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BRAIN IN INSANITY.

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PATHOLOGICAL ANATOMY OF THE BRAIN IN INSANITY.

The Essay to which was awarded the Prize offered by several Superintendents of Asylums—formerly Assistant-Physicians in the Royal Edinburgh Asylum—to the Students of Dr. Skae's Class, Session 1861.

"Man is not born to solve the problems of the universe, but to find out where the problem begins, and then to restrain himself within the limits of the comprehensible."—GÖTHE.

THE great progress which medicine in general has made during recent years, must in considerable part be ascribed to the anatomical direction it has assumed. The study of pathological anatomy has entirely changed the character of medical science, which, instead of a chaotic medley of unfounded theories and ingenious hypotheses, the fruits of speculation, is now a philosophic system resting on a firm foundation of facts with mutual and definite relations. To such an extent has the pathological investigation of disease been carried, that, in the ordinary maladies which attack the body, the instances are now exceptional where we cannot demonstrate certain gross, palpable changes of structure having an invariable causal connection with functional disturbance. By bringing diagnostics to our aid, we can also in many cases predict with confidence and precision the nature and extent of the lesion which will be found after death. But the triumph does not cease here. In conjunction with chemistry and the microscope, pathological anatomy has passed from the gross alterations of organs, and succeeded in elucidating the processes and changes which take place in their ultimate elements; and Virchow, bringing to the subject all the zeal and instinct of genius, has given us an insight into the arcana of cell-life, and laid down the comprehensive generalisation as the basis of a new pathology, that the cell is the ultimate agent by which, both in health and disease, structural and functional alterations are effected. All the practical departments of the healing art have participated more or less in this progress. Medicine proper, or that branch which restricts itself to the study of internal dis-

eases, has separated itself more and more from dynamics, and found a natural explanation of its symptomatology in anterior changes of structure; while surgery and midwifery, with their outbranching specialities, are daily becoming more anatomical in character.

But whilst we are congratulating ourselves on the present promise of medical science as a whole, there is one very important element of it which, pathologically, at least, forms an exception to the general state of progress, namely, insanity. This department may still be considered the "terra incognita" of pathology, the land of adventure to the future investigator, which allures with the prospect of brilliant discoveries, and the solution of problems hitherto insoluble. In common with its sister branches, the investigation of the pathology of insanity took an anatomical direction; and, judging from the magnificent results which were achieved in the former, it was quite natural to expect that the key to the different forms and symptoms of mental disease would be found in alterations of the cerebral tissue. With the minute study of the membranes of the brain, it appeared as if a new epoch had commenced for the whole pathology of insanity, and it had therewith acquired a kind of rational, somatic basis. And, indeed, it may be said without exaggeration, that the theory of Bayle, and all which followed it in the literature of medical psychology, was the most decided step by which it joined itself to the general movement of medical science. But, unhappily, notwithstanding the plenitude and the apparent significence of the anatomical phenomena which the labours of the most distinguished alienists in all countries have brought to light, the expectation of a rational, somatic pathology has not as yet been realised, and pathologists have failed to bring out of the facts at their hand other than a contradictory or negative result. When we come to compare and to bring them into connection with the symptoms of mental disease—for a true pathology cannot stop short with the mere registration of anatomical details,—we enter upon a field of doubt and conjecture, without any guiding light or beaten path, surrounded on every side by the dangers of error; and though all the teachings of physiology, all the past history of pathological anatomy in its connection with etiology, confidently assure us that this is the only direction by which we can reach the goal of a scientific pathology, yet the confusion is so great, and the difficulty of evolving order out of the chaos so immense, as to make this labour at once the most complicated problem and the highest effort that have ever engaged the attention of the metaphysician and the physiologist.

The causes that have led to this disproportionate progress of medical psyschology as compared with the other branches of medicine lie mainly in the subject itself. In by far the greater number of cases, death occurs many years after the commencement of insanity, which it is not uncommon to find extending over periods little short of a lifetime. Meanwhile, the symptoms both in the nervous system and in other parts of the body have been undergoing a variety of alterations. Some which at first were strongly pronounced have become milder in character or have altogether disappeared, while others of an entirely different kind have been ushered in. Thus, various diseases have arisen, pursued their course, and left their effects upon the cerebral substance. When at length death removes the unhappy sufferer from the stage, a number of important changes are found to have taken place in the brain, but it is generally impossible to trace back the history of these abnormalities, to fix the date of their origin, and to establish a relation between them and the symptomatological phases through which the disease has passed. It is true that in a considerable number of cases we have an opportunity of examining the brain shortly after the outbreak of insanity, when it is still at its height, as in cases of acute mania which have rapidly succumbed to exhaustion or accidental diseases. Here it might naturally be expected that we should find structural changes sufficient to account both for the immediate cause of death and the more remote cause of the mental disturbance, but the deviations we do meet with are often such as occur in diseases which leave the integrity of the mental functions untouched. As Dr Flemming very aptly observes, "we are in the same position, in which one would find himself without a guide upon the field of a recently fought battle—given over to a feeling of melancholy wonderment at the carnage and devastation which give evidence of the violence of the struggle, but not of the operations whose theatre he surveys."

An equally important cause of the unsatisfactory state of the pathology of insanity lies in our imperfect knowledge of the minute anatomy of the nervous system. Of all organs, the brain is least known, either anatomically or physiologically, and, consequently, the medical psychologist cannot be expected to detect slight deviations from a normal standard he does not possess. Hence has arisen the assertion that very often not the slightest irregularity is to be found in the brains of persons dying insane. Upon this point, however, the best authorities seem agreed, that such statements are only a proof either of the peculiarity of the ideas entertained as to what anomalies are essential for the production of insanity or of the incompleteness of the anatomical

examination, and that a careful necroscopy, were we in a position to make it, could always detect sufficiently important deviations from the normal state. In connection with this point, it ought to be taken into account that the brain and nervous system are under very different conditions from those of other parts of the body. In the latter all vital manifestations occur only as material alterations, visible and palpable; hence even the slightest deviations are manifested in a material product. But in the former they are immaterial, in so far as the product of their activity is neither material nor visible, but only thought, sensation, and volition; and, in accordance with the same law, disease less frequently gives rise to a material product in the nerve-cells. The reason of this we find explained in the following passage from Virchow's 'Cellular Pathology.' He observes, "That in all those tissues which are subject to important functons, we find those functions are chiefly due to very delicate changes of arrangement or, if you wish it expressed in more precise terms, to minute changes of place in the minute particles of the internal matter, the cell contents. In these cases, therefore, it is not so much the real cell in its pure form that decides the question, as the specific matters with which it is provided internally—the chief agent is not so much the membrane or the nucleus of the cell as the contents."

