undoubtedly had a chequered past. It has suffered by the activity of impostors, by the prejudices of its enemies, by the intemperate advocacy of its friends, and perhaps more than all by the crude empiricism of its methods. Those medical men who have attempted its employment have not always duly recognised the fact that the physical problem underlies the biological one, and that it is of vital moment to know something of the nature of the energy they employ. Until comparatively recent years this has scarcely been possible of electricity. Modern electro-therapeutics may in one sense be regarded as the practical outcome of those modern views which, inaugurated by Faraday and developed by his followers, have resulted in the electric dynamo, the electric light, the telephone, and many another application of electrical science to industrial pursuits. In point of fact, medical electricity “came before its time.” It sprang from no solid basis of sound electrical knowledge. Carried away by the striking neuro-muscular phenomena that attend its application to living conductors, yet without any adequate knowledge of its physical nature, enthusiasts began to apply it *à tort et à travers*, without method and without measurement, and to all sorts and conditions of disease.

Medicine cannot reasonably cultivate an attitude of aloofness towards an agent to which it owes so much as it does to electricity. None deny that a fast increasing knowledge of neuropathology is largely due to electrophysiological research. Long ago it was pointed out that by the action of electricity on vital structures a surprising accuracy of diagnosis may often be arrived at, and that not only does it enable us to interrogate the neuro-muscular apparatus and ascertain the nature of a lesion, but sometimes even to foretell the duration of an illness.⁴ Electrical methods are now beginning to throw a not less important diagnostic light on a class of obscure gynecological cases where diagnosis is of vital moment, a diagnosis which “at one time will point to operative interference, at another will disarm the surgeon’s

hand and show a conservative treatment to be not only possible but almost certainly successful.”⁵ It is certain that in the use of the Faradic current of tension and of the galvanic current respectively, for the purpose of distinguishing inflammatory from non-inflammatory pain, gynecology has acquired a real addition to its diagnostic resources. To test the claims of electrical treatment it must be judged by the same standards that apply to the rest of medicine. What conditions is an accredited therapeutic agent expected to fulfil, and in which of these has electricity been tried and found wanting? Its physical and physiological effects are easily demonstrable. It is accurately measurable and under safe, easy, and complete control. Then comes the crucial question, Has electrical treatment made good its claim to curative power? Has it, when brought face to face with disease, had a success as constant and as clear as the average drug? A drug is looked upon as a curative agent because, other conditions being the same, effects follow its administration which without it would be absent. This “method of difference” in establishing the causality of an agent is sufficient for the ordinary affairs of life. Apply it to electro-therapeutics.

The three conventional forms of current hitherto used in medicine—viz., the galvanic, the faradaic, and the so-called “static”—are now supplemented, and to some extent supplanted, by electricity in certain new modalities. There are: 1. Those pulsatory currents produced by the electro-motive force of the ordinary constant current dynamo—currents which for medical as well as for other uses can now be turned on as required, like the water or the gas. 2. There are alternating currents of a more or less perfectly sinusoidal character, the frequency of which may vary from a few alternations to many hundreds or even thousands a second. The ordinary alternating light circuit furnishes a current of this order with a frequency of about 7000 to 10,000 alternations a minute. This as well as the constant current can be safely used through a resistance or a sliding shunt. 3. There are those oscillatory currents produced by the discharge of a Leyden jar, called by Dr. Morton (their discoverer) the “static-induced,” which, although produced by an old and familiar apparatus, have every right to be ranked as modern currents. 4. There are currents of high frequency and potential, whose alternations may number hundreds of thousands, millions, or even exceed a billion a second.

