The Electro-Neural Pathology of Insanity. By A. H. Newth, M.D.

The macroscopical and the microscopical researches on the pathology of the brain, in insanity and other neuroses, though hitherto carried on with zest to an almost unlimited extent, have yet been devoid of any very definite trustworthy results. Nor is this to be wondered at when we consider that infinitesimal particles, acting on the nervous system, are capable of producing very decided effects. Thus, a distinct sensation of smell is produced by so small a quantity of odorous particles as to be practically immeasurable. Therefore, the wonder is, as Dr. Maudsley observes, that any morbid appearances should have been expected to be found in many cases of insanity.

But that there must be some physical causation for disturbed mental activity is beyond question; even if purely psychical causes are recognised in some cases. How else is it possible to explain the emotional or mental disturbances arising from purely organic effects, as affections of the liver, the heart, etc., and their immediate relief when treatment is successfully directed to these. So also the sudden accession of a fit of mania, and its sudden disappearance, the periodical relapses, the peculiar form the mania takes, in so many cases being evidently due to reflex activity, are all clearly dependent on some abnormal physical state, and only the most blinded, bigoted spiritualist could fail to see the fact.

While, however, this is pretty universally acknowledged by psychologists, there is still an almost total ignorance of how this physical disturbance is produced, and what it is. That it is not, at least, in some cases, due to histological changes in the nerve elements is proved by the fact that insanity may exist without any appreciable changes in the brain, and also that there may be extensive disorganisation of the brain without any affection of the mentality. But that something has taken place to cause the deranged neurosis is a certainty, and we can be as sure of this something being a physical factor as we can that the storm of wind, which arises, we know not how, and goes, we know not whither, is due to physical forces. And as we have the assurance of the possibility that the order and nature of these storms will be some day clearly explained, so we may feel sure that in time the mental and motor storms which rage in individuals will

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have their cause and order also fully explained. This will not be, however, till observers learn to turn from the post-effects to the antecedent operations. Meteorologists were at a standstill as regards practical results, so long as they contented themselves with merely examining and recording what had been, and did not endeavour to trace the causes leading up to these results. So alienists will never progress in their advancement towards a perfect study of mental disease, while they simply describe lesions which are, probably, the result of the disordered neuroses. In order to understand nervous function, either in its healthy or its diseased state, the condition, previous to its activity, either normal or abnormal, and also the condition during this activity have to be most minutely studied by means which have yet to be discovered. This, as Dr. Maudsley says, is the destined field, therefore, of future discoveries.

Nervous activity is not affected by permanent and appreciable changes in the nervous structure, it is, as electricity is, a form of energy. And it would be as reasonable to seek for alterations in the mechanical apparatus of the telegraph or telephone, when some unwonted disturbance has been observed by the erratic movements of the one, or the incoherent sounds of the other, as to try to find a pathologico-anatomical effect in all cases of disordered nerve function, as in insanity. Lesions certainly do exist in some cases to produce abnormal activity, or to suppress all or partial activity, just as mechanical disarrangement of the needle, the battery, or other parts, will interfere with the working of the telegraph or telephone.

If, then, there are no decided lesions to mark disordered nerve action, to what physical condition is this disorder due? This we have yet to seek, but it is without doubt due to some change in the static or dynamic arrangement of the molecular elements concerned in the dovelopment of nerve energy. And it is in this direction that neuro-pathologists should direct their attention, and possibly by the use of delicate galvanometers, or other kinds of electrometers, of which the necessary form and application have yet to be discovered, it may eventually be possible to arrive at some definite idea of the pathology of disordered nerve action and insanity.

For it has been almost positively shown that nerve force is correlated, if not identical with electricity, the experiments of Pflüger, Du Bois Reymond, Matteucci, and others, seem

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pretty nearly conclusive on this point. Granting this, we may reason from analogy that, as the electro-motor force of conductors may be altered, either in intensity or effects, by external circumstances, so the neural force may be changed by some variation in the surroundings of the nerves, without any material alteration taking place either in the central or peripheral termination of the nerves, except, perhaps, such as might arise from the effects of the disordered nerve action.

