Beard, (Geo. M.)

CERTAIN QUERIES IN ELECTRO-PHYSIOLOGY AND ELECTRO-THERAPEUTICS.[1]

BY

GEORGE M. BEARD, M. D.

---

1. *Is it possible to affect Diseases of the Skin by Central Galvanization alone, without making any Application to the Diseased Surface?*

This query I am now in a position to answer decidedly in the affirmative. My conclusion is based on experiments made during the past year, in a variety of cases of diseases of the skin, some of which I have had exceptionally good opportunities to study, not only during the treatment, but subsequently.

Central galvanization is a term that I have applied to a method of using the galvanic current, in which the negative pole is placed at the pit of the stomach, while the positive is passed over the head, neck, and spine, in such a way as to bring the cranial contents, the sympathetic, the spinal cord, in short, the entire central nervous system as well as the pneumogastric, under the direct influence of the current.[2] Among my experiments with central galvanization in diseases of the skin are the following:

[1] Extracted from a paper read before the Medical Section of the American Medical Association, May 8, 1872.

[2] I have previously described this method, in a general way, in the *New York Medical Record*, December 15th. The details of the applications will soon be published in the NEW YORK MEDICAL JOURNAL, when a comparison will be made between this and the ordinary method of using electricity, localized electrization, and general faradization.

In the Long Island College Hospital, a very remarkable case of chronic eczema of the leg in a woman of middle life, of a most obstinate character, that had resisted all forms of treatment *for eight years*, was immediately relieved of the symptoms of distress and irritation by two applications of central galvanization, and in less than *a week* the appearance of the leg was greatly altered for the better. The disease had involved the whole surface of the leg below the knee, and was especially severe at the ankle, so that the patient could not bring her foot to the ground, and was helped about the ward with great difficulty. In six weeks the leg was nearly well, and the patient was able to go several blocks. In three months the portion of skin that had been diseased had become smooth, except one small spot at the outer ankle. By June 25th, the patient was entirely well, and was discharged from the hospital.

A boy of eleven years of age, who for six years had suffered from general prurigo, with severe itching and pain, especially at night, was immediately benefited by central galvanization, and in *eight* weeks' application was nearly cured.

Both of the above cases were presented, at the different stages of their progress under treatment, before the medical class of the Long Island College Hospital.

A child, that was covered by patches of eczema over a large part of the body, was cured in two weeks by central galvanization.

Another case of general prurigo, in a woman of middle life, improved slowly, but yet decidedly, under the same treatment.

Two cases of acne, of very long standing, have improved appreciably, under central galvanization, after the usual remedies have failed. One of them was a young man whom I was treating for epilepsy. His back was covered with acne, and also the face, arms, and forehead. Central galvanization was used for the epilepsy, for three months, on the average about twice a week. At the end of that time, although the epileptic attacks were not entirely dispelled, the acne was so far benefited that the back was almost entirely smooth, and only a very fews spots remained on other parts of the body. The other case, where acne has been the only symptom, is now de-

cidedly improving under central galvanization, and is still under treatment.

A case of syphilitic eczema of the hands and feet, of long standing, was relieved and nearly cured by central galvanization, and then relapsed, and was again successfully treated by the same method. I may here remark that relapses of inveterate affections are possible, after this method of treatment, as after any other method; but it would seem that electrical treatment thus directed to the nerve-centres would achieve a more permanent cure than electrical treatment directed to the periphery alone.

A case under care of my assistant, Dr. Sterling, of obstinate and very long standing, lichen of the lower limbs, attended with severe itching, was somewhat benefited by *local galvanization* of the diseased surface, but relapsed, and did not on the second trial yield to the same treatment. *Central galvanization* relieved the itching at once, and after three applications the improvement was so great that he discontinued treatment.

On the other side, it should be remarked, in a case of absolute and painful gastralgia, complicated with eczema of the anus, that was treated by central galvanization, the gastralgia yielded rapidly and permanently, but the eczema constantly *grew worse*, and about in proportion to the improvement in the gastralgia.