1. With reference to currents produced by the constant current dynamo it is to be remarked that although “continuous” or “constant,” and always flowing in the same direction, they are not absolutely uniform in strength. They are “pulsatory.” They thus differ to some extent in physical nature from the current produced by the uniform electro-motive force of, say, a Leclanché cell. Small as this difference may be from an electro-therapeutic point of view, it must not be lost sight of. It is usually considered that with a 100-volt light circuit current passed through a controlling resistance pain is greater than when supply is drawn from a battery of low voltage. An explanation may perhaps be found in the physical character of the current rather than in its originally high voltage. The current controller or adaptor may be constructed on the principle shown in the following sketch, where A B is a fine platinoid wire of

FIG. A.

suitable resistance with a sliding contact at X, which regulates the potential of the patient's circuit. By such arrangement it is evident that any desired maximum or minimum of potential difference can be secured in proportion as the resistance between the runners (or the runner and the other shunt connexion) varies between zero and the total resistance of the wire. The variation of the difference of potential can be as slow and gradual as is desired. In practice the wire is coiled. The arrangement is, in fact, a “sliding shunt,” and supplies, in the opinion of the writer, the best form of current controller or “reducer of potential” for adapting light circuits to medical use. An

¹ Lombroso: *Revue Internationale d'Électrothérapie*, 1894, p. 65. Paris.
² *Ibid.*
³ *Ibid.*

⁴ Erb: *Electrotherapeutics*. Smith, Elder, and Co.

⁵ Apostoli: *Revue Internationale d'Électrothérapie*, 1892, p. 65. Paris.

instrument for the above purpose has lately appeared which, with many excellences, is not without faults. It consists of a rheostat having a total resistance of about 33,000 ohms, with a 16 candle-power lamp placed in circuit with each of the "leading in" wires "to protect the patient in the event of a short circuit." It has been pointed out in THE LANCET how futile is such a device. A lamp cannot be trusted to as a circuit breaker for medical purposes; it may allow twice its proper amount of current to pass before breaking. The magnetic cut-out⁶ is, so far as the writer is aware, the only arrangement yet suggested which can be seriously trusted to for the purpose in question; and even here it is to be remembered that the action is not quite instantaneous. In the adaptor under consideration there is also a third lamp arranged "in shunt" with the rheostat. The throwing in of this shunt reduces the voltage of the 115 volts circuit to 60 volts.

2. Of modern currents the one which will perhaps prove the most important for medical use is that form of alternating current whose curve is of the sinusoidal type. It takes its name from the fact that the current strength "follows the law of sines as regards its variation in time; it is a simple harmonic current"; a current which gradually attains its positive and negative maximum, shows no lost time and no actual interruptions. It is represented graphically by a curve of sines which may be contrasted with the very sudden and dissymmetrical changes of potential shown by the pointed curve of a coil's alternations. Inasmuch as the excitant action of an electric current bears a direct ratio to the suddenness of the fall of potential, it follows that the sinusoidal current will be better tolerated than the more brusque alternation of the coil. But on this very account it is equally evident that the latter for certain purposes can never be supplanted by the current in question.⁷ It appears by the researches of d'Arsonval that in the case of animals submitted to the action of sinusoidal currents an examination of the blood by the usual physiological methods shows a greater intake of oxygen and a greater output of carbon dioxide, a fact which of course in its turn points to increased metabolism throughout the body. A similar increase in the oxidation as evidenced by the increased excretion of urea has been proved by Gautier and Larat as the result of the therapeutic use of currents of alternating light circuits; but these are not of course strictly sinusoidal. They may be used through a rheostat and cut-out or by means of the sliding shunt already described. A small therapeutic alternator in which the rapidity of alternation is under the control of the operator furnishes in the experience of the pre-ent writer a current at once more useful and more easy to handle.

