

to many other diseases, and the modern science of preventive medicine is based largely on this knowledge. May we not hope that some day the knowledge of such differences as I have noticed may lead to the discovery of their causes? Through careful observation of, and comparison between, the hygienic conditions and prevailing occupations of different places, and of the moral and social habits of the people, the causes of the varying liability to insanity in particular districts may be discovered, and of the various forms which it assumes, as well as the laws which govern its spread and increase. Thus would be laid the foundations of a noble branch of preventive medicine which would have for its object not only to check the ravages of that social scourge, insanity, but to help people to develop their moral, as well as their physical nature, in accordance with the laws of health and the facts of physiology.

On the Physiology of General Paralysis of the Insane and of Epilepsy.—By GEORGE THOMPSON, L.R.C.P. Lond.;
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(Continued from page 586, Vol. xx.)

In the introductory remarks contained in the previous portion of this essay, I said that, as far as possible, I would refrain from referring to the condition of the nervous centres as seen after death, except to explain the nature of certain phenomena seen in these diseases during life. Having arrived at the second portion of my subject, I shall draw attention to the condition of the brain and spinal cord where death has been the result of an epileptic fit, or while the patient has been in what is now so well understood as the *Status Epilepticus*.

But I shall first take a cursory glance at the healthy brain, its structure and functions.

The brain is an erectile organ—in other words, an organ whose functions require that it should be capable of receiving a varying amount of blood. This variation of blood flow is not necessarily general at any given time, but, according to the function to be performed, may be local. It is fair to presume that there are times when the portion of the brain to which is assigned the function of intelligential secretion will be called into active play, while those portions to which

we connect the functions of sense and motion may be at rest. At these times of activity of function, then, whether local or general, a rapid flow of blood is essential. In health the blood vessels are highly distensile, and this distensibility is of a vital, rather than a mechanical character. The superabundant muscular tissue which they possess, with a corresponding absence of the other constituents of the muscular walls, allows for the vital character of dilatation and contraction of the cerebro-spinal vessels. The gelatinous nature of the reticular tissue allows the relative displacement of the all-important nerve-cells; while the variable amount of cerebro-spinal fluid allows of expansion of the cerebral mass without compression as the result. The conditions essential to a due performance of the functions of the brain are, then, healthy brain tissue, *i.e.*, cells and fibres; healthy neuroglia, or reticular tissue; healthy vessels—vessels capable of receiving and acting on the command to dilate or to contract, whatever may be the source of such command; and healthy coverings capable of secreting or absorbing the cerebro-spinal fluid, according to the needs for such secretion or absorption. Given all these conditions, and the Medico-Psychologist would find his occupation gone.

In the disease now under discussion (*i.e.*, epilepsy) it has been proved beyond doubt that at least one of these elements of the brain structure is invariably at fault. This faulty portion is the neuroglia. Dr. Batty Tuke, in the small, but able, portion furnished by him in the "Manual" by Drs. Bucknill and Hack Tuke, shews* how the neuroglia is the subject of no less than five distinct forms of degeneration. These are (*a*) general sclerosis, (*b*) disseminated sclerosis, (*c*) atrophy, (*d*) miliary sclerosis, (*e*) colloid degeneration. At least three of these degenerations—the first, second, and fourth—have been found in epileptic subjects; the others occurring thus:—Atrophy in senile dementia, and the colloid form in "chronic cases." The coarser anatomy of brains of epileptics generally shews hypertrophy, real as to volume, but false as to the actual proportion of nerve tissue; in other words, there is "just† the ordinary amount of nervous matter, *plus* a certain quantity of interstitial exudation." The sclerosis of epileptic brains is every day seen. Who has not, in slicing down such a brain, felt the hard resilient touch given to the knife, almost amounting to the sensation given in cutting

* *Op. Cit.*, fol. 625.