The subject is not yet wholly worked up, and many questions will arise concerning it that I am unable to answer; but if the future shall confirm the experience of the past in this matter, if other observers shall obtain the same results that we are continually obtaining in the dispensary, the discovery will be of inestimable value.

It will be of value to the dermatologist and to all who seek to relieve some of the most obstinate maladies of the race. It will be of value to the pathologist, who will here find an additional argument in favor of the theory that the centre of disease as well as the centre of life is in the nerves.

Finally, it will be of value to us, as explaining, in a most interesting way, the beneficial action of certain remedies, as arsenic, phosphorus, cod-liver oil, etc., in diseases of the skin.

2. *To what extent is it possible to affect the Cervical Sympathetic by External Electrization?*

Concerning the power of electricity to affect the sympathetic, and through the sympathetic to modify the circulation, there has been not a little difference of opinion among electro-therapeutists.

Two years ago I instituted careful experiments, with the coöperation of some of the leading ophthalmologists of New York, to see what effect galvanizing and faradizing the neck (placing the electrodes in such a position that the current in passing from one to the other must traverse the cervical ganglia of the sympathetic) would have on the retinal circulation.

These experiments, which have been since frequently repeated with different individuals, with different strengths of current and with different batteries, seem to me to demonstrate the following propositions:[1]

1. Galvanizing or faradizing the region of the cervical sympathetic has a marked temporary influence over the retinal circulation. It may cause contraction of the arteries, or dilatation of the veins.

2. The faradic current produces precisely the same effects on the retinal circulation as the galvanic, only more slowly. The physiological difference between the current in this respect is therefore a difference of degree and not of kind.

3. Mild currents and short applications caused contraction of the blood-vessel of the retina, while strong currents and long applications caused dilatation. Much seemed to depend *on the temperament and condition* of the individual. *What would cause contraction in one would in the other cause dilatation.*[2] These varying effects correspond with clinical experience.

4. When the patient on whom the experiment is made is in an excited or irritable condition from any cause, or from pre-

[1] The ophthalmologists who observed the retina in these experiments were Drs. Roosa, Hackley, Loring, Matthewson, and Newton, to all of whom I desire to return my acknowledgments.

[2] The opposite and contradictory results obtained by different observers who have studied the effects of chloral, bromide of potassium, etc., on the retinal circulation, may be similarly explained.

vious electrization, even a mild current will sometimes cause dilatation at once, without any early contraction.

5. The contraction which takes place is sometimes followed, a few minutes after the close of the *séance*, by dilatation which is greater than normal.

6. The dilatation which takes place is sometimes followed by contraction after the close of the *séance*.

The question now arises, whether these changes in the retinal circulation were due to the effect of the current on the sympathetic or on the pneumogastric, or did they take place through the spinal cord or by reflex action.

This question is answered by comparing the result of these experiments with the result of experiments made by Duchenne and Prof. Ligeois, of Paris. These gentlemen laid bare the cervical sympathetic in a rabbit and electrized it with both currents in the same manner that I electrized the necks of the individuals on whom I experimented. The results on the circulation in the rabbit's ear were in every distinctive feature identical with the results on the retina when the galvanic current was passed through the neck of the living human subject.

The effects of galvanizing the cervical sympathetic—disposition to sleep, sweating, increased circulation in the extremities, etc.—seem to confirm these physiological observations.

While making all these concessions, I retract nothing I have elsewhere said of the method of using electricity by galvanizing the cervical sympathetic. It is a method that has been greatly overrated, and the effects it produces are a complex resultant of the direct and indirect action of the arrest on other parts of the person's system besides the sympathetic. Practically I find that *central galvanization* accomplishes all that galvanization of the cervical sympathetic will accomplish, and *very much more than the latter method could accomplish.*

The experiments of Onimus and Legros[1]—from which they conclude that the *faradic* current always *contracts*, and the *galvanic* always *dilates*, the blood-vessels—are unsatisfactory, for two reasons:

[1] "Traité d'Electricité Médicale," Paris, 1872, pp. 177–185.

