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PHYSIOLOGICAL AND THERAPEUTICAL
RELATIONS OF

ELECTRICITY

TO THE NERVOUS SYSTEM.

BY

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ELECTRO-THERAPEUTIST TO THE N. Y. STATE WOMAN'S HOSPITAL.



(Being a portion of a paper read before the American
Neurological Association.)

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WHILE the various methods of electrization have each their separate history, and must be regarded as entirely distinct processes, it is not to be supposed that in their therapeutical application they do not stand in near relation to each other. Very seldom in persistent and severe disease—that is in any measure amenable to electrical treatment—is it possible to rely on any one method, and at the same time derive the maximum of benefit that electricity can afford.

Localized faradization and galvanization, general faradization and central galvanization are constantly supplementing and replacing each other, in their relation to pathological conditions, and he alone will reap the reward of full success in this department who has a clear appreciation of the physiological relations of each method and an experimental knowledge of their uses.

Localized electrization necessitates, of course, an accurate anatomical knowledge. The motor nerve points must be thoroughly studied; the relative reaction of nerves, muscles, in health and disease, to both

currents must be clearly appreciated; the polar influence of electricity, as distinguished from that of current direction, must be understood; in short, all those physiological changes that result from localized applications should be fully investigated.

Central galvanization demands a far greater familiarity with the physics of the constant current, and with both functional and structural derangements of the central nervous system, than is possessed by many who essay its use. If there is any one therapeutical process in the whole range of practical medicine that more than another defeats its own legitimate ends through careless and ill-directed or ignorant applications, it is this. As a matter of experiment, we submit a person in robust health, and with no marked nervous susceptibility, to central galvanization. If the current is gradually increased, and as gradually decreased, no unpleasant sensations are perceived, although ten, fifteen, or even twenty ordinary cells may be included in the circuit. The metallic taste is decided, the head experiences a sensation of fulness, and if the experiment be prolonged or the electrodes small, itching and heat will be experienced at either pole, and on the head, the seat of the anode, a slight pain of a dull, aching character may possibly be felt. A second person of increased nervous susceptibility will experience an exaggeration of all these phenomena, and subsequently may suffer from severe headache. Because of the symmetrical influence which the galvanic current by the method of central galvanization exerts on the brain, little if any dizziness is perceived, by even the most sensitive patients; if, however, the current be passed transversely through the head, the so-called falsification

of the muscular sense that results through an unsymmetrical stimulation is the occasion of immediate and intense vertigo.

In thus transversely galvanizing the brain, the hemispheres are differently affected, and the result is a disturbance of the equilibrium. This dizziness, as a rule, passes off immediately on the removal of the electrodes, in healthful conditions, and is attended by no harmful results. In certain pathological conditions, however, and signally so when such conditions are associated with those peculiarly impressible nervous organizations that are so familiar, transverse galvanization of the brain is a highly culpable procedure. Let it be clearly understood then, that, as a rule, transverse galvanization of the brain should be avoided. If it were necessary, I might cite not a few suggestive cases, and not alone from my own experience, illustrative of the importance of this law; but it will perhaps suffice if I simply indicate a few guiding propositions. In the first place, there is a certain class of patients, that I just alluded to as being peculiarly impressible, who will in no degree be benefited by this form of application; on the contrary, if there is mental or physical derangement from any cause, such applications inevitably aggravate the existing disturbance. I would that I might specifically designate this class to the tyro. In most instances there is no outward indication of any such susceptibility, and very frequently the most careful examination will fail to elicit a suspicion of any unusual relation of the nervous system to electrical stimulation.

It is only when you come to subject them to the test of actual treatment that idiosyncrasies are manifested

that would not be distinctly revealed by any other method.

In two exceptional cases, for example, a current of comparatively feeble tension caused an astonishing aggravation of functions of all the nerves of special sense.

If the statements of the patients may be trusted, the cerebral commotion during the applications was excessive.

Sight, smell, taste, and hearing were all perverted and exalted, and that these evidences of excitation were not the result of fancy, I thoroughly satisfied myself by unerring tests. In these cases, as in a number of others that enter as factors into the experience that guides these observations, the after-effects were only less unpleasant than the primary, and were disagreeably persistent. Now observe the effects of applications by the method of central galvanization in the same patients. The same tension of current caused a decided metallic taste (but no vertigo and no ringing in the ears), with a slight feeling of fulness about the head, and a persistence in this form of treatment resulted in grateful relief. In consideration, therefore, of these facts, we should ever be watchful for these susceptible cases; and to avoid errors of judgment that might prove unfortunate, we should not presume even on the most extended experience, but should in the beginning pursue a tentative course. In the second place, we have in cerebral effusion and softening, and more especially in cerebral congestion, conditions that call for care, in any method of galvanizing the nerve-centres. In old apoplectic cases transverse galvanization of the head has often been used with no unpleasant results, but this certainly is no reason why

it should be thus used. There can be no doubt that it might in many instances prove exceedingly hazardous, and I have seen unmistakable evidence of the ill effects (in producing dizziness and nausea) of an injudicious application of localized faradization in the neighborhood of the base of the brain. It is in the consideration of the symptoms of cerebral congestion, however, that we see most clearly the importance of rightly selecting our methods of electrical treatment. To give any direction to the current, excepting a longitudinal one, by which I mean from the summit of the head downward, or from forehead to occiput, is, I believe, not only unphysiological, but, as well, contrary to the teachings of all extended and carefully guided experience.

In this connection, and especially with reference to central galvanization, an exceedingly important practical point arises concerning *polar influence* and *current direction*.

Is the position of the poles, or the direction of the current, the more important factor in the production of therapeutical and purely physiological effects?

