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REPORT ON ELECTRO-THERAPEUTICS.

(Containing some final alterations.)

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Electro-physiology.

Ziemssen.—Die Electricität in der Medicin. 4te Aufl.; Physical. und Physiol. Erlangen, 1872. 1 ster Theil.

Cyon.—Principes d'électro-thérapie. Paris, 1873.

Wreden.—Ueber elec. Reizung d. Gehörorgans. Pflüger's Archiv, Bd. vi.

Weber-Liel.—Ueber das Wesen und die Heilbarkeit d. häufigsten Formen progress. Schwerhorigkeit. Berlin, 1873.

Loewenberg.—Ueber d. Einwirk. elec. Ströme auf d. sogen Binnen-muskeln d. Ohres. Monatschrift f. Ohrenheilkunde; Canstatt's Jahresb., 1873.

Both Cyon and Ziemssen deserve the thanks of the profession for having attempted, in the above works, to rescue electro-therapeutics from the hands of the purely empirical and to place it upon a scientific basis.

The laws of electrotonus, discovered long since by Du Bois-Reymond, Pflüger, and others, are stated by Cyon with remarkable clearness and conciseness.

For the sake of what follows, a brief review of the most important of them may be permitted here.

When a current of electricity is allowed to flow constantly through a (frog's) nerve, its susceptibility to excitations (mechanical, electrical or chemical) suffers certain definite changes. Around the point where the current enters the nerve (positive pole, anode), its irritability becomes diminished, so that to produce a given response (a muscular contraction of a certain strength), a more intense excitation must be used than was previously necessary. Around the point where the current leaves the nerve (negative pole, or kathode), the irritability of the latter becomes, on the contrary, greater than before, so that an irritation previously inefficient now meets with a response.

These states of altered irritability are called, respectively, anelectrotonus and katelectronus. Several theories for their production have been proposed (by Du Bois-Reymond, Hermann and others), but it will be sufficient for our purpose to assume, speaking roughly, that, where the current enters the nerve, the vibration of its molecules becomes less rapid than before (anelectrotonus, or diminished irritability); where the current leaves the nerve, that the rapidity of the molecular vibration is increased (kalectrotonus, or increased irritability).

At the moment that the electrical circuit is closed, the state of increased molecular vibration is induced with great suddenness around the kathode, and thereby the nerve is sufficiently excited to call out a contraction in the muscle which it supplies.

This excitation, accompanying the closing of the circuit of a constant current, takes place, therefore, exclusively at the negative pole (kathode), and *not at all at the positive pole* (anode).

When the circuit is broken, the reverse is true; the diminished molecular vibration around the positive pole (anode) during the passage of the current gives place suddenly to a state of normal, or even increased vibration, and an excitation, *confined to the positive pole,* is the result.

Many investigators have attempted to reproduce these phenomena upon the human subject, and it has, indeed, been demonstrated satisfactorily that with the optic (and perhaps with the auditory) nerve the anelectrotonic and katelectrotonic states may be produced at will.

Pflüger's laws are more difficult of verification; but by taking great precautions, Cyon has obtained very satisfactory results in experimenting upon the ulnar nerve.

It is a matter of common observation in experimenting with the human nerve, that a contraction attends the closing of the circuit (if the current has a certain strength) when only the positive pole is on the nerve, the negative pole, on the contrary, at an indifferent point.

This is, no doubt, because the human nerve is surrounded by good conductors, which give an easy passage to the electrical current, and induce it to leave the nerve almost immediately after entering it.

The muscles constitute for the nerve, in fact, a negative pole (kathode), and the conditions for the induction of katelectrotonus at the moment of circuit-closure are thereby given, although of the metallic poles only the positive be in the neighborhood of the nerve.

It is claimed on many sides (especially by Brenner and his followers with regard to the auditory nerve), that a state of more or less permanent anelectrotonus may be induced in a nerve by bringing it under the influence of the positive pole for a time, and then gradually reducing the strength of the current to zero, so as to avoid the circuit opening reaction. In this way, it is said that irritative conditions in nerves, and, indeed, in other tissues, may be removed.

The facts may be true, but physiology does not justify this explanation; for, with the frog's nerve at least, the anelectrotonic state disappears immediately, or almost immediately, after the opening of the circuit. A more probable explanation would seem to be that better conditions of nutrition are induced in the irritated nerve by the passage of the current. Furthermore, much doubt has been thrown on the propriety of Brenner's diagnosis of irritation, and, indeed, on the whole theory of the reaction to electricity of the auditory nerve, by Wreden, of St. Petersburg, who has made a long series of experiments to show that the subjective sounds which attend the so-called galvanization of the auditory nerve, are, in fact, due to the contraction of the intrinsic ear-muscles.

That many cases of ringing in the ears and partial deafness are, in fact, dependent upon abnormal conditions of these muscles, and are often curable by galvanizing them (by passing a metallic probe into the tympanic cavity through the Eustachian tube), has been conclusively shown by (among others) Weber, of Berlin. Loewenberg suggests that, by the use of a manometer connected with a water-tight ear-speculum, the supposed action of these muscles might be studied.