1. They ignore the wide difference in degree between man and the lower animals. In proportion as the organization of man is more complex than that of the lower animals, in that proportion will the physiological reactions of the human body to the electric current, or indeed to any other influence, be more complex and uncertain, and more liable to deviations and modifications, than the physiological reactions of the inferior forms of life to which we are supposed to be related. Conclusions in electro-physiology, derived solely from experiments on animals, have therefore the great merit of simplicity, but when applied to the far higher and more complex organization of man, and especially of civilized man, with his excessively-sensitive system of nerves, they are apt to lead into serious error. Granted that the differential effects of the galvanic and faradic currents on the sympathetic of animals are precisely what has been claimed by Onimus and Legros, it by no means follows that the same is true of the susceptible nervous system of human beings.

2. They do not attach sufficient importance to the strength of the current in making electro-physiological researches. A current from a powerful battery of say thirty cells may produce an effect to all appearance entirely opposite from that produced by a current from a weak battery of five or ten cells. This consideration is of very great importance in electro-therapeutics, and is probably not much less so in electro-physiology.

3. *Is it possible to improve the General Nutrition of Marasmic and Debilitated Children by General Faradization?*

This query can now be answered definitely in the affirmative. I am accustomed to apply the faradic current all over children and very young babies, in all cases where lack of appetite or strength, or flabbiness of muscle, or emaciation, or simple nervous irritability, indicates a chronically depraved nutrition of the general system.

I make these applications with currents as strong as can be borne without apparent pain for about two minutes. It is a fact of great interest that children bear electricity relatively

very much better than adults. With many adults of both sexes electrization must be administered with caution and with studious care not to overdo the treatment; with children this caution appears to be less requisite. All other medicines are adapted to the age of the patient; to a babe of one year we give one-twelfth, to a child of seven years one-half of the adult's dose. Electricity does not need to be so adapted. Unpleasant effects of a temporary character may be caused by such undue stimulation, but the danger is, I believe, less than in the treatment of adults, at least when the faradic current is used.

I attempt no explanation of this fact. We know that the nervous system of children is different from the nervous system of maturity; that it is less liable to neuralgia, to hysteria, hypochondriasis, and insanity, and it may be that, between this fact of comparative exemption from the nervous condition of which these diseases are symptoms and the fact of the greater capacity for bearing electricity, there is a kind of correlation which future science will unfold.

I have sometimes suspected that perhaps children might, after all, experience equally with adults the annoying secondary effects of over-electrization; that the *malaise*, the nervousness, the exaggeration of general morbid symptoms, are really experienced by children when they receive more electrical treatment than is good for them, but that their defective intelligence does not allow them to observe these unpleasant effects or to speak of them.

Certain it is that children, of both sexes, and of all ages between a few months and a few years, can be faradized; one pole armed with a broad sponge being applied to the coccyx, the other applied all over the surface of the trunk and limbs daily, or every other day, without any apparent harm, and with rapid, permanent and sometimes brilliant improvement in the nutrition.

More specifically, the infant thus treated exhibits greater liveliness and vigor, nurses with greater energy and enthusiasm, grows more rapidly, and assumes a healthier color. Infants do not object to the treatment; some of them appear to like it as they like milk.

Of a litter of four puppies, two were submitted to general faradization, every other day, for eight minutes each, and two were not so treated, all having an equal chance at their mother's breast and nothing besides. All the puppies were carefully weighed at the beginning and at the end of the treatment, which lasted for four weeks. It was found that both of the pups that had been electrized weighed more than the puppies that had not been electrized; all had, of course, increased in weight, but of those electrized one had increased *five* ounces and the other *eleven* ounces more than his fellows that had not been electrized. The difference of size in favor of the puppies that were electrized was so marked and so easy to see, that without great difficulty one who had never seen them succeeded in picking out, from ocular inspection, those that had been treated, and that too in the evening, and in a bad gas-light. It was observed during the treatment that the puppies that were electrized became ravenous, and sucked with greater energy than their less favored companions.[1] That this result is exceedingly interesting and suggestive, all will agree, and yet it is nothing more than I have frequently obtained in the treatment of patients, even of adults. I have frequently treated babies from six weeks old and upward, in the same manner as these pups were treated, and for the same purpose.