"It is these which, when exposed to certain influences, become comparatively rapidly changed without our being always able morphologically to detect any trace in the arrangement of the contained particles. We cannot perceive any definite chemical change, or any alteration in the nutrition of the parts; we only see a displacement or dislocation of the particles, which, however, probably depends on some slight chemical change in the molecules composing them." It will at once suggest itself that these conditions are competent to explain the failure of pathological histologists in detecting any remarkable changes in the nervous tissue in mental diseases, while, at the same time, it may be used as an answer to those who deny the somatic origin of insanity in the absence of appreciable microscopical alterations.

The complexity of the subject is still more increased by the fact that the brain in the pathological conditions of its parts preserves a character of almost indivisible unity, so that structural alterations of different kinds are associated with similar functional disturbances, while on the other hand dissimilar deviations of function accompany similar organic lesions. Thus in mania, melancholia, and dementia, any psychological consistence between the symptoms and the post-mortem appearances cannot be established. Nor, indeed, in a clinical point of view, are these

forms separated from each other by any sharp line of demarkation. The same thing holds good in general paralysis, which clinically occupies a much more favourable position than the others. It is now generally believed that this is a distinct disease, whose symptoms, course, and prognosis, can be predicated with confidence. Indeed, it was the discovery that general paralysis of the insane is constantly associated with anatomical alterations of the cerebral tissue which first led to the opinion that organic lesions are really the essential causes of all mental disorders, and it was hoped that by starting with it as the first step of a classification, all diseases of the mind might acquire the much-desired somatic foundation. But even as regards general paralysis, in which the anatomical lesions are so striking, the difficulties which stand in the way of the realisation of so beautiful a scheme are far from inconsiderable. For it cannot be denied that not only are the pathological appearances inconstant in undoubted cases of this disease, but that the same alterations are found in the most exquisite degree in other forms of insanity. A most convincing proof of this occurred last summer in the Edinburgh Royal Asylum. In the case of a boy of twelve years, afflicted with epileptic dementia, a most exquisite example of a general paralytic's brain was observed. It presented all those appearances which have been exclusively associated with the "delire ambitieux," the white, fleshy, thickened, and gelatinous arachnoid, with adhesion of the pia matter to the cortical substance and an extreme and general atrophy of the convolutions. But in this case it need scarcely be stated that there were no symptoms of paralysis or monomania of grandeur. This and observations of a similar nature are sufficient to show that, pathologically at least, general paralysis does not present any anatomical features by which it can be distinguished from other forms of insanity. The foregoing facts obviously preclude anything like an attempt to describe the pathological phenomena of psychical diseases in "tout ensemble" groups, labelled with the names of special forms; for that would be a mere arbitrary classification which has no existence in nature. The most convenient and natural plan will therefore be to inquire—1st. What pathological alterations are found in the brain of persons dying insane? 2nd. What relation do these individually have to the mental symptoms, and to the whole disease?

The following is a brief summary of the structural alterations which have been described as most frequently met with in the brains of the insane. They are: adhesions and thickenings of the cranial bones; Pacchionian granulations; osseous projections

and deposits in the meninges; thickenings and opacities of the arachnoid, with serous effusions into the meningeal spaces; similar collections in the ventricles of the brain; partial or extensive hyperæmia of the brain and its membranes; unequal consistence of the cerebral substance; vascular dilatations and varicosities; papillary excrescences on the pia matter; discolorations of the cortical substance to ash and yellow gray, of the medullary to gray and yellowish white; softening of the medullary matter, sometimes to a diffluent mass; so-called apoplectic cysts in different stages of metamorphosis; increased specific gravity of the brain substance; general and partial atrophy; destruction of the brain by suppuration; ossification of the arteries, tumours, &c., &c.

Of all these abnormalities those which relate to the vascular system are entitled to the first place. They are included within the extremes of hyperæmia and anæmia.

Congestion is perhaps the most difficult point in the whole pathology of insanity. For a long time it has been the custom to ascribe a great rôle to it in the causation of mental disorder; and, although adverse opinions have not been wanting, the theory that it is a factor in the production of psychical disease appears not without foundation. It is only expressing an every-day experience to say that this condition is a frequent post-mortem appearance in autopsies of the insane; and it is impossible to turn over many pages of asylum registers, or consult any book upon the pathology of insanity, without finding minute descriptions of congestionary phenomena. Sometimes it is the dura mater, which presents a diffused blush, and its surface is covered with varicose vessels and dotted over with multitudes of red points, the result of capillary rupture. In this condition it is sometimes found to be thicker than usual, parchment-like, discoloured, and adherent to the cranium or the arachnoid. At other times congestion appears more pronounced in the arachnoid, which presents large masses of dilated veins; Guislain describes it as having the aspect of an inflamed conjunctiva. More frequently, however, the hyperæmia of this membrane is found after death to have been apparently expended in the production of the milky-coloured spots and the opaque, thickened parts with the serous infiltration between it and the pia matter, so often met with under such conditions. The pia matter is very frequently thickened, and easily separable from the brain substance, particulary when it has a tough, leathery character; but in general paralysis it is almost regularly so adherent to the cerebral matter, that portions of the latter are carried away on attempting to strip it off. Its vessels are seen to be enlarged,

varicose, and gorged with blood. In intense congestion the brain substance presents a pinkish or violaceous hue, and on incision is found to be beset with a multitude of small red points, the puncta vasculosa; it also feels remarkably doughy to the touch. In the majority of cases, however, these appearances are not to be observed in so great intensity. Of thirty-four cases of acute mania, taken from the pathological register of the Edinburgh Royal Asylum, fourteen showed a well-marked congestion of the pia matter, with a pinkish or violaceous hue of the brain substance; in the remainder the hyperæmia appeared more limited and partial, prominent at some points, and at others passing into absolute absence of vascularity. In two or three instances the only appreciable changes were slight thickening and opacity of the arachnoid, which may be regarded as the products of an extinct hyperæmia. Indeed, unless the brain is examined at the very acmé of the congestion, it will often be found that the over-supply of blood has been expended upon the altered tissue and the exudation, while there is some reason to believe that nothing disappears sooner than congestion; so that the absence of injection is no proof of its not having been present before death. The hyperæmia may be either active or passive, but in most cases the colour communicated to the tissues is not sufficiently characteristic to admit of the distinction of the one from the other. It is only in very intense congestion with a general injection of the vessels that these two conditions can be distinctly determined—the active by the deep reddening of the cerebral tissue, and the passive by the engorgement of the veins. This question is therefore in some respects without the pale of pathological anatomy, and must be answered indirectly by conclusions based upon the symptoms observed in the living. The predominent character of passive congestion is depression, with a general diminution of functional activity; the senses react slowly and weakly, and the flow of ideas is torpid; the patient comprehends with difficulty what is said to him; his answers follow slowly, apparently unwillingly, and with the expression of indifference. These symptoms perfectly correspond in their character to those which are observed in passive congestions of other organs, namely, a general depression of function. In active hyperæmia, on the other hand, we find an opposite state of matters. Exaltation is here the characteristic feature. It is attended by extraordinary restlessness and moveability; all the functions of the brain are exaggerated, the susceptibility of the senses increased, the formation of the ideas and fancies quickened. But the condition of the brain of the insane is distinguished from that of the sane not merely by increased