3. The so-called "static-induced" current is the direct product of the static machine with condensers. The patient is not insulated, however, but the connecting rods between the two Leyden jars are removed, the inner coatings are connected with the discharging rods, the latter being separated by a small spark gap.⁸ If, now, a rheophore held in each hand be attached to the outer coating of each Leyden jar it is evident that such an arrangement gives two circuits: one, the primary, includes the discharging rods, the spark gap, and the inner coating of the Leyden jars; in the other, the secondary or induced, there are the patient's body, the rheophores, and the outer coating of the jars. A current is thus obtained for which striking physiological effects are claimed; and certainly the ability to secure by its means powerful muscular contraction without pain is as wonderful as it is useful. More remarkable perhaps than the production of a new current from the static machine is the striking revival of an old one. The so-called electrostatic bath, with all its accompaniments and modifications, "soufflé," "douche," "frictions," exactly as described by Maudsley and the pioneers of the eighteenth century, has once more vigorously pushed itself to the front. It consists, as everyone knows, of the simple placing of the insulated body in connexion with one pole of the static machine. In

explanation of the effects long known to follow its use it is now ascertained that this procedure produces well-determined effects, such as increased skin action effects on blood pressure, increase in the frequency and depth of the respirations, as well as (with the positive bath) an increased excretion of urea and of phosphates. Keeping in view the ever-changing electrical conditions of the air and the influence of the weather upon health, it is not impossible that "the electrics" of the atmosphere will eventually prove the key to treatment by the electrostatic bath.

4. Currents of high frequency and potential are generally obtained for medical purposes by means of the oscillating Leyden jar discharge traversing a solenoid. Such currents may carry energy enough to light a 5 candle-power lamp, and if the human body with its thousands of ohms resistance be at the same time placed in circuit there will scarcely be a perceptible diminution in the brightness of the glow; and yet, notwithstanding the tremendous amount of energy passing, there is scarcely a consciousness of its passage. Pain is absolutely absent. Why this harmlessness, whence this immunity from pain? Many theories have been advanced, all of them perhaps wide of the mark, but probably an inhibitory or "throttling" effect of the nature shown in an experiment shortly to be detailed enters into the question. Whatever the explanation, it is to be noticed that painlessness seems to be the great characteristic of all high frequency work. The physiological effects claimed as the result of passing these high frequency discharges through the body are many, but amongst the most noteworthy are (1) a considerable increase in the nutritive exchanges as evidenced by a greater absorption of oxygen and an augmentation in the carbonic acid exhaled; and (2) a vaso-dilator action on all the bloodvessels, resulting in a fall of blood pressure. Such currents are already emerging from the stage of experiment and promise, soon to bear fruit in actual practice. It is to be noticed that "rapid pure electric alternations" produce no excitatory action on the neuro-muscular apparatus, but seem to exert merely a paralysing or fatiguing influence, or what has been termed a "throttling" effect on the passage of another stimulus. The recent experiment of Lodge and Gotch, which points to this conclusion, is as follows: Taking the physiological limb and applying a stimulus of a rapidly alternating character directly to the nerve, "at the same time as some other well-known one-hundredth volt, stimulus is applied to another part of the same nerve further from the muscle; it can be shown that rapid electrical alternations, if entirely unaccompanied by static charge or by resultant algebraic electric transmission, evoke no excitatory response until they are so violent as to give rise to secondary effects such as heat or mechanical shock. Yet notwithstanding this inaction they gradually and slowly exert a paralysing or obstructive action on the portion of the nerve to which they are applied, so that the nerve impulse, excited by the feeble, just perceptible, one-hundredth volt stimulus above, is gradually 'throttled' on its way down to the muscle, and remains so throttled for a time varying from a few minutes to an hour after the cessation of the violence."

Turning from this the most modern of currents to that which is the most ancient, the familiar spark of the so called static machine, the attention is arrested by a striking difference. That excitatory action so completely absent in the former is in a marked degree present in the latter. Apart, however, from this great physiological difference the current of pure rapid electric alternations and the static spark have many points in common. Each static spark seems single, but it in reality passes backwards and forwards hundreds of thousands of times. It oscillates, each oscillation growing less and less until the conductor is discharged. It is not to the conductor, however, that attention ought to be directed, but rather to the surrounding medium, to the electrostatic field, to the dielectric strained by electromotive forces, and the insulating power of the air eventually breaking down under the electric stress or tension. At the same time from the discharging circuit "waves of electrical distortion," to and fro disturbances of the ether, spread and radiate in all directions. This is the genesis of what are known as oscillatory currents, currents which are for the most part sinusoidal in character. In all electrical work it is instructive to transfer the attention from the conducting wires to what is going on outside them and to picture the ether disturbed by electromotive forces propagating the disturbances by undulatory or wave movement, until the energy becomes dissipated or taken up by some

⁶ THE LANCET, April 9th, 1892.

