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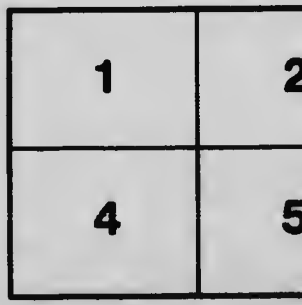
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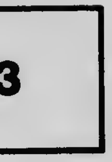

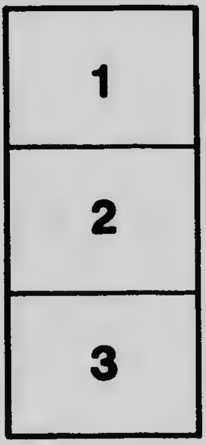

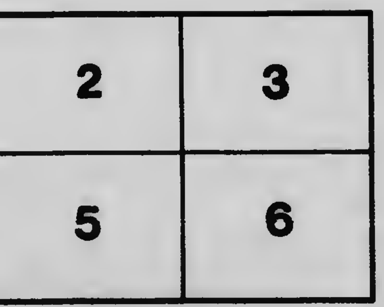

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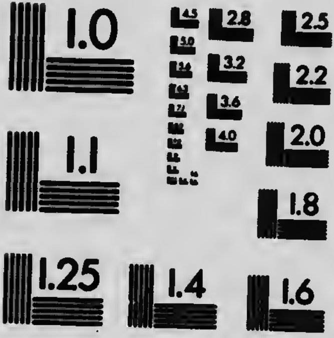

FROM THE TRANSACTIONS OF THE ROYAL SOCIETY OF CANADA

THIRD SERIES—1907-1908

VOLUME I SECTION IV

The Influence of [illegible] on the Nerve Centres

BY SIR JAMES GRANT, K.C.M.G., F.R.C.P.

OTTAWA
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With compliments of the author

I.—*The Influence of Electrolysis on the Nerve Centres.*

By Sir James Grant, K.C.M.G., F.R.C.P.

Consulting Physician, General Hospital and St. Luke's, Ottawa, Canada.

(Read May 14, 1907.)

In 1854, when a student at McGill University, my attention was directed to the marvellous operations of the nervous system, since which time I devoted spare hours to the problems of this intricate structure. Tear and wear are the result of both mental and physical strain, at no time more marked than in the present century. For many years I applied electricity in the ordinary way, frequently with beneficial results, without knowing exactly the why or the wherefore.

The power of the galvanic current to decompose water was discovered, the first described by Nicholson and Carlisle in 1800. In 1806 Sir Humphrey Davy presented to the Royal Society a lecture on some chemical agencies of electricity, and the following year announced the discovery of the decomposition of the fixed alkalies. The phenomena of electrolysis are due to a modification, by the current, of the chemical affinity of the particles through which the current passes, causing them to undergo decomposition and recomposition. In the electrolysis of inorganic substances, it cannot be expected to solve the mysteries of life and disease. As the body is largely composed of water, holding in solution salts of potash and soda, it thus becomes an excellent electrolyte. The current of a dry battery transmitted by an ordinary neurotone, is the simplest and most efficient method of electrical application. The umbilicus may be considered the storm centre, as far as collateral influence on the sympathetic system is concerned, as here the solar plexus approaches nearest the surface through its many *filaments*, which in turn accompany all the branches given off the abdominal aorta. It also interlaces with the nerve fibres of the phrenic plexuses, gastric, hepatic, and splenic plexuses, supro-renal plexuses, renal plexuses, superior mesenteric plexus, spermatic plexuses, and inferior mesenteric plexuses. Although according to Bastion a wide basis of positive knowledge does not exist, it is accepted that the sympathetic system of nerves, with its double gangleonated cord and great gangleonic plexuses, is to a certain extent an independent nervous system, penetrating deeply by its roots

into the cerebro-spinal axis. Its fibres are conducted to and from the viscera, along the course of the blood vessels. The peripheral ganglia are dominated by a still higher regulating centre, situated in the medulla oblongata, in relation with all the vaso-motor nerves throughout the system. Although the nature of its relations, with the medullary centre, are still uncertain, the fact that the fibres of the sympathetic, are mixed up on the vessels, with those having a vaso-motor function, and has to do with the calibre of the blood vessels generally; with the activity of all the glandular organs; with the movements of all the hollow viscera, and with the nutrition of the tissues generally, places the sympathetic system in the front, as a central motive power. These are the circumstances which count, in the operations of the system. When the tear and wear, can be so changed, by electrolytic action, as to afford, the freer transmission of normal nerve force, the constitutional changes for the better, become most marked.