activity, such as a quicker and more lively play of imagination and thought, but rather by its depraved and perverted action. The more hasty the latter becomes, the less does it attain completness. The sensations follow so quickly that the attention cannot control them; an idea is scarcely generated before it is obscured by another; a thought is not cogitated before it is carried away by a train of others equally fleeting. In general the symptoms of exaltation are combined with those of depression. The reason of this is easily seen when we consider the condition of the vessels demonstrated by the microscopical observations of Schroeder Van der Kolk, Ekker, and Albers. These writers have published observations to the effect that, in certain forms of mental disorder, particularly mania and the "delire ambitieux," the capillary vessels are found dilated and varicose. Some vessels under the microscope appear to be enlarged, while others are considerably contracted, or retain their normal calibre. Some are dilated to three or four times their usual size. When this condition becomes chronic, venous dilatations, varicosities, are developed in the gray matter. Hence it is evident that neither the effect of the irritation nor the stasis of the blood are uniformly spread over the whole organ. In some parts of the organ active assimilation of the blood with increased function will be going on, while in others the stasis has already put an end to it and given rise to depression. Owing to the structural peculiarities of the brain, these conditions may disappear in one part and be transferred to another—a fact which explains the great alterations in the symptoms of cerebral congestions. Thus exaggerated action predominates and intermits, sometimes here and sometimes there, in organs of quite heterogeneous function; now it shows itself in an overactivity of certain senses, then in the domain of the ideas, and again in uncontrollable action of the will.

The relation of congestion to insanity has been made the subject of lively discussion, in which it has been argued that nothing is more deceptive than the assumption that a hyperæmic condition of the brain can give rise to mental disorder. Some, like Engel, have gone so far as to deny the posibility of deciding whether congestion of any organ, and especially of the brain, originates before, during, or after death. Those who incline to metaphysical theories assert, that it may be the consequence of insanity, as seen occurring in so many mental emotions within the bounds of health, or it may be what Virchow calls a collateral phenomenon, that is, the noxious influence affecting the brain may at the same time disturb its functional and its vascular condition, and that in all cases it is impossible to say whether

the injection of the vessels is not produced after the commencement of the disease by the vociferations and violent behaviour of the patient, or during the paroxysm of death. It is added, that the frequent occurrence of congestions and obstructions of the cerebral vessels, as in diseases of the heart and lungs, without any disturbance of the mind, prove that these conditions are not merely possible, but in most cases the actual ones.

Taking our stand on broad, physiological principles, it may legitimately be concluded that a case is made out for a causal relation between congestion and insanity in the perfect correspondence of the symptoms during life, and the post-mortem appearances with the phenomena which we can experimentally produce in organs accessible to objective perception. To those who make the objection that congestions of the brain occur without giving rise to mental symptoms, it may be answered that, when such do arise, they are merely mechanical conditions, and that it is not asserted that the pure, naked over-supply of blood constitutes the whole process of insanity. Physiologically and pathologically, congestion is not the only thing required that an alteration should take place in the nutrition of a part; besides the increased quantity of blood, it is necessary that "particular conditions should obtain in the tissues (irritation), altering the nature of their attraction for the constituents of the blood, or that particular matters should be present in the blood (specific substances) upon which definite parts of the tissue are able to exert a particular attraction" (Virchow). It is quite consonant with our present physiological notions and our knowledge of insanity to believe that some ultimate "irritability," constitutional or acquired, resides in the nervous tissue of the insane, which, on the addition of another link, rapidly developes into disease of the mind. These two are necessary and essential links of the same process, mutually dependent. Thus the narcotic poisons, when brought into direct contact with the nervous tissue without the intervention of the circulation, exert no narcotic effect. This experiment, though it leaves undecided whether the process of of narcotism commences first in the nerve fibres or in the vessels, appears to prove that the medium of the circulation is necessary for the action of these matters. It is highly probable that the first step in the process of insanity is an irritable state of the nerve-cells, but it is just here the "problem begins;" and as Dr. Bucknill has stated, and the foregoing experiment confirms it, the connection between cellular and vascular change is of so intimate a character, that it is difficult to assent to the proposition that pathological conditions of the cerebral vessels are to be viewed as secondary phenomena. The positive philosophy of the

nineteenth century has set its ban upon all attempts to discover ultimate causes, and we shall do well to "restrain ourselves within the comprehensible," which in this case is congestion.

The occurrence of *Anœmia* of the brain in the insane has been proved by post-mortem examinations, as well as by observations made on the living. In the dead body this condition is indicated by a very pale cortical substance, extremely few vessels on the upper surface, and still fewer in the medullary matter. In the brains of aged persons the defficiency of blood is recognisable on making a section, in the wide, open mouths of the empty vessels throughout the brain substance generally; in the bodies of younger individuals, the vessels are often contracted in some parts and dilated in others. The perverted action of the brain often takes the form of dementia, or dementia with excitement, and in slighter degrees a melancholic direction. Anæmia, as a temporary condition, is sometimes associated with a temporary melancholy in lying-in women. But it is rare to meet with a pure and general anæmia of the whole brain. Thus we often find that while the large, external vessels of the cerebral surface are bloodless, those in the interior of the medullary substance are gorged to their ultimate ramifications; the medulla oblongata is often covered with over-filled capillaries, while the optic thalamus and the corpus striatum present not the slightest vascularity. It was long a puzzle to pathologists why, in states of general anæmia, the symptoms during life should be those of active congestion, namely, exaltation and increased function, and the brain after death should be found with all the characters of anæmia. This difficulty has been solved by the discovery of a condition which Virchow terms ischæmia, or partial anæmia combined with hyperæmia. It is due to contraction of the veins, the capillaries, or the arteries. When the vessels become contracted, from whatever cause, it is obvious that the course of the blood will be interrupted—that a stasis will take place; consequently, below the contracted part the brain is deprived of its supply, while above it the blood accumulates in extra quantity, and, being obliged to distribute itself in the lateral vessels, on the principle of compensation, gives rise to an over-fulness of the adjacent parts. Virchow also points out that this condition of the vessels is also generally combined with a venous hyperæmia which he regards as the contra-distinguishing sign from states of simple anæmia. These observations are particularly valuable, because they explain why conditions of anæmia and hyperæmia respectively are accompanied by symptoms so exactly similar that they connot be distinguished from each other. They are of an indefinite and mixed character. States of depression and exaltation

alternate and intermingle with each other. The latter are said generally to predominate, but are often accompanied by a peculiar expression of deep and painful suffering.

Equally interesting and important, as bearing upon the causation of insanity, are the causes to which Virchow ascribes ischæmia. It may originate from mechanical obstructions, thrombosis, &c., and also from dynamic conditions, of which the most frequent is probably spasm of the vessels, when their calibre is diminished by contraction of the muscles.

Among others still more applicable to mental diseases, we find narcotics (alcohol, opium, &c.), asphyxia, paralysis, hyperæsthesia (including over-irritation, in consequence of mental strains) cold, electricity, and mental emotions with a depressing effect.