† Handfield Jones, quoted in "Bucknill and Tuke."

down a half-boiled potato? The hypertrophy is shewn by the manner in which the brain of the genuine epileptic is seen to fill the cranial cavity. The brain bursts from the dura mater when that membrane is divided; and the sulci on the surface of the organ are reduced to mere lines formed by the dipping of the more immediately investing membranes, so closely are the convolutions packed together. This condition is always the more marked when a fit has been the cause, or the immediate precursor, of death. The heightened specific gravity of the epileptic brain is a further indication of the changes which have come about in its minute structure.

Now, I do not undertake to show how these changes arise, but rather desire to consider their physiological bearings in bringing about certain phenomena known as an epileptic seizure. And when I speak of an epileptic seizure I do not desire to limit the term to what is known as a thorough epileptic fit. There are many gradations in the truly epileptic habit which may be evinced in loss of consciousness, a burst of fury, a sensory hallucination, or a motor spasm, one or all of them. These gradations of the disease are well known as Epileptic Vertigo, Aura Epileptica, Partial Epilepsy, and good instances are given by Trousseau.* The young amateur musician, whose case is reported by this writer, who would continue to play the violin during a period of perfect unconsciousness, is a good instance of "local" epilepsy. There was no recognised muscular spasm. The few bars read were sufficient to excite such automatic movements as to enable him to continue his part. The other cases I would quote from Trousseau are, that of the architect who walked high planks while undoubtedly unconscious of what he was doing, and that of the president of a tribunal, who would leave his seat for a time and return to it without being aware of the act. In every large lunatic asylum many instances of subjective delusion, generally of a transitory nature, are to be found. Cases of motor spasm without loss of consciousness are not uncommon. So that it would be absurd to say that because in such instances you do not have all the phenomena which go to make up an "epileptic fit" you do not see before you cases of epilepsy.

The occurrence of such cases of *partial* epilepsy, as some would term them, teaches us this, that, whatever may be the morbid cause of the phenomena displayed, it may be limited

* Art. Epilepsy, Dr. Bazire's Transl. fol. 59.

in its extent, or at least comparatively so limited. Where loss of consciousness is alone the symptom no morbid alteration of the structure of the sensory motor centres need be found; and where an illusion of sense, or a disturbance of motion may be the only evidence of functional disturbance, change in the portions of the brain known as the intellectorium might be looked for in vain.

I have drawn particular attention to the condition of the reticular tissue as found in epileptics, for the reason that I am hopeful of shewing that this tissue, when sclerosed, has much to do with the cause, if it is not the very cause itself, of true epilepsy, and I think, if I pursue the subject so as to consider the conditions which may be the cause of epileptiform seizures occurring in toxæmia or in certain other diseased states of the brain, it will be seen that the views I hold have at least common sense to commend them.

I should say, here, that I cannot believe or see any sense in the doctrine of a "discharging lesion" put forward by Dr. Hughlings Jackson, and supported, I am sorry to say, by so eminent a physiologist as Dr. Ferrier. Shew me an "open sore" or a "catarrh," and I will admit that here we have a "discharging lesion;" but I aver that the term is not well applied to a disturbed function such as that known as epilepsy. I object to the term because of its liability to mislead, just as the names "inflammation" and "fever" were, in days gone by, deemed to imply a demon got into the blood, which must be exorcised. Dr. Ferrier, in his account of his electrical experiments, takes much pains to convince his readers that no "lesion" of the brain structure was effected, doubtless being convinced that to destroy brain-matter would result in a total failure in his experiments, which, as performed, were, and are, the wonder of the scientific world. Destroyed brain-matter cannot be the origin of such force as would lead to a spasm of muscles, or an illusion of sense.

The evidence of the microscopists is that brain-matter proper, *i.e.*, the cells and the fibres, is not necessarily destroyed in epileptic subjects, but rather that its disproportion to the other tissues is in consequence of the undue development of these other, and less important, tissues.