⁷ The subject of coils cannot here be entered upon; it is sufficient, however, to remember that the modern instrument furnishes currents of a range and quality far superior to those of the "faradaic machine" in ordinary use in this country. This superiority is secured not only by the number and variety of the windings of the secondary coils, but by the nature of the interruptor, which is not a vibrating one and has a separate source of supply to "action" it. The result of such arrangements is that not only is irregularity in action avoided, but a range of rapidity of alternation is obtained varying from the slowest rate (for muscular action) to 30,000 a minute for sedative effects.

⁸ In practice the circuit is usually broken by a special electrode.

suitable appliance and utilised for work. The energy, however, does not, according to "modern views," travel by the conductor, but through the insulating medium, or dielectric. The conductor, whether it be a wire or a living body, only guides the energy and concentrates it for useful work. Applying this to that very imperfect conductor, the human body, it is evident that the latter may be regarded as an appliance capable of utilising in a variety of ways energy transmitted by the ether. It resembles an ordinary metallic conductor in that it guides the effects transmitted by the ether contained in the dielectric, but it differs from the wire in the fact that the guidance is probably effected by that peculiar form of conduction known as electrolytic; and this leads up to the infinitely important point that electrolytic conduction is probably "invariably accompanied by decomposition, and only occurs by its means."⁹ Further, Helmholtz has shown that "the most infinitesimal electromotive force is sufficient to effect its due quota of decomposition." From a different standpoint it may be allowable to think of the ether vibrations springing from some electrical source as impulses communicated, motion added, to the already pulsating atoms of a vital structure. Giving further play to such a train of thought, it is possible to imagine certain of the delicate mechanisms of the human body as "receivers" syntonised for the reception of similarly vibrating ethereal impulses radiating from some given source. The relationship of physiology with physics is strongly brought out in a theory (whether it prove right or wrong) recently suggested by Professor Lodge. It is found that a tube of metallic filings—i.e., a series of loose contacts—diminishes its electrical resistance when exposed to "even the distant neighbourhood of a Leyden jar or coil spark." Such an arrangement is called by Lodge a "coherer," and he suggests that perhaps the eye acts on such a principle. He "wishes to guess that some part of the retina is an electrical organ, say like that of some fishes, maintaining an electromotive force which is prevented from stimulating the nerves solely by an intervening layer of badly conducting material with gaps in it, but that when the light falls upon the retina these gaps become more or less conducting and the nerves are stimulated." This is the so-called electrical theory of vision, and to Professor Lodge, and to him alone, is due the merit of having suggested it. Although the nature of the action of the eye as a detector of radiation is still little better than a guess, it cannot be said that there is anything extravagant in the idea that the hexagonal pigment cells or the rods and cones of the retina act, under the impulse of those ether vibrations which constitute light, in a way almost identical with the action of a coherer. It seems even conceivable that other histological arrangements—e.g., those nerve fibrils which conduct yet only touch and do not anastomose, those motor nerve endings which are only in contact with the sarcous substance; indeed, any conducting arrangement in the animal body which may be classed as a "bad contact"—may constitute the physiological analogue of what would be electrically known as "a coherer."