It has been a disputed point whether the narcotic poisons give rise to perversion of the mental functions by altering the conditions of the circulation of the brain through irritation of the nerve fibres or the vascular walls, or by the introduction of a poison injurious to nutrition, or at least by some power peculiar to themselves of decomposing the blood. Virchow having in view some experiments of Schroeder Van der Kolk and Ekker, appears to look upon these poisonous effects as due to an inchæmic condition of the brain produced by their administration; although he is doubtful whether the ischæmia is to be regarded as an effect of the agony, caused by the long contraction of the muscles of the vessels—or whether it preceded the death struggle. It has already been shown that in all probability the medium of the circulation is necessary to ensure the action of the narcotics, and it is no violent assumption to conclude that some of their symptoms are caused by a condition of ischæmia. It is equally probable that the poisons engendered in the living body, as the rheumatic, the gouty and puerperal conditions of the blood, may act in much the same manner, and should be placed on the same category as the narcotics. Mental emotions, too, besides their spasmodic effect upon the quantitative relations of the circulation in the brain, are perfectly calculated, from their known propensity to derange the secretions and excretions and alter the quality of the blood, to give rise to conditions of ischæmia by irritation. Of course in all these cases we are still obliged to assume a special and specific irritability of the nervous tissue, shrouded in the mystery of ultimate causes and individual idiosyncrasy.

Anæmia is also met with as a secondary condition, the result of induration, which exercises a pressure upon the vessels ramifying through the indurated part. It generally originates from the hypertrophic induration consequent on injury. It is associated

with sleeplessness, perverted mental action, and a morose, melancholy humour.

The next point for our consideration is that of hæmorrhage. Effusion of blood into the sac of the arachnoid is not a very unrare occurrence. Hæmorrhagic extravasations into the deeper parts of the brain are occasionally met with in monomania. In one case of monomania of unseen agency, the right optic thalamus contained a cavity, about the size of a hazel nut; while, on the left side, a recent hæmorrhage—the immediate cause of death—had torn up the corpus striatum and optic thalamus, the clot being separated from the ventricle by a thin layer of cerebral substance, which had given way at one point, the external wall of the sac being formed by the cortical substance only. In general paralysis, the corpora striata and optic thalami are sometimes found puckered, this being due to a loss of substance resulting from contraction of apoplectic cysts; section of the organs reveals numerous small cavities, surrounded by yellow softening.

What relation, then, do these hæmorrhages bear to the mental disease? At first sight, these appearances appear to be among the brightest triumphs of pathological anatomy in insanity. Effusion of blood, pressure and irritation of the brain—what more is required for the explanation of mental derangement? On a nearer view, however, important doubts are suggested as to this connection. First of all it is essential to determine the time at which the extravasation took place. When a fresh, moderately-sized clot is found after long duration of the disease, it is obvious that the latter cannot be due to the hæmorrhage. It is more difficult to form an opinion when only the remains of the extravasation are found, namely, false membranes, and when apoplectic symptoms have occurred before the patient has been placed under medical observation. In some cases of this kind, it certainly appears as if the apoplectic symptoms had given the first impetus to the insanity, and as if it had dated from them. To the cases given by Bayle, it may be well to add the two following, from the 'Report' of the Edinburgh Royal Asylum, for 1855.

History.—A. B—, a reader for the press, of sober and industrious habits, fell into general bad health from over-attention to business. About a year previous to admission into the asylum, he lost his speech and the power of his left side, for the space of a quarter of an hour. Previous to this no mental derangement was observed. After the first seizure similar attacks occurred about every three weeks, but gradually diminished in their duration; and, at the time of admission, they only lasted two or three minutes. His memory became gradually impaired, his

speech faltered and his gait was affected. The delusions so characteristic of general paralysis took possession of his mind about four months before coming to the asylum. During his residence in the asylum he became gradually fatuous, and general paralysis became more complete. He died after having been in the house seven months. During the last four days of his life he lay in a semi-comatose state, with the flexor muscles of his hands and arms permanently contracted, and his jaws firmly locked. On examination after death, a thick false membrane was found beneath the dura mater on the left side; it completely covered the hemisphere, with the exception of the base. The membrane was nearly twice the thickness of the dura mater, of firm consistence, and apparently well organised; over its surface there were many dark patches, which appeared to be old clots of blood. A false membrane was also found on the right side; but it was thin and delicate, and was limited to the upper surface of the hemisphere. There were about two ounces of fluid beneath the arachnoid, and one ounce in the lateral ventricles. There was also a granular condition of the lining membrane of the ventricles. The nervous substance of the brain did not present any abnormal appearance.

Remarks.—The points of interest in this case are—How was this false membrane formed? and, When was it formed? In answer to the first of these questions, there can be little doubt that it was the result of extravasation of blood. At first sight, it may appear more uncertain when this hæmorrhage took place. It will be observed, that the first apoplectic seizure was of short duration, and that the hemiplegic symptoms were only of temporary duration. We know that a similar lesion is not unfrequent in new-born children, as a result of pressure on the head. In those cases the paralytic symptoms are also temporary. The fact is explained by the pressure being uniformly spread over the surface of the brain, and not confined to one point, as in hæmorrhage into the brain itself.

A similar lesion was noticed in the Appendix to last year's Report.

History.—J. S—,was a tailor, of sober and industrious habits. Ten years previous to admission he had a seizure somewhat like an apoplectic fit. Soon after this he was obliged to give up work, on account of impairment of vision. His friends observed, also, that his temper was much altered from this date; he became irritable and discontented. About a month previous to admission he had another seizure, after which his mind was greatly affected; he displayed the characteristic symptoms of exaltation, and was violent and abusive to his family. During his residence

in the asylum, he had many congestive attacks. He became generally paralysed, and was completely amaurotic.

A year after admission, or eleven after the invasion of the malady, he died in a condition similar to that of the last case.

Post-mortem.—A false membrane was found to extend over the entire superior aspect of the cerebrum. The arachnoid had a granular appearance. There was very little fluid in the sac, pia mater, or ventricles. The spinal canal contained about five ounces of fluid. The spinal cord appeared unusually soft; and about the middle of the dorsal region, there was a portion of the nervous matter of a yellowish red colour, and softer even than the rest of the cord. In this, as in the former case, there was no apoplectic seizure, or well-marked paralytic symptoms, to indicate the existence of any extensive hæmorrhage; the reason is undoubtedly the same—its occurring in the sac of the arachnoid, and spreading over the entire surface of the cerebrum.

Similar appearances, preceded by similar symptoms, were also found in another case of general paralysis during the past winter. Between the dura mater and the pia mater a membranous layer was found, of a brownish yellow colour, nearly a quarter of an inch thick at some parts. It covered the whole of the cerebrum, but was not so thick towards the base of the brain. It was comparatively free from both dura and pia mater. In the middle fossa of the brain, on the left side, there was a similar layer of organised lymph thrown out upon the external side of the dura mater, between it and the bone. The pia mater and arachnoid were thickened, and adhered firmly to the gray matter; the thickening had a milky appearance. The gray matter was pale, and divided into two layers by a well-marked line, and softened, but not to such an extent as to be washed away by water.