Both Cyon and Ziemssen criticize severely the loose and unscientific manner in which marvellous results are set down on all sides as due to the so-called *galvanization of the cervical sympathetic.* The cervical sympathetic (apart from its connection with the pupil and the salivary glands) contains the vaso-motor nerves for the ear, face, and some parts of the brain, but not for the rest of the body, and the nutrition of the legs, for instance, can in no wise be dependent upon its influence.

Moreover, as the sympathetic is usually galvanized, not it alone, but also the depressor nerve and the vagus, must be brought under the influence of the current, and, perhaps, through their agency, the circulation of the distant parts of the body may, indeed, be affected.

Cyon points out that the spinal centre for the vaso-motor nerves of the arms lies in the upper dorsal, that for those of the legs in the lower dorsal, region.

Ziemssen has measured carefully the rise in temperature which normal muscles exhibit when made to contract by faradic currents, and found it to amount to several degrees in a few minutes (4°–8° F.). The therapeutical importance of such a rise must, of course, be great. No elevation of temperature, on the other hand, attended the passage of a pretty strong galvanic (constant) current through the skin and muscles for five minutes, except at the point of application of the electrodes. At the same time, there can be little doubt that the nutrition of the various tissues of the body, especially when they are for the moment in a pathological, but tending to return to the normal, state, may be improved by the simple passage of a constant (galvanic) current. Physiological evidence therefor is given by the increased weight which Orimus and Legros found a number of puppies, selected at random from a large litter, to attain under daily galvanization.

ELECTRO-THERAPEUTICS.

NEFTEL.—Galvano-therapeutics. New York, 1871; also, New York Medical Record, December, 1872.

CLARENCE J. BLAKE.—Annual Report of the Massachusetts Charitable Eye and Ear Infirmary.

J. RUSSELL REYNOLDS.—Clinical Uses of Electricity. London. 1873.

HERBERT TIBBITS.—A Handbook of Medical Electricity. London. 1873.

HOLST.—Die elect. Behandlung von Migraine. Dorpater. Med. Zeitschrift, II., 4 Schmidt's Jahrb., No. 6, 1872.

BOUCHUT.—Paralysie Infantile. Bull. gén. de Thérapie. 1872, Août. Centralblatt, No. 45, 1872.

CINSELLI.—Sulle correnti galvaniche continue. Gaz. Med. Ital. Lomb., No. 37. Canstatt's Jahresb., 1873.

N. MAYER.—Philadelphia Medical Times, May 15, 1873.

GERHARDT.—Heilung d. Icterus catarrhalis durch Farad. d. Gallenblase. Berl. Klin. Wochenschr., No. 27, 1873.

George M. Beard.—Cases illustrating the Treatment of Skin Diseases by Central Galvanism. N. Y. Medical Record, Aug. 15, 1873.

Neftel and Blake report cases where electricity was of service in the diagnosis and treatment of various *aural diseases*. Neftel found "hyperæsthesia" of the auditory nerve in some cases of chlorosis, and a torpid condition in case of Bright's disease. (Compare above.)

Reynolds and Tibbits, both connected with the Queen's Square Hospital, London, recommend the use of *static* (frictional) *electricity* for its tonic effect upon the nervous centres, the treatment consisting in charging the patient, placed on an insulated stool, with *free electricity*.

Tumors of various kinds are reported as having been relieved, at least temporarily, in this way.

The free electricity obtained from one pole of a large galvanic battery (the other being connected, by way of the gas tubing, with the earth) was found by them to have a similar tonic effect in cases of general nervous debility.

Dr. William R. Fisher *(New York Medical Journal*, May. 1873) speaks of the importance of placing weak or palsied muscles in a relaxed condition while faradizing them. Under these circumstances, they become able to contract, although previously unable. The reviewer believes the point to be an important one.

Holst has been more fortunate than most physicians in his treatment of *hemicrania* by electricity. He distinguishes sharply between two opposite forms of the disease, one due to an irritated condition of the cervical sympathetic, and consequent spasm of the vessels controlled by it (observed and studied upon himself, by Du Bois-Reymond), the other to paralysis of nerve and vessels (first described by Moellendorff).

The excessive irritability of the nerve he treats by bringing it (vide above) under the influence of the anode of a galvanic battery, a long and narrow electrode being pressed inwards and backwards from just in front of the sterno-mastoid muscle, while the other pole is grasped by the patient's hand.

The neuro-paralytic form he treats, on the contrary, by exciting the nerve strongly through the agency of the negative pole (kathode).

Not being able to tell, in most cases, which form of the disease is present, he lets the results of treatment decide the diagnosis.

Dr. Anstie believes, as is well known, that migraine is dependent upon degenerative changes affecting the root of the trigeminus. In this, as in all true neuralgias, he finds that the vaso-motor nerves are generally affected, but secondarily causing, in most cases, first vascular spasm, then vascular paralysis.

