Art. VI.—The Brain in Health and Disease.

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The Histology and Functions of the Cerebrum.

The study of the histology and functions of the cerebrum—not alone of the several ganglionic centres, but also of the different layers of the great "hemispherical ganglia," formed by the convolutions of the cerebrum—has as yet been little prosecuted. It presents a wide field for investigation, experimental inquiry, and discovery; and, already, such investigators as Dr. Ferrier, Sir Charles Bell, Dr. Carpenter, and Dr. Brown-Séquard have thrown great light upon the localisation of brain function. We know very little, positively, of the different operations of psychological and intellectual life, the phenomena of which have been but slightly noticed and are open to discussion. Mental diseases depend upon a physical lesion of the central nervous system, and as there is a very close relation existing between the regular functional activity of a normal brain and the diverse functional manifestations in insanity, the study of the structure and functions of the successive ganglia which compose the brain is a matter of deep interest as well as necessity to students of psychology.

The white substance of the hemispheres consists of medullated nerve fibres of about 0.0026-0.0067 mm. in diameter, while at the surface of the larger ganglionic masses, and towards the cortex, some non-medullated fibres are seen. The fibres of the white matter are separated from one another by bands of delicate connective tissue-fibrillated sustentacular matter, in which are situated, at intervals, round or oval nuclei, smooth in contour, and measuring 0.0093-0.0075 mm. These fibres of the white matter may be divided very properly into two classes: 1st. Those having a radiating and converging direction or course; and 2nd. Those uniting the two halves of the cerebrum and forming the corpus callosum, which is properly to be looked upon as a physiological as well as an anatomical commissure, and it is often found to be absent in congenital idiots. The cortex of the cerebrum, or grey matter of the convolutions, is divided into several layers or laminae, the number being variously estimated by different observers, among whom are Kölliker, Arndt, Meynert, and Frey; the latter regards...
the cortex as divisible into six laminae. The general plan of structure of the grey matter of the cerebrum is, primarily, a wide-meshed network of medullated fibres, in whose interstices ganglion cells are situated. We also find that very delicate network of very fine fibres met with in the grey matter of the spinal cord, first discovered by Deiters, which consist of very delicate fibrillæ springing from the broad protoplasm processes of the ganglion cell. These fibrillæ, Deiters regards as a system of secondary axis cylinders for the most delicate nerve fibres. Gerlach first described the network as occurring as well in the cortex of the cerebrum as in the spinal cord. The remainder of the