As opposed to the significance of these facts, it is asked, how comes it that so many hæmorrhages into the substance of the brain, as well as between the membranes, are not followed by insanity? Here we are again obliged to have recourse to a special irritability or disposition to insanity. Indeed, nothing is more common than to find individuals who have an hereditary tendency to disorders of the mind suddenly becoming insane after a slight attack of apoplexy. On the whole, however, it is the general rule that cranial hæmorrhages in the insane occur first in the course, and not before the commencement of the malady, which has a disposition to hæmorrhage among its consequences. It is not improbable that the convulsions and spasms so often occurring in the course of mental diseases are oftener the cause than the consequence of hæmorrhage. In general paralysis especially, the vessels are atheromatous and fatty, and

will easily burst when the strain upon them is very intense. Common epilepsy often terminates in cranial hæmorrhage.

Inflammation.—Acute inflammation of the brain, resulting in suppuration, red and yellow softening is very rarely met with in the insane, and when it does occur, it bears much the same relation to insanity as hæmorrhage; but the so-called subacute inflammations of the membrane are much more frequent pathological phenomena, and have given rise to considerable discussion. These conditions, however, never go beyond irritation and hyperæmia, whose products are circumscribed induration, opacity, thickening, and adhesion of the membranes. When the disease proceeds from inflammation of the meninges, it is communicated from the pia mater to the grey substance, which at the acmé of the inflammatory process is softened, but, as it subsides, becomes indurated and adherent to the investing membrane, so that the latter cannot be removed without bringing away pieces of the adhering brain substance. Another condition of the brain, which results from these inflammatory attacks, and permanently remains, is a varicose dilatation of the vessels. This state of the vessels is thought to cause atrophy of the parts of the brain substance in which they ramify. These appearances, in a slighter degree, are tolerably common in cases of acute mania; but as they are also found in the brains of the sane, and little or no importance is ascribed to them, they may be regarded as possessing no value in this form. In general paralysis, however, in which they are met with in most exquisite examples, they have been regarded as very important anatomical facts, and have given rise to several theories, of which that of Bayle has, perhaps, been most widely prevalent. This pathologist states that, in his opinion, general paralysis of the insane is the result of a primary chronic meningitis, very often combined with consecutive inflammation of the cortical substance of the cerebral convolutions. It is not due to a general induration of the brain, as was asserted by Delaye, since this condition is found in scarcely one-fifth of the cases; it is not the consequence of a premature encephalitis (Calmeil), and, finally, it is not the result of inflammation of the gray substance. The paralysis and delirium of the first period, or the period of the monomania of grandeur, Bayle ascribes to congestion of the pia mater, and in some measure to the chronic phlegmasia of the meninges—a double lesion, which simultaneously compresses and irritates the brain. The second period of the mania depends upon an increase and extension of this inflammation; it is at this stage that the false membranes form. The excessive agitation, the epileptiform attacks, and other convulsive motions of all kinds, which supervene during this period, are the

effects of a consecutive inflammation of the grey substance of the brain. The third period, that of dementia, with very considerable general paralysis, great weakness of the intellectual capacity, and suppression of ideas, is the indication of great compression of the brain, depending on the continuous progress of the serous effusion which is due to the meningitis. The weak point of Bayle's theory is, that it lays far too great stress upon mere mechanical conditions, such as pressure and irritation. It is very easy to perceive how the exudation of an acute meningitis can give rise to paralysis and convulsive symptoms by its pressure upon the cortical substance, but it is not so easy to explain how meningeal inflammation can excite delusional ideas.

If such were the case, we should be prepared to expect some similarity between the delirium of meningitis and that of the general paralytic; but the maniacal symptoms observed in the latter resemble common mania much more than meningeal inflammation. The most prevalent view at the present time regards this so-called inflammation as a secondary condition, due to a chronic phlegmasia of the whole brain. The frequent serous effusions, caused partly by atrophy of the brain and partly by other causes, under such dyscratic conditions, possess a very irritating character, and cannot fail, from their pressure and irritation, to give rise to inflammation, tension, and thickening of the meningeal coverings. But if any further proof is required that these thickenings, opacities, and adhesions, as well as the inflammation by which they are caused, are purely secondary phenomena, and are not concerned in the production of the "delire ambitieux," it will be found in the fact that these pathological appearances are found in the highest development without any delusional ideas. I have already referred to an interesting case of this kind, and will now give it in detail. As already said, it was in the case of a boy of twelve years of age, the subject of epileptic dementia. He is described as being a healthy boy till he was two years old, when he had a "teething fever." He then had convulsions for the first time. Since then he has had fits almost every day, and sometimes many in a day. At first he fell down, but latterly he merely laughed, trembled, and ran during the paroxysm. No symptoms of paralysis could be detected in the voice or the gait. On opening the skull, the medical officer exclaimed in astonishment that it was an exquisite example of a general paralytic brain. The dura mater was very adherent along the sutures. Skull-cap ordinarily thick, somewhat irregular; four and a half ounces of fluid under the dura mater, between which and the arachnoid there intervened a false membrane, vascular and thicker than the dura mater. This false

membrane was adherent all over the surface to the dura mater, and in many places to the arachnoid. The latter membrane was very much thickened, especially over the anterior lobes; this thickening extended downwards, as far as the corpus callosum, along the horizontal fissure. Over the anterior lobes it presented a white, fleshy, gelatinous and œdematous appearance. The vessels of the pia mater were in many places enlarged, varicose, and plugged up by fibrinous clots. The convolutions were pale, anæmic, and extensivelly atrophied, and the gray matter could be stripped as a continuous membrane off the white substance. As in general paralysis, the lining membrane of the ventricles over the optic thalamus and corpus striatum was thickened and minutely granular, and the pia mater was adherent to the gray substance at different parts.

The conclusion deducible from the foregoing case requires no comment. I have yet to refer to another theory, viz., that inflammation resulting in adhesion of the pia mater to the cortical substances is the immediate cause of mania in general. Now this appearance is scarcely ever observed except in general paralysis, and it would not be in accordance with strict scientific rules, to apply it to all forms of mania. Another objection is urged, that all wounds involving loss of brain substance can only heal by such adhesions, while they are rarely followed by insanity. This is a species of argument which has been too much used with reference to mental disease, and it seems never to be taken into account that the pathogenetic processes of insanity are diseases *sui generis*, as much so as two fevers due to different specific causes. The one great fact for us is, that a diffuse inflammation of the gray cortical substance extending over many convolutions, is never observed without eminent disturbance of the mind.