Descending from the region of wild dreams and speculations, many of which are still immeasurably short even of the experimental stage, and reverting to a sober survey of medical currents, the attention is arrested by the want of uniformity in their designations. A new nomenclature seems desirable and almost necessary—a nomenclature in which electrical currents for medical purposes can be distinguished by their physical character rather than by the name of a discoverer or the mode of their production. Such a classification has recently been formulated by Professor Houston and Mr. Kennelly, two distinguished physicists to whom electro-therapeutics is already under many obligations. It is pointed out that medical currents can be referred to four main types—viz., continuous, alternating, intermittent, and convective. These are subdivided as follows:—1. Continuous currents may be (1) uniform and (2) pulsatory. The former class is produced by a uniform electromotive force, such as that of a Leclanché cell, and would comprise those currents at present known as galvanic. A pulsatory current is, as already stated, continuous, and always flowing in one direction, but not uniform in strength. Such a current is produced by the constant current dynamo. (Fig. B.) 2. Alternating currents—that is, currents which periodically reverse their direction—may be symmetrical or dissymmetrical; the symmetrical may be sinusoidal (Fig. C) or non-sinusoidal (Fig. D). The electromotive force of the

former is represented by a curve of sines. In a non-sinusoidal alternating current the positive and negative maxima are equal but not smoothly attained, and the graphic representation is of a more or less angular, not of a wavy, character. Voltaic alternating currents are of this type. The most familiar example of the dissymmetrical alternating current is that produced by the ordinary medical induction coil. (Fig. E.) Intermittent currents are oscillatory and non-oscillatory. "An oscillatory current is an alternating current, usually sinusoidal in type, but decaying in amplitude—i.e., each wave is smaller than the preceding one.

FIG. B.

FIG. C.

Oscillatory currents produced by the discharge of a Leyden jar correspond to the 'static induced.' They are usually of extremely brief duration and of very high frequency, a whole series of perhaps ten oscillations being completed in, say, the 20,000th part of a second. Non-oscillatory intermittent currents are produced by the discharges of influence machines through circuits unfavourable to the

FIG. D.

FIG. E.

Figs. B., C., D., E., are after Houston and Kennelly.

development of oscillations. Franklinic currents are of this nature. Convective currents or convective discharges are produced by the convection of electrified particles of air or other material (the static breeze).¹⁰ The classification thus detailed is as follows: (1) continuous current—(a) uniform, (b) pulsatory; (2) alternating—(c) sinusoidal, (d) non-sinusoidal, (e) non-symmetrical; (3) intermittent—(f) oscillatory (g) non-oscillatory; (4) convective—(h) static breeze. Such a nomenclature may require modification, but it is very practical and possesses the great advantage that in the selection of a current for medical purposes the name points directly to its physical character, and in some measure, therefore, to the therapeutic indication it may be expected to fulfil.

Looked at from the standpoint of modern practice, the field of electro-therapeutics seems broadening. No longer limited to strictly local applications, it now embraces those procedures whose aim it is to influence, and which demonstrably can influence, the entire economy. Its object is so to utilise electro-physiological data as to influence innervation, heart action, muscular conditions, respiration, temperature, the oxidations, every functional action and metabolic change, and not least by the process darkly known as "vaso-motor influence" to modify and control the blood-supply to organs and tissues. There are times when the power of electrification to reach an internal organ will depend not on any direct action inherent in an electric current, but on an influence which, having its starting point in the electrical stimulation of some surface area, and travelling perhaps *via* nerves of common sensation, will strike the spinal cord at some special spot, and reflected thence will find a route by filaments of the sympathetic to some particular organ, an organ thus in neural relationship, through this special segment of the cord, with that area of cutaneous surface which was the site of the electrical stimulation. Such a process not only throws light on the *rationale* of peripheral electrical excitation, and especially of the action and uses of the faradaic brush, but is

⁹ Lodge: *Modern Views*, p. 79. Macmillan and Co.