The use of *weak, long-continued galvanic currents* is increasing in favor. Bouchut found good results in infantile paralysis from letting the current from four elements run from six to twelve hours at a time through the paralyzed muscles, and considers the resulting improvement an argument for the myopathic origin of the disease. Ciniselli and Mayer recommend the wearing for a long time of batteries, such as have been long in use in the treatment of ulcers, either on opposite sides of the head or on other parts, for neuralgia, paralysis and a long list of nervous disorders.

These batteries differ from Dr. Garratt's disks principally in the further separation from each other of the metallic plates, whereby the tendency of the current to penetrate deeper into the tissues is increased.

T. Clifford Allbutt (*West Riding Hosp. Rep.* for 1872; *Practitioner*, Dec., 1872) gives a number of cases of *dementia* and *melancholia* treated successfully by the use of galvanism directed to the head and the cervical sympathetic. Arndt (*Zeitschr. f. Psych.*, Bd. 28) has met with similar results.

Arndt's observations, however, have by no means been confirmed in all the large hospitals in Europe, and the cases and observers are too few as yet to justify a decided opinion in the matter.

Gerhardt has succeeded, in several cases of *icterus catarrhalis*, in causing the gall-bladder to contract strongly by energetic and well-directed faradization, whereby the plug of mucus was expelled from the gall-duct. In most of these cases, careful percussion had revealed an area of dulness, which disappeared after treatment.

In the treatment of *skin diseases* of the most chronic and obstinate character, Dr. Beard has met with marvellous success, both when using local and central galvanism (galvanism of nervous centres). We shall look with interest to see if his observations are confirmed by others.

It has long been known that the health of the skin may be influenced by the state of the central nervous system, and that eczematous, herpetic and other inflammations may be caused by lesions of peripheral nerves, but that so close and so general a connection exists between the state of the central nervous system and that of the skin as the results claimed to follow the galvanization of the former would indicate, would certainly surprise all but the most neuropathic of dermatologists.

Dr. D. F. Lincoln reports the results of the use of electricity, during the past year, at the Boston Dispensary for Diseases of the Nervous System, in a great variety of diseases, mostly of nervous origin. Among those "relieved" are 5 cases of *epilepsy* out of 8, 18 of *myalgia* out of 19, 22 of *asthenia* out of 47, 6 of *neuralgia* out of 9.

ELECTRO-SURGERY.

J. BYRNE.—Notes on Uterine Surgery. New York Medical Record, December, 1872, and January, 1873.

NEFTEL.—Die elect. Behandl. d. bösartigen Geschwülste. Virch. Arch., 1873, I., VII.; Centralblatt, 5 July, 1873.

CARL MICHEL.—Pharyngitis u. deren Heilung durch Galvanocaustik. Allg. Med. Centr. Zeit., 26th and 27th March, 1873.

RODOLFI.—Della elettr. nella congiuntivite gran. Gazz. Med. Ital. Lomb., Nov. 2, 4, 7, 14, 1872. Canstatt's Jahresb., 1871. Schivardi. 1871.

TRUEHEART.—Granular Conjunctivitis. New York Medical Record, No. 168, 1872.

GIRARD.—Amputations-neuroma. Deutsches Arch. f. Chirurgie, B. I., H. 1.

Dr. Byrne appears as an advocate for the use of the electro-cautery in *uterine surgery*, in a series of very sensible papers, in which he also describes some new and apparently excellent forms of instruments and batteries. (All fluid batteries for this purpose will, probably, be superseded some day by magneto-electric machines, such as Mr. M. G. Farmer makes for exploding torpedoes.)

Michel has used the galvano-cautery to advantage in *chronic pharyngitis*, touching lightly the thickened prominences of the mucous membrane with the red hot wire, which may be easily introduced, even through the nostril. The operation is not attended with any great pain, and in ten or twelve days every trace of it has disappeared.

In *granular conjunctivitis* good results are claimed to follow the use of the constant current, one (either) pole armed with a soft sponge being applied directly to the conjunctiva, while the other is placed on the eyebrow or molar process. (Vide JOURNAL, Vol. x. 1872, page 305.)

The duration of each application is ten to thirty minutes.

Three to five applications are generally enough; if not, then one should begin again after an intermission of three to eight days. Meantime, solution of nitrate of silver, gr. ij.–℥i., may be used.

Neftel claims to have destroyed a number of *cancerous growths*, with better results than usual in the way of recurrence, by means of electrolysis. He believes that the cancer cells, being of low vitality, are killed by the current, even when they are not in a position to be directly decomposed.

His papers on the subject would repay careful perusal.

Girard gives a carefully reported case in which three *amputation-neuromata*, which had recurred twice after removal by the knife, were destroyed by electro-puncture, needles connected with a battery of thirty-six small Bunsen elements having been thrust into them. Eight weeks after the operation (the longest time that they had remained away before), there was no sign of recurrence.

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