The method of treating the pups, I may remark, was to put them on a sheet of copper, while the hand of the operator or a sponge-electrode was rubbed all over the surface of the body, previously moistened.

I am now making a similar experiment with a litter of rabbits.

4. *Are there certain Constitutions for which Electricity in any Form, or however administered, is contraindicated?*

This question must also be answered in the affirmative. There are individuals whom electricity always injures, the only difference in the effect on them between a mild and a severe application being, that the former injures less than the latter.

[1] The details of the application were entrusted to my assistant, Dr. Sterling.

There are patients upon whom all electro-therapeutical skill and experience are wasted; their temperaments are not *en rapport* with this mysterious force which we call electricity.

It matters not what may be the special disease or symptoms of disease from which they suffer—paralysis, or neuralgia, or neurasthenia, or hysteria, or affections of special organs —the immediate and the permanent effects of galvanization or faradization, general or localized, are evil and only evil. I have not arrived at this opinion by theorizing; I have been driven to it by the accumulating and irresistible logic of facts. The first query that arises in the mind of the electro-therapeutist when a case under his care responds badly is, "Am I rightly using this remedy; am I making the application too long or too severe, or by improper methods? Would a change of current be desirable?" But after we have tried all electrical applications; after we have gone from galvanism to faradism, from general to localized electrization, from long and severe to short and gentle treatment; after we have rung the changes on all these, and yet persistently aggravate rather than mollify the disease, and instead of strength and relief produce weakness and distress, and instead of calmness cause irritation—then we have only to make as graceful a retreat as possible, and put that patient down as a case that was not born to be treated by electricity. I have no explanation to offer of this phenomenon; and the popular belief or supposition, that the excess or deficiency of animal electricity has something to do with these matters, is as undemonstrable as it is plausible; he who should attempt to prove or disprove it would find he had undertaken any thing but an easy task. It would seem to come in the list of those strange but familiar likes and dislikes in regard to certain articles of food or drink, or to certain sights or odors. I know of no physiognomical or other external appearances by which to determine whether a patient does or does not belong to the unfortunate few who can have no lot or share in electro-therapeutics. The strongest equally with the weakest, the plethoric and the enervated, are found among these Gentiles of science.

The reverse proposition, that there are certain constitutions for which, by whatever form of chronic disease they may be

afflicted, electricity is always indicated, is equally true. There are patients who find in electrical treatment almost a specific. Whether they suffer from dyspepsia or neurasthenia, from hysteria or diseases of special organs, rheumatism or neuralgia, electrization always relieves them up to a certain point, at least, if it does not positively cure. *The broad fact to be understood is, that it is not so much the disease or the symptoms as the temperament that indicates or contraindicates electrization.*

While some chronic diseases are more amenable to electricity than others, among all patients there are individuals to whom it is a matter of indifference what special affection they may suffer from; so long as improvement in local or general nutrition is indicated, they will be benefited by electrical treatment.

To all this it should be added that some persons are *indifferent* to electricity—they can bear almost any strength of either current very frequently, and for long applications, without experiencing any effect either good or evil. Electricity may be poured over them in limitless measure; they may be saturated with it, and they may come out from the applications, or from a long course of treatment, just as they were before, not a whit better or worse. Patients who are quite delicate and sensitive exhibit this supreme and provoking indifference to electricity. I am inclined to believe also that patients vary in *their susceptibility to electricity at different times of life.* Susceptibility to stimulants and narcotics oftentimes undergoes strange modifications during the lifetime of an individual. Those who at one time cannot drink coffee sometimes find that a few years so modify the temperament that they can drink it with absolute freedom, and *vice versa.* Similarly, also, alcoholic liquors act in a most capricious way, sometimes benefiting, at other times injuring even when nearly all the other conditions except age are the same. Idiosyncrasies in regard to certain articles of food are by no means constant through life—they may change either way, and that too in the course of a few years; they may be modified by attached febrile or other diseases that revolutionize the system, or by residence in various climates, or by mere lapse of years. Analogy would

lead us to suppose that susceptibility to electricity might also be thus modified, and my observations seem to convince me that such is the case.