I would then explain the occurrence of epileptic seizures in this way. There is a sclerosed neuroglia, whether the result of the insane diathesis, whatever that may be, or the result of a specific disease, such as, say, syphilis. This hardened neuroglia is no longer able to accommodate itself

to the frequent, and often sudden, changes in the quantity of blood passing through it, and the least resisting portion of the brain substance—the cells and nerves—is suddenly exposed to an unusual degree of pressure. Now, as the various centres are subject to varying degrees of hardening, as of varying degrees of blood-flow into and through them, so are the phenomena which follow upon the disturbance varying in character. But I would remark here that there is seldom any degree of change of phenomena in individual cases. This will explain how it is that fits as they occur in the same individual, possess such a remarkable resemblance the one to the other; the cry is the same; the manner of falling is the same—so that often the part once bruised in a bad epileptic never heals, and is always receiving further laceration; the character and degree of the muscular spasm hardly ever varies—if once unilateral, always unilateral; the period of unconsciousness (if this occurs) is always of the same length; and the mental disturbance will vary as little as the other phenomena.

I think it is Dr. Crichton Browne who relates the case of an epileptic girl, who, when seized with a fit, always cried “bolsters and pillows,” and she never varied the cry, even to the extent of putting the “pillows” before the “bolsters.” Whatever the “impression” that she had may have been which gave rise in her mind to the necessity of having about her such useful things, the impression was always the same. Numerous instances such as these will occur to every experienced asylum officer, and I need not dwell further on this point.

It follows then, that, as a rule, the morbid condition which gives rise to an epileptic seizure is more or less localized, and, that, though all the organs which go to make up a cerebro-spinal system may be in some degree involved by the disease, there will be some organs which will be implicated more than others. The excitation of spasmodic action—or rather that turgescence of vessels which at least accompanies spasm—probably has its seat elsewhere. The very exciting cause of vascular dilatation may be objective or subjective. The sight of some loathsome object, or an object of terror, will momentarily blanch the nervous system, and if an otherwise healthy condition exist there the disturbance will end, though doubtless a reactionary turgescence will sooner or later follow. But, if there be a sclerosed condition of the reticular tissue, the *ictus* may be manifest in severe mental

or motor disturbance, or both. In this way those sudden and unaccountable impulses to strike, which are seen in the insane, may be placed amongst the epileptiform diseases. I described such a case in this Journal:* it was that of a shoemaker, who for years was impulsive, and manifested no motor spasm until a short time before such an attack which led to his death. After death the usual engorged condition of an epileptic, dying in the *status*, was found.

I have under my care a man (G. W.) whose tracing may be seen in my paper on "the Sphygmograph in Epilepsy,"† who, besides inheriting the hereditary taint, is the subject of marked tertiary syphilis (acquired); a grainer by profession, of whose clever handiwork this asylum bears abundant proof, but who cannot be allowed to do "oak" graining, because of the severe fits certain to follow, as he says, because of the severe mental strain necessary for the performance of this kind of work; though he can, with impunity, do other work to which it is not necessary to apply much "mind."

Another exciting cause may be a "sensation" arising, possibly, in the disturbance of the function of some organ remote from the head, yet closely allied to the suspected seat of epilepsies—the *medulla oblongata*.‡ The stomach is often the subject of such "sensations." It would be difficult to say how much the association of a "qualm" in the stomach with an epileptic fit may not eventually become a simple habit. In such cases the disturbance which follows may become purely automatic, just as the musical dog (of history) howled when a discordant chord was played in his hearing. But however automatic may be the nature of an epileptic habit, the structural changes of nervous tissue must be taken for granted.

I may now refer to those epileptiform attacks occurring in senile cerebral atrophy, general paralysis, and allied diseases, and in toxæmia.

For healthy action I had presumed a healthy state of the organ called into energy. Whilst in true epilepsy we find the disease confined to the neuroglia, in the disease now under more immediate consideration other portions of the brain seem to be involved. For besides the degeneration of the interstitial substance, the vessels and membranes partake of the general disease. In addition to the loss of function of

* April, 1874, fol. 94.