Effusion.—The consideration of serous effusions conveniently and naturally follows that of the inflammatory exudations. Insanity, associated with effusion into the meninges of the brain, is of very frequent occurrence. In 411 cases collected by Dr. Skae, subarachnoid serous effusions were found 202 times, and similar collections in the sac of the arachnoid 171. Effusion is not the ultimate condition of the brain upon which insanity depends, for the serous collection is itself the consequence of a prior disease. No one asserts that mania, melancholia, and dementia are accompanied at their commencement by serous effusions; the most which is alleged is, that that suppressed or exhausted activity of the brain which takes the form of dementia may partially be caused by the effusion. The seat of the serous collection, rather than its nature, influences the form in which

insanity expresses itself. When it is located principally upon the upper surface of the brain, it is generally attended with great restlessness and fidgety imbecility.

When it is in the lateral ventricles, the loss of mental power keeps an even pace with the increase of the fluid. When the ventricles become full, the patient sinks into complete dementia, and death takes place by serous apoplexy. Great weakness of the limbs, and paralysis of some parts, are frequent symptoms. The brain substance is bloodless, and in some parts appears harder than in others. Very probably the granular appearance of the lining membrane of the ventricles in general paralysis has some connection with these fluid collections, though in what way further investigations must determine. It is highly probable that the great part of these serous effusions is first exuded in the stage of death, else we should find symptoms of pressure upon the brain developed much more frequently than is the case. To meet this objection, it has been said that the brain gradually accustoms itself to the pressure while the serum remains. But in order to prove this, it must be shown that symptoms of pressure have been present for a considerable time during life, and disappeared very slowly. Such conditions, undoubtedly, very often take place, but not always. A great number of cases, especially those without paralysis, never manifest any symptoms of pressure during life, while all general paralytics have a longer or shorter soporous stage in which the serum may probably be effused for the first time.

Effusion into the substance of the brain—œdema cerebri—is a condition which has been found in connection with mania and dementia. It is said to occur primarily, but more frequently it is the result of serous collections in the ventricles, which, owing to the thinness of the lining membrane, pass by endosmosis into the substance of the brain. Albers states that it is regularly found in combination with effusion into the cavities of the brain, when the ependyma or lining membrane remains normal, or is atrophied and thinned. That such is not always the case is proved by the autopsy of the following case of dementia. The ventricles of the brain were not over-dilated, and did not contain more than the usual quantity of fluid; their lining membrane was slightly thickened and opaque. A large quantity of yellowish-looking fluid was found under the arachnoid. The gray matter was extremely pale, the white substance soft and œdematous, the water running off copiously with every cut of the knife, and rapidly collecting into small lakes in the concave, uneven parts made by the incision. There was œdema of the extremities. The last fact favours the supposition that œdema

cerebri may have no other connection with the brain disease than merely an accidental concomitant of a general œdematous state of the body. This is also borne out by Dr. Hagen, who has met with it eighteen times; in all instances there was either œdema of the lungs, hydrothorax, œdema of the heart, softening of the spleen, or it had been preceded by œdema of the extremities or diarrhœa. Dr. Hagen cannot confirm the statements which authors have made respecting its importance. Proper stupor was observed in none of the cases; the forms of disease were mania and dementia, but they presented nothing constant in their symptoms. A kind of stupor sometimes set in simultaneously with and mixed up with the sopor preceding death. He directs attention to the fact that stupor occurs without any œdema, and that the latter does not occur exclusively in connection with this condition, but is also found in others, as has been demonstrated by Aubanel and Thore in 'General Paralysis.'

Next to effusion comes softening. This is seldom an independent disease of the brain. Insanity, associated with cerebral softening and caused thereby, is a very rare phenomenon. Softtening of the brain substance does not in itself give rise to mental disease, but is only an accidental alteration added thereto. In this complication the insanity is to be regarded as due to perverted action of the mind, and the symptoms of softening as independent or accidental phenomena. Loss of mental power, dementia, imbecility, and monomania with exaltation, are caused by conditions of the brain, which at the termination of their pathological development result in softening; but the foregoing forms of mental disease are not caused by the latter in itself. Softening of the superficial layers of the gray matter is found in encephalitis and œdema, but not very often. Accordingly, when dementia exists, it is to be referred far more to irritation of the nerve-cells and atrophy consequent thereon than to softening. Cerebral softening, according to its different causes, induces very different trains of symptoms; the inflammatory is accompanied by phenomena indicative of encephalitis, only the pain is less; that resulting from extravasation of blood and serum is attended by symptoms similar to those of apoplexy or fainting; and softening occasioned by obliteration of atheromatous vessels is indicated by attacks of giddiness and apoplectic seizure arising from the previous loss of the cerebral functions. But in all these cases the cerebral softening is only local, and destroys the activity of that function peculiar to the affected part. In softening of the grey matter of the convolutions, we find loss of memory and of imaginative faculty; the patient exhibits want of decision, and a less than usual readiness in the exercise of his judgment;

altogether there is a marked decrease in the energy of the intellectual functions. In softening of the white substance we observe paralysis of the limbs and tongue, of the face and the eyes—what is termed general paralysis—when the softening affects a large extent of the white matter, as the posterior part of the centrum ovale of Vieussens, the optic thalami, the corpora striata, and the floor of the lateral and third ventricles, or only paralysis of one of these parts, or of several combined, when they have suffered singly or in combination. Severe pains are experienced in the paralysed parts. As in all paralyses, the general nutrition suffers, and that of the paralysed parts in particular, digestion and the action of the bowels. No tissue of the paralysed part remains normal when the paralysis has continued any length of time, all become atrophied, fall off in volume and weight, and present a considerable interstitial depost of fat between the normal constituents of the tissue. The prognosis must be very unfavourable for it is but seldom that the softened brain substance heals; and when it does, it is only by passing into induration. When this takes place, spasm of a tonic kind is roused in the paralysed limbs. Softening caused by inflammation and extravasation of blood heals directly, but the atheromatous very seldom. Red and yellow softening are rarely met with in the insane, and occur not more frequently, perhaps less so, than in others.

Induration.—Induration of the brain is generally limited to certain parts of the organ; we find mention made of an induration of the whole brain, consisting in a certain tough property of the cerebral tissue observed in some cases of typhus fever; but as it is not known whether the insanity which occasionally follows this fever is associated with this alteration or not, it may be left out of view. Authors usually describe induration of the brain occurring—1st, as a scrofulous infiltration; 2nd, as a fibrinous deposit after local inflammations and apoplexy, in the form of a very hard cicatrix, round which the brain-substance is altered and presents a yellowish-green colour; 3rd, as a sequela of softening. The white substance is the principal seat of these partial indurations. They are oftenest found in the centrum ovale of Vieussens, in the optic thalamus, and in the anterior lobes. The cerebellum also presents indurations, the consequence apoplexy. The form of insanity associated with induration is usually melancholia and dementia. The first symptoms are giddiness and uncommon weakness of the limbs, which are affected with extraordinary stiffness and an imperfect kind of spasm, seldom disappearing until the induration is removed or reduced to a minimum. In aged individuals the symptoms are generally those of senile dementia, with great restlessness and

trembling of the limbs, impaired memory, and sometimes difficulty of speech. In those indurations, the sequelæ of apoplexy, a transition from paralysis to spasm, or a combination of both, is not uncommon. The spasm occurs as epilepsy.