I am further inclined to believe that susceptibility to electricity, favorable and unfavorable, like all other constitutional tendencies, is subject to the laws of hereditary descent, and runs in families. I am now treating by electricity three members of the family of a physician, who are afflicted with quite diverse maladies, but all of whom not only improve under the treatment, but can be electrified with great freedom by either current; and yet none of them are strong, and two of them are delicate.

On the other hand, I have treated families where several of the members are so susceptible to the electric current that the application must be made with great care lest unpleasant results occur. I am fully convinced also that the proportion of those who do *not* bear electricity well is larger among the higher than among the lower classes; in hospital and dispensary practice the number of patients who exhibit excessive susceptibility to the electric treatment is quite limited, whereas in private practice, among the intellectual classes, one out of five or ten, take the cases as they run, must be treated with very considerable caution, lest disagreeable symptoms arise.

5. *Have the Slow Interruptions of the Faradic Current any Therapeutical Advantage over the Rapid Interruptions of the same Current, or over the Slow Interruptions of the Galvanic Current?*

In this matter there has been too little of fresh, independent observation, and too much of blind and absurd deference to European authority. If a muscle will not contract under a rapidly-interrupting faradic or slowly-interrupting galvanic current, it will not contract under a faradic current, however slowly interrupted. The slow interruptions are not, according to my experience, any less irritating than the rapid interruptions. I have tested them side by side with rapid interruptions, in cases of facial paralysis, hemiplegia, and infantile paralysis, for the sole purpose of ascertaining the truth in this matter, and I do not find any therapeutic advantage in favor

of the slow interruptions. It may be that in Duchenne's machine such a difference of therapeutic action is observable; but those who use a machine which, like Kidder's, gives a very rapidly-interrupted and pleasant current, will find that the reputed advantages of a slow interruption have been overrated. I have compared slow with rapid interruptions in the machine of the Galvano-Faradic Manufacturing Company, which is an excellent contrivance for producing slow interruptions, and I have not been able to differentiate any advantage that it has over the galvanic current, or over the rapid interruption of the same machine.

The practical difference between the *primary* and *secondary* faradic currents has also been over-estimated. Granting all that Duchenne claims in regard to the differential *physiological* action of the currents of the primary and secondary coil, that the primary acts more powerfully on the deeper tissues, and the secondary on the skin, and so forth, still we are forced to admit that the practical therapeutic difference in the action of the currents is not so demonstrable, and that, whatever difference there may be, cannot well be reduced to a general law.

Electro-physiology is one science, electro-therapeutics is another. Electro-physiology answers only to explain, to fortify, and to elucidate, and in some respects to guide electro-therapeutics; but, in the present state of either science, it cannot be a complete basis for electro-therapeutics, and theoretical deductions from the former to the latter cannot be accepted until they have stood the test of experience.

Similarly, also, in Kidder's machine, in which the helix is composed of three coils of wire of different length and thickness connected together, and, so to speak, *tapped*, at different points there is a decided difference in the electro-physiological action of the different currents A–B, A–C, A–D, B–C, C–D, and B–S; but the practical difference between these currents in the treatment of disease, so far as Dr. Rockwell and myself can ascertain from long use of the machine, can mostly be explained by the differences of intensity. To the head and very sensitive parts we use the A–B current, because it is

mild and pleasant; to the body generally, we use A–D and A–C.

There may be an important therapeutical difference in the action of these currents besides that of simple intensity, but, on account of the vast complications of the subject, it seems impossible to reduce it to a general law.