It has been suggested, and with great probability, that the electro-motor and electro-sensorial nerve molecules are arranged in a peri- (or di-) polar series, which touch each other by their positive poles. This state, corresponding to the "open" condition of an electric battery, is easily influenced by surrounding circumstances, which act either continuously or temporarily and cause either a permanent or temporary or an intermittent disarrangement of the nerve molecules. The effect of these extraneous influences may be to cause the nerve to act irregularly, by intermitting the current, to increase, decrease, or abolish its effects by induction, or even to reverse the current, so that a centrifugal is changed to a centripetal one, or *vice-versa*. If this is so, we may have, here, the germ of a fact which will explain many neuroses. Thus, if we take a motor nerve of the arm, for example, and imagine any of these effects produced in it, we shall have, with an intermitting current, a trembling of the limb, as in paralysis agitans, *delirium tremens*, etc. Neither of these diseases has any definite material lesion, so they both may arise from causes which may be considered as having an analogy with inductive processes. If there is an induced current so acting as to diminish the normal current, then effects, such as paralysis, or anæsthesia, are produced; if it acts so as to increase the nerve force, then such phenomenon as excessive motor activity or hyperæsthesia is the result, according as the action is on the motor or sensory nerves.

Thus, hydrophobia may be a disease which is dependent on induced neural activity, though the cause of this induction has yet to be found. So also epilepsy, and here we may, probably, be able, at least, to imagine a condition in which the electro-motor force that manifests itself in the peculiar convulsions has been gradually accumulating during the remissions, either around the efferent nerves, or at some other part. This accumulation increases, until, at length, it reaches a state when it can no longer remain quiescent,

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but, bursting as it were through the barriers which bound it, gives place to convulsions by violently affecting the nerves of the muscles which come within its influence; it may also be started into action by some exciting cause. If this is correct, it may serve to explain why remedies which check the fits for a time frequently cause them to be much more violent when they occur, the induced nerve force having accumulated during the intervals to an increased extent. So also hysteria, chorea, hysterico-chorea, and other analogous affections, where there is no lesion to account for the symptoms, are possibly due to nervous induction.

Now these effects are not only probably the result of an induced electric state, dependent on changes in the surroundings of the nerve, but they may also be caused by whatever increases the nerve force, without proper opportunity for it to expend itself in a normal manner, Thus, some sudden shock to the nervous system, as hearing affecting news, causes startings of the limbs, and may frequently originate epilepsy, chorea, or other nervous affections. This may be explained by the fact that the volitional power has sent, by whatever means it uses to do so, a larger supply of nerve force along certain nerves than they can use up, either by motor effects, or otherwise (the motor effects being, of course, spasmodic movements), a residuum is left, which has a tendency to increase and relieve itself periodically.

If we now pass from the consideration of nerve force expending itself in muscular action, to nerve force acting mentally, we may arrive at the same analogous results. The formation of an idea has as much connection with nerve action as the motion of a muscle. If, then, we can understand that the nerves supplying ideas are influenced in the same way as motor nerves are, that is, as we have supposed, by induction, we may readily comprehend how this induced action will occasion perverted ideas. In this way all the strange delusions of the maniac may readily be accounted for. It will also explain how it is that a maniac, during his periods of excitement, when not only his ideas are in a morbid state of activity, but also his whole muscular system is violently contorted, or otherwise acting strongly is so powerful that it requires several able-bodied men to restrain him. He must have some addition to his nerve-force, for, in his ordinary state, he could not will to exert such strength. This addition is the super-added nerve force, received from induced or other effects.

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It is not improbable also that, working with this idea, we may explain some of the peculiarities of insanity, such, for instance, as *general paralysis of the insane.* This disease is pretty generally characterised by a wasting of the nerve fibres, not that this wasting is peculiar to this disease, for it is also seen in *sclerosis*, etc., but it is certainly an accompaniment of it, whether as a cause or effect is undetermined; but, so constant is it, as a section of any large nerve will show, that it is a question whether we may not regard *general paralysis*, or *paresis*, or *progressive paralysis*, as really dependent on this atrophic state, or, at least, so associated with it as to be, with other effects, pathognomonic of it. Then, would it not be better to discard the old, inconvenient, confusing terms, and apply the name to it of *Progressive Nerve Atrophy?* This would correspond to progressive muscular atrophy, a disease with which it has many correlative symptoms. It may be objected to as introducing a new term, when the old has become recognised, but this conservatism is not well. Medical and scientific terms can never be too correct, for if they are not supported by pathology, or do not express correct ideas of those things for which they stand, they obscure the study of the facts. For men's minds are so prone to association of ideas, that an incorrectly termed scientific fact or disease is almost certain to be connected with erroneous ideas of that disease, associated with the incorrect terms.