Hypertrophy.—Hypertrophy of the brain is met with in two forms of the insane; in the first the organ is merely distended by an over-accumulation of blood; in the second there is an actual increase in the volume of the cerebral substance. These conditions, more especially the latter, are often found associated with melancholia; and when this is the case we frequently find a very extensive and beautiful development of the convolutions. Sometimes they present the most exquisite arching of their upper surface, at others they are flattened by the pressure of the cranium. Certain alterations of the nervous tissue are stated to have been observed in hypertrophy. Many places of the gray matter appear harder than usual; the veins are dilated forming microscopic varicosities, and some of the smallest are enlarged to four times their ordinary calibre. It is not unreasonable to infer from this condition of the vessels, that they must exercise a pressure upon the nerve-fibres and the multipolar ganglia, and thus an imperfect paralysis of the gray matter will be produced. At the same time the fatty matters of the cortical substance increase, and a great number of granules and granular bodies are to be observed in it, altering its colour to a yellowish-gray, or even to brown. In many places which appear hard and somewhat depressed, small blood-red spots of the size of a needle's head occur, consisting of blood-corpuscles, granules, and sometimes crystals of hæmatine. They are only small extravasations of blood, which are remarkable from their small size and great number. It has often been observed, that in insanity associated with hypertropy the patients exhibit a tendency to suicide, a very dull, obstinate disposition, and an incapacity to collect and retain their thoughts. Under this head it is convenient to notice Dr. Skae's observations as to the relative increase in the weight of the cerebellum to that of the cerebrum in the insane generally, but more particularly in general paralysis. These extend over 199 cases, of which 98 were males and 101 females. From the average of the whole it was found that the cerebellum in the males bore the relation of 1 to 6·74 in the insane, and 1 to 7·06 in the sane; in the females, 1 to 6·64 in the insane, and only 1 to 7 in the sane. It ought to be noticed that the relative increase in the weight of the cerebellum does not seem to have been caused by a simultaneous loss of weight in the cerebrum, for the cases experimented on appear to indicate an increased absolute weight of the whole brain as compared with the sane. In con-

nection with this point, the same writer has pointed out that the specific gravity of the brain substance, as a whole, is higher in the insane than the sane; and, what is still more curious as confirmatory of his foregoing observations, that the specific gravity of the cerebellum attains a greater increase in relation to that of the cerebrum, than it does in persons dying sane. Under these circumstances, Dr. Skae asks, "whether it may not be inferred that the cerebellum is the organ through which we exercise self-control—control over the volitions and successions of our thoughts, as well as over the voluntary muscular movements—a perturbed volition, or a loss of self-control, being of all others the most essential, characteristic, and pathognomonic feature of insanity?" All things considered, it appears no very violent assumption to regard the increased weight of the cerebellum as a species of hypertrophy.

Atrophy.—Of recent years considerable attention has been directed to this condition of the brain, and at one time it appeared to have the special mission of founding a peculiar species of mental disease. German writers describe two kinds of cerebral atrophy. In the first it is uniform, extending over a greater or less extent of the brain, with a diminished volume of the atrophied part. In the second it is what is called interstitial—that is to say, the parts on the whole retain their original size, but the solid constituents of the brain substance decrease and atrophy—this is termed marasmatic atrophy. The former is generally associated with induration, and extends uniformly from the great hemispheres to the optic thalami and corpora striata. It is a secondary process, and very often results from inflammation of the pia matter, which partially closes up the vessels of the brain. The space which the brain does not occupy is filled with fluid. The second, or marasmatic form, is often accompanied by senile arachnoiditis, and, upon section, shows wide openings of stearotic vessels.

The most interesting fact connected with cerebral atrophy is its relation to general paralysis, in which there is a disposition to regard it as preceding the paralysis of muscular motion and the "delire ambitieux." If there is any such connection, it can only be with marasmatic atrophy, which is rather a pathological process than an anatomical fact. Numerous cases are on record to prove:—1st, that atrophy of the brain-substance is observed without any previous symptoms of paralysis or the "delire ambitieux;" 2nd, that monomania of grandeur occurs in its most perfect types without paralytic phenomena; 3rd, that the same delusional ideas are observed with and without paralysis of the tongue, when no atrophy was recognisable after death. So long

as these three facts are not disproved, they serve to show that cerebral atrophy, as an anatomical fact, has no fixed or definite relation either to general paralysis or to monomania of grandeur, or to the two diseases combined.

The exact experiments of Dr. Bucknill upon the absolute atrophy of the brain in insanity, made by comparing the quantity of water which the brain displaces, with the capacity of the cranium, seem to have conclusively determined that all conditions of dementia are associated with a certain degree of cerebral atrophy; for, although it may not be the primary cause of insanity, it is quite in accordance with physiological notions that the nerve-vessels, when placed in conditions of mal-nutrition, should undergo an atrophic process, and thus be rendered incapable of functional activity. Without hazarding any theory, it may be said that we find atrophy of the brain associated with dementia, sometimes combined with a delirious sort of insanity, paralysis of the tongue and body, impaired sensation, and a considerable diminution of the natural heat. It has been observed that the cranium is sometimes thicker on the atrophied side.

Osseous projections and deposits.—In the falx, and adhering to the cranial vault, masses of bone are not unfrequently met with, measuring several inches in size, and weighing from half an ounce to an ounce and a half. Their average thickness is stated at about one to three lines. Although these formations are generally the result of various antecedent pathological processes, still they are calculated, from their size, to injure the cerebrum by their pressure and irritation, to alter its nutrition and give rise to a varicose hyperæmia. In this way they may render insanity permanent.

Dr. Meyer, of the Hamburgh Asylum, has succeeded in tracing back the pathological process, to which these osseous formations are due, to the Pacchionian granulations. These he regards as the starting-point of the deposits, found in the falx, the transverse sinuses, and the frontal part of the dura mater. The ossification always commences with a chalky incrustation of the epithelial covering, consisting wholly or in greater part of carbonate of lime. As the process advances, the superficial layers of connective tissue adjoining the incrustated epithelium, become involved. Numerous, very small chalk granules, are to be observed between the fibres, which are stiff and brittle, and have lost the disposition peculiar to connective tissue to form wavy or curly bundles. When the superficial layers are completely ossified, the central bundles often retain their natural structure and flexibility intact, and the ossifications are connected to the arachnoid by a thin, fibrous pedicle. After penetrating the dura mater, and forming

more or less extensive depressions in the cranial vault, these villous-like processes readily grow into its internal surface, and after its removal project from it in the form of stalactite osteophytes. When they are not wholly ossified, they are easily distinguished by a certain flexibility, as well as by their fibrous pedicle from the oseophytes of the external layer of the dura mater, which forms the periosteum of the internal plate of the skull. Large pieces of bone are formed by the growing together of adjoining groups, often from opposite sides of the falx, through foramina and thinned places which have resulted from the growth of the Pacchionian granulations.