¹⁰ Houston and Kennelly: *The Polyclinic*, September, 1894. New York.

one of the many points which, if duly weighed, tend to a wider conception of the entire question of treatment by electrical methods. To "kick up" a set of sluggish muscles into action, to stimulate, if such expressions be allowable, the neuro-muscular apparatus into a display of electrical gymnastics, can no longer be considered the sole aim and object of electrification. Such effects doubtless rank amongst the most striking and valued effects of electric currents, but cannot in the presence of those varied and far-reaching influences of the kind that have just been considered any longer claim exclusive possession of the field. The latter view begins now to be clearly reflected in practice. The revived use of the electrostatic bath, the methods of central galvanisation and of general faradisation, and general applications to the entire body by means of the water bath through which sinusoidal or other currents are passing, are procedures which seem to be supplementing and in some measure displacing the more strictly localised forms of application; and now that it is known how to obtain currents of high frequency and potential, and that it has become possible to demonstrate the physiological qualities that belong to them, it becomes probable that there will soon be the opportunity to realise in practice the therapeutic effects not only of passing these high frequency discharges through the body, but of subjecting it without contact with the terminals to a kind of electrical bombardment in the rapidly alternating electrostatic field between them. This is new ground; once broken, it is likely to prove a wide and fruitful field. Progress in this direction is rapid and striking. France, America, and Germany are at the present moment each the active centre of an onward movement in electro-therapeutics, a movement which experimental investigation, clinical observation, and organised association go hand-in-hand to accelerate and to strengthen. Another mark of progress appears in the fact that physiologists begin to recognise that chemical and electrical processes are inseparable from those that have hitherto been called vital, and that electromotive force is very constantly the outcome of physiological action. There are signs that physics begins to "encroach on the domain of physiology" and that medical men are more and more turning their attention to physics.¹¹ What has been called "physical biology" or "biological physics"¹² seems already beginning to differentiate itself and to stand out as a special branch of science. It forms a kind of neutral ground where medical and electrical science find a common holding point and a common end. To the medical man his line is clear. With the lessons of experience well in view, he takes his stand upon the broad principles of electro-physics and the known action of electrical currents on vital structures. When such indications fail to guide him and fail they often must, he will not on that account fold his arms in helpless inaction, but falling back upon an enlightened empiricism he will gently feel his way. He will "not ask, but try." He will not be afraid to acknowledge that after all is said therapeutics is to a large extent but a process of cautious experimentation.

Brighton.

HEPATIC ABSCESS FOLLOWED BY AMOEBIC DYSENTERY; OPERATION; RECOVERY.

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THE following case is of special interest as demonstrating the causal connexion between dysentery and the so called tropical abscess of the liver. In almost every case of hepatic abscess which I have seen at the Seamen's Hospital during the past ten years there has been a history of an antecedent attack of dysentery, but this is the first case in which the causal connexion has been so definitely proved. Murchison's great authority is always quoted against this view, but he seems to have based his conclusions on the statistics of Indian observers rather than on his own experience. The migration of the amoeba coli from the intestine to the liver must now take the place of chill, excessive eating and

drinking, tropical climate, and other vague generalities to which tropical abscess is so frequently ascribed. Amoeba coli have been found in the pus of a liver abscess by many observers, and also in the dysenteric stools at the same time by pathologists in Germany and in America; but so far as I am aware this is the first occasion in which their coexistence has been demonstrated in this country.

The patient, a Lascar aged forty-two years, was admitted to

the Seamen's Hospital, Greenwich, on Dec. 22nd, 1894. On admission he complained of pain in the right side of the chest, cough, fever, and a feeling of general illness for one week. His general health had been good, and he had had no serious illness. In June, 1893, while in Calcutta, he had an attack of dysentery with some tenesmus and tormina, and passage of blood and mucus. He got quite well in about twelve days, and since then had not been similarly affected,

his health being fairly good. He was taken ill with the present attack while on board his ship in the West India Dock. He complained of a constant dull aching pain in the right side and some cough; these symptoms gradually became worse in the course of a few days. On examination he was found to be a poorly nourished man, with an anxious expression and slightly accelerated breathing. There were signs of fluid in the right pleura.

¹¹ D'Arsonval, Académie des Sciences, Paris, 1893.

¹² Ibid.