† W. R. Reports, Vol. II., fol. 806.

‡ Van der Kolk.

the neuroglia, the very important changes in the membranes lead to perversion of function of these parts. Hence the condition so common in senile dementia, known as the "water-logged" brain. It would almost be a matter of dispute whether the atrophy of the brain substance was the result or the cause of the presence of so much cerebro-spinal fluid as is invariably found in these diseases. I should be inclined to ascribe to the diseased membranes the power to originate the atrophy by compression alone. It is beyond doubt that the membranes are diseased, and, therefore, it is but fair to presume that their function is perverted.

The cause of an epileptiform seizure may then be said to be—the sudden driving in of a quantity of blood upon a brain already compressed by an abnormal amount of fluid. The same may be said as to the effect of poison taken into the blood, such as, say, opium and hydrocyanic acid, though, doubtless, the effect of the former is a general congestion, while that of the latter is more local in its operation. In poisoning by opium, charcoal fumes, chloroform, and similar substances, the intense turgescence of the brain, confined, as it is, within its unyielding bony walls, may account for that perversion of its function, as shown in the phenomena of unconsciousness and muscular spasm and paralysis. Turgescence, or what would in effect be the same, serous congestion, is absolutely necessary for the excitement of convulsive action. Dr. Ferrier is most careful to state* that in all cases, whether the fits were general or partial, the immediate antecedent was an excited, hyperæmic condition of the cortical matter of the hemispheres, that is, at the points to which the electrodes were applied.

The strong resemblance which exists in the sphygmographic tracings taken by myself, in epilepsy, and those I have already quoted† as having been taken by M. Loraine, of Paris, in tetanus and poisoning by burning charcoal, is, of itself, sufficient proof that similar vascular conditions exist in these three morbid states. I cannot say to what immediate influences this abnormal state of the vessels is due. I must for the present rest contented in shewing that such an unusual state does exist. That it is of a reflex nature there can be little doubt in surmising.

It is a singular fact that all medicines that possess the confidence of the profession as being antagonistic to convul-

* W. B. Reports, Vol. III., fol. 39.

† W. B. Reports, Vol. II., fol. 303.

sive action are such as are known to control the vascular system. Ergot of rye, belladonna, bromides of potassium and ammonium, valerian, and its combinations with zinc, are familiar instances. I was once so fortunate as to commence a sphygmographic tracing, which began with a form modified by ergot, and ended with the characteristic tracing found in epilepsy; the patient in the ten seconds required to pass the slide over the clock-work box of the instrument having gone off into a severe fit. This tracing may be seen faithfully copied in my paper already quoted.* I would not rest contented, however, in knowing that certain drugs have a kind of "governor-ball" action over the vessels, for at the best treatment by such drugs can only be deemed as palliative. Such treatment may ward off the fits until the "epileptic habit" has become accustomed to that form of treatment, when, as we often see, the fits return with an accumulated force. The treatment, which is to be of a lasting and effectual character, is that which shall have for its basis a means of attacking some constitutional habit or condition. If that habit be, say, syphilitic, then it is reasonable to suppose that iodide of potassium will do more than "ward off" the fits; if strumous, then cod-liver oil will have a marked effect; if "herpetic," arsenic should be given; and so on.

My object in putting together these imperfectly worked-out speculations, is that a more rational system of therapeutic treatment should be called into being, and not so much through an observation of the results of disease as through a real appreciation of the disturbances of function, for evidences of which, as I firmly believe, we may not always look in vain. So long as, when first baffled, we do not throw aside, as useless, such means as the ingenuity of man may produce, or scoff at the efforts of others, of the value of whose work we are, perhaps, not capable of forming a just estimate, so long shall we assist at the grand progression which science is ever making.

* W. R. Reports, Vol. II., fol. 304, fig. 1.