The osseous deposits found in the falx would appear to have most influence upon insanity. Proceeding, as we have seen, from the arachnoid, they always cause a more or less considerable pressure upon the subjacent hemispheres. In the parts subjected to their pressure and irritation, the pia mater has been observed beset with numerous dilated vessels, and these vascular alterations are continued into the brain-substance, which in some places is indurated, in others softened, and almost always somewhat atrophied.

The form of mental disease most frequently associated with these conditions is melancholia. Imbecility is sometimes found connected with the smaller deposits; but in both cases, the condition of the membranes, irritated by a dyscrasic nutrition, appears to have a far more disturbing effect than the ossification itself. The great thickening, often parchment-like character of the meninges, not unfrequently combined with ossific deposits, shows that the nutrition of the brain must have suffered in a very high degree. Ossification of the arteries has been found in dementia. I observe, from the pathological register of Morningside Asylum, that osseous formations are occasionally met with in cases of monomania, particularly of suspicion.

Scrofula, tubercle, cancer, and other tumours.—These conditions, it must be confessed, are very rare in the insane, certainly not less so than in the sane, in whom they are found to cause in only a small fragment of cases some unessential and variable disturbances of the mind, generally not going farther than depression and weakness of memory. These facts appear to favour the theory that there must reside in the nervous system of the insane an ultimate irritability of tissue, which tumours and other neoplasms may develope into disease. Scrofulous deposits occur in the brain in infiltrated and isolated forms, but the former are the more frequent. They are to be met with in the arachnoid and pia mater, forming white specks, consisting of sandy, granular bodies. Isolated scrofulous tumours are generally developed in

the brain-substance. This condition of the brain is occasionally found in dementia of the scrofulous, in conjunction with serous effusion, and may possibly have some connection with cretinism. In some rare cases, insanity appears to depend on tubercle of the brain, either primarily deposited in that organ, or transplanted thither during the course of pulmonary phthisis. In 184 cases of insanity, associated with tubercle of the lungs, Dr. Clouston, of the Edinburgh Royal Asylum, found it only once. Disease of the mental functions resulting from primary cancer is very unfrequent, because cerebral cancer itself is so exceedingly rare. When it does occur, it oftenest takes the form of meningeal cancer; and so long as it is of small size, it gives rise to no very important symptoms. As its growth progresses, it occasions symptoms of pressure and atrophy of the brain, and by degrees weakness of memory and perverted judgment show themselves, until at length absolute dementia is ushered in. But in many cases this is an exaggerated statement; the disease often stops short with a kind of torpor of the intelligence, which from time to time breaks forth in fitful gleams of reason. Sometimes small cancerous tumours act like foreign bodies in the brain, and cause spasm, and pain, and epilepsy. They also give rise to inflammation of the membranes, and serous effusions into the meninges.

Insanity is occasionally found in association with hydatids of the brain, and fibroids of the dura mater and arachnoid. These, like tumours in general, besides functional disturbances of the cerebral functions, give rise to many and various abnormal expressions of the intellectual faculties, such as impaired memory, the confounding together of recollections, incapacity for minute and sharp reflection and judgment, and, finally, dementia.

Mania and monomania are not observed in connection with tumours of any considerable size; these paralyse the brain too much by their pressure and irritation to permit of these symptoms being developed. Hygromata and cysticerci have been found in the choroid plexus, and encephalo-cysts in the brain-substance. Fibroids are developed from the pia mater and arachnoid, and from the lining membrane of the ventricles. Besides the general symptoms already mentioned, when they are situated upon the corpus striatum or optic thalamus, they cause hemiplegia, squinting, and impaired speech; while symptoms of cerebral congestion are not wanting.

The last subject is abnormalities of the cranial bones. We observe that in insanity the skull is often unusually thick, and its diploe entirely filled with osseous matter. It is generally believed that this condition, if not quite an accidental occurrence, originates during the progress of the disease. There are some

exceptional cases, however, of short duration, in which it is obvious that the thickening could not have taken place after the commencement of insanity. Some advocates of mechanical theories have represented this condition as giving rise to mental disease by pressure and constriction of the cerebral movements, but it is probably an indication that the bones are involved in the same process which affects the brain. It does not speak in favour of this view that this sympathy of the bones nearly as often takes the form of atrophy and thinning, in which, of course, there can be no pressure; but, indeed, both phenomena are met with in the sane. According to Virchow, atrophy of the cranial bones gives rise to weakness of intellect and impaired memory. Hyperostosis of the skull would appear to have some relation to atrophy of the brain-substance, being often found on the atrophied side; but whether as a consequence or a cause has not been satisfactorily determined.

Deviations in the structural build of the skull appear to be of considerably greater importance, being one of the chief peculiarities of cretinism. It is often larger or smaller than it should be, and very unequal in its different diameters. These abnormalities are often found in the insane, and some of them are due to the ossification of the sutures. As regards the relation of these cranial deformities to insanity, it is evident that they cannot be a proximate cause, because they exist a long time before its outbreak, and they are also found in the sane. As a prominent instance, it may be mentioned that the sutures of Lord Byron's skull were found ossified at his early death. They may, however, be regarded as a pre-disposing cause. Stahl, who has paid considerable attention to this subject, points out that the premature closing of the sutures is not caused by pressure upon the brain, but, on the contrary, is an indication that the organ has grown in and away from the bones in certain directions, and thus permitted their ossification. The symptoms are different according to the degree of deformity. Cretinism sometimes sets in immediately, or at first there may be nothing more than a slight deficiency of natural sharpness, sometimes obstinacy and unmanageableness, until, under the pressure of the conditions of life, the insufficient intellect completely breaks down, and insanity is ushered in.

This closes the review of the pathological appearances in insanity, and the result which is deducible from the whole foregoing observations is so evident, that it is scarcely necessary to express it. The pathological lesions of the cerebral tissue are not the final and ultimate causes of insanity; for in all cases it is necessary to assume a special and specific irritability of the

nervous tissue peculiar to the insane. This granted, they then assume their legitimate position as secondary causes, and take their place with the pathological phenomena of the body in general. In making this assumption, it will be found that medical psychology takes up no position inconsistent with the facts we possess in relation to the causation of disease. In tracing back a disease to its ultimate source, we never get beyond the exciting or secondary causes. We have established pretty clearly that almost every individual and every family has a "predisposition" to some special malady, constitutional or acquired. There the "problem begins," and we wisely fall back upon the exciting causes which develope this "predisposition" (as we in our ignorance call it) into active disease. The same holds good in insanity; there is an ultimate and peculiar idiosyncrasy, constitutional or acquired, which, under certain conditions, such as congestion or anæmia, is rapidly developed into mental disease, and these abnormalities in nutrition, in their turn, give rise to pathological alterations of the brain-substance which deprave or destroy the functions of the mind.

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