It must be acknowledged that the contraction laws of Pflüger render it quite possible that in the electrical stimulation of a given nerve-piece, the polar influence has more to do with the resultant physiological effects than the direction of the current.

These laws are thus formulated: "The nerve is excited by the appearance of anelectrotonos and by the disappearance of catelectrotonos, but not by the appearance of catelectrotonos and the disappearance of anelectrotonos." More specifically, Pflüger's laws may be thus stated:

First. "The mildest currents applied to the nerve cause contraction only on closing the circuit independently of direction.

Second. "Currents of medium strength cause contraction both at closing and opening in both directions.

Third. "Strong descending currents cause contraction only at closing the circuit, while strong ascending currents cause it only at opening."

Although it is impossible to illustrate these laws by clinical experiments on patients, they can be readily verified on the fresh nerve of an animal. In experimenting on one's self or upon others, the strongest current that can be well borne produces the effect only that follows the application of a very mild current directly to the nerve; viz., contractions only on closing the circuit independently of direction.

The French school, and notably Legros and Onimus, deny the efficacy of polar influence in exciting physiological phenomena, ascribing them chiefly to current direction. They ascribe anelectrotonic effects to electrolytic action, and to the induction of currents of polarization. In support of Pflüger's laws, on which are based the theory of polar action, I refer to some interesting experiments by Dr. Mason, published under the title of "The Polar Action of Electricity in Physiology," in the *New York Medical Journal* of December, 1874.

Now in central galvanization proper we generally understand that the anode is above and the cathode below, and according to the theory that polar influence is the chief cause of physiological phenomena, this position of the poles in central galvanization would seem, on physiological grounds alone, to be chiefly in-

icated for the relief of symptoms of central origin. The teachings of experience at all events strongly confirm its propriety.

It is very certain that in many conditions, and especially in neuralgia and spinal irritation, therapeutic effects vary according to the position of the poles.

In central galvanization also, few facts are better established in my mind than that certain conditions, such as cerebral congestion and forms of hysteria, may be injured rather than benefited by what are termed ascending currents, but whether the ill effects are due to polar action or current direction, I am not prepared to say.

When we come to the consideration of general faradization, we enter upon one of the most, if not the most, important departments of electro-therapeutics.

General faradization is a term that has become somewhat familiar to the professional ear since we first introduced it eight years ago, but its rationale, its *modus operandi*, and the necessity of thoroughness in the details of its application, are illy appreciated.

When we reassert the idea enunciated at that time, that electricity is not only a stimulant but a tonic of great power, we do not refer to electricity *per se*, if the idea may be thus expressed, but to electricity used after the method of general faradization, which in its most thorough form demands that the whole body, nerves, muscles, and all organs of special function, be, so far as possible, brought under the influence of the current.

When, therefore, persons declare that they have tried electricity on many occasions, and have failed to perceive any tonic effect, the idea is immediately suggest-

ed, that the fault lies in the operator, and not in the agent or method employed. The successful employment of general faradization requires, of course, a certain amount of anatomical and physiological knowledge, but it is not for lack of this that so large a proportion fail to appreciate its power. The most thorough students of the principles of electro-physiology are frequently among those who are most deficient in the practical manipulating skill that comes only from long experience and patient labor. If it were possible, as it is not and never can be, to relegate the administration of general faradization to nurses and attendants, the method would undoubtedly soon come into very general use, and its remarkable therapeutic powers, especially as a tonic, be everywhere recognized. Dr. Vater, of University of Prague, has, in a series of articles in "The Wiener Medicinische Zeitung," borne abundant testimony to the wide and varied therapeutical effects of general faradization. Instead of subjecting the method to the test of theory alone, and then in his ignorance rejecting it, he has put it to the severer and more conclusive test of a patient and discriminating clinical investigation. He concludes that if the nervous system be thoroughly influenced, and the muscular tissues not too violently, but passively exercised, tonic effects may be pretty uniformly expected; that they are more readily observed in nervous organizations, and that they are as permanent as those following any other remedy.

Benedict, one of the most able and indefatigable of investigators, says that, "especially in insomnia, even of lunatics in migraine and general nervousness, he has observed the most beneficial results." In general gal-

vanization, substantially the same processes are to be followed out as in general faradization, substituting of course the galvanic for the faradic current. It is not often that this method (somewhat heroic certainly, if any considerable strength of current be used) is indicated in the treatment of disease. It produces effects too profound both reflexly and directly on the central and peripheral nervous system, to be tolerated in the majority of those conditions of nervous prostration that so readily amend under general faradization.

All who have had a wide practical experience in electro-therapeutics have undoubtedly on occasions found themselves surprised and in perplexity on account of the remarkable insusceptibility of certain cases to the influence of the ordinary methods of electrization.

Some years since, I observed in a patient suffering from disease of the supra-renal capsules, this insusceptibility to a marked degree.

In its relations to electricity, the nervous system seemed to be profoundly anæsthetic.

The patient was perceptibly strengthened by general faradization, although it was necessary to use enormous power to make any sensible impression upon him, but beyond a certain point of improvement these applications failed to be operative. The patient was then submitted to general galvanization. The usual effects of galvanization of the cervical portion of the cord and sympathetic, viz., metallic taste, increased flow of saliva, and involuntary contractions of the œsophagus, became manifest only under currents of considerable tension, and the power that the patient could bear without inconvenience far exceeded what

was obtainable from the thirty-six-cell apparatus that I had at hand.

A decided improvement was immediately manifest in the condition of the patient, and as his strength increased it became in due proportion more and more susceptible to the influence of the applications.