"There is a great probability that a nervous impulse may be a change propagated by electrical agency, and even in its essential nature an electrical phenomenon, a travelling and temporary dislocation of pre-existing discrete particles, and not a travelling process producing new and differently gifted particles from the old." It is as solutions of electrolytes confined to minute cylinders, that nerve fibres have a most important interest, and yet the characters of these solutions, are beyond the reach of methods of ordinary chemical investigation. In the transmission of the electric current, it is well to be aware of the remarkable discovery of Du Bois Raymond, that the whole longitudinal nerve fibre, is probably equally positive, and the whole transverse surface, uniformly negative. In order to intensify the conduction of the electric current, moisture is not only necessary externally, but is well provided for internally, as the nerve fibre is, throughout, a moist conductor. Nerve fibres are in fact only finely drawn processes of cells containing inorganic salts within them, and the electrical conductivity, is provided by the electrotonic currents, and by their distribution. The axis cylinder of the nerve fibre, is a better conductor than the tissues which ensheath the fibre, and more electricity in fact, is carried or conveyed along the axis cylinders, than is at the same time carried, by the other tissues of the nerve. The electrical phenomena of nerve depend entirely on the inorganic salts which it contains, and from recent investigations, the nerve trunk has three kinds of conducting material; an external medium of poor conductivity, a dividing membrane, and an internal solution of conductivity, of a higher order than that of the external solution.

Recent investigations as to the physical conditions present within the nerve fibre, in the axis-cylinder, have pointed out the existence of a remarkable condition of protid material, in a state of colloid solution, in some way a possible store of potential energy. In this direction the potassium ring of McCallum, surrounding granules within the nerve fibre, is most interesting and important, in relationship with solid colloid masses, in aqueous solutions of salts. Such electrolytes, even by a limited degree of motion, tend to diminish the usefulness of an electrical current, transmitted through the colloid solution. A single fact which dominates all, is that, nerve is a material adapted for the transmission of energy, from point to point, throughout the entire system, resting upon the undoubted presence of inorganic salts, as permanent constituents of the axis-cylinder.

In no part of the human system are the irregularities of life more marked, than in the alimentary canal, where the defences of the organism, permit the ingress of bacterial toxins. In this tract, the blood making process becomes interrupted, through the non-elimination of normal nerve power. Under such circumstances the perfectly stable nervous system is a rarity.

Here particularly electrolysis becomes an important factor, giving new life and activity, by establishing, beyond doubt, an average neuropsychic equilibrium.

The daily, in fact the hourly changes in the component parts of the human body, are mysterious and difficult to define, and no where more so, than in the nervous system, the centre of thought, intellectual power, and locomotion. My object in producing this paper is to sift a portion of the wheat from the chaff, and define a few of the limitations and possibilities of electricity. One point is certain; where damage to neurons or their nuclei, have cut muscle fibres off, from the normal source of stimulating energy, electricity is of little account, as far as maintaining muscular contractility is concerned. The reaction of degeneration, is characterised by loss of excitability in the nerves, and of the excitability to rapidly interrupted currents, in the muscles. The reaction of degeneration is of great moment, and when present, a lesion in some part of the nervous tract, is readily diagnosed. In such conditions, electrolysis is useless. In nerve degeneration, when the induced current fails to meet with any response, it is called, the reaction of degeneration. Weakened muscle cannot be strengthened by too strong a current, which must be avoided. So, also with weakened nerve tissue. The power of the current must be graduated in proportion to the strength of either muscle or nerve.

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