The peculiar ideas of strength and grandeur, which are so prominent a feature in general paralysis, may be due to this nerve atrophy; and they may be explained in this way: the nerves being atrophied, and the nerve-producing force, whatever that is, being still in activity, there must necessarily on every effort of the will to produce nerve action, be a much larger amount of nerve force sent along the nerve than its atrophied state can convey, that is, supposing the same quantity to be sent as if the nerve were not wasted. The nerve force, which we will suppose has been sent to act on a muscle, has failed to produce action, or has only caused feeble action, not from any want of muscular power, for the muscles are generally well developed in this disease, but because there is not a sufficient nerve conductor to carry it. What, then, becomes of the excess of nerve force? It returns along the sentient nerve, and this, added to the usual recipient energy, conveys to the mind the idea of excessive power. Thus the idea of strength will be in proportion to the exertion to produce muscular activity, for the excess of nerve energy has

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been added to the received impression of muscular activity increasing that idea. Thus, if the idea of strength is suggested to the paralytic, he at once imagines he is gifted with almost superhuman power. In the same way the ideas of grandeur may be explained, the recipient ideational nerves conveying a much stronger impression than is usual. These enlarged ideas are started into activity by associative or suggestive impulses—thus, give the idea of money, and the paralytic at once believes he is possessed of untold wealth. The convulsive and muscular tremors met with in this disease may also be due to the nervo-electric disturbance, by a storing up, as it were, of the electro-motor energy, and its sudden and irregular action.

Nerve action, as manifested by muscular contractions and other effects, is not necessarily dependent on a proportional amount of vigour in the individual. It is so constantly noticed in certain forms of insanity associated with general weakness, that there are an unwonted muscular activity, out of all proportion to the physical weakness, and a constant flow of perverted ideas. This neuro-pathologic activity is probably occasioned, not only by a super-added nerve force, but also by a change in the nerve molecules, so that a state of 'electrotonos' is established, probably cathelectrotonos in the centrifugal nerve, and anelectrotonos in the centripetal nerve. This change being brought about by some such influences as induce it in experimental investigations, probably the sympathetic nerves may, by abnormal activity, occasion an inductive activity by acting either directly on the nerves or through the blood. This idea of cathelectrotonos in the efferent and anelectrotonos in the afferent nerves may serve to explain the phenomenon so often seen in the insane, namely, great muscular activity, with diminished sensation.

It is so characteristic of the insane that, while frequently capable of great exertions, they are incapable of feeling pain, for they fall about and injure themselves in a way that would be most serious to a sane man, yet they seem almost unconscious of the fact. If a state of excited action is produced at the muscular termination of a nerve, and a diminished activity at the central part, then this phenomenon is easily accounted for. In the same way it will easily be understood that delusions of sight, hearing, etc., may be occasioned by this neuro-pathologic activity.

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It is not to be supposed, however, that this will explain all cases of insanity or of perverted nerve action; there must necessarily be many which are entirely dependent on nerve lesion, chiefly, perhaps, in the central organs, while others are due to disorders of circulation. In studying insanity, as, indeed, most cases of disease, we have to take into consideration not one factor alone, and work out all ideas of disorder from this factor, but to consider many factors, which are capable of producing the same effects.

It will at once occur to many that if some cases of disordered mental action are due to abnormal electro-neural states, we may have a powerful remedy in the electric battery. And this is no doubt so, the value of which has yet to be appreciated, by a careful study of suitable diseases and modes of application. In fact, the success that has attended its use in many cases has been most marked. It is needless to say, however, that this is a remedy which can only be used in the early stages of disease: when tissue changes have set in and permanent nerve lesions have been formed, it is almost hopeless to anticipate any benefit. In the same way the use of metallic applications are likely to be beneficial, by affecting the electric-neural state.

These crude ideas may probably be received with a smile of incredulity by some, and by others, perhaps, with contempt, at the author's vain attempts to explain that which is so difficult of explanation. He does not, however, pretend to have settled the ideas which he suggests, he only offers them as a sort of rough finger-post, pointing in a direction which he thinks has been too much neglected, and he believes that a more extended study of neuro-pathology will lead to results which may prove of vast and permanent good. If it does not introduce a better form of treatment, it may be useful in diagnosis, for instance, serving to distinguish curable forms, as syphilitic insanity, from other forms which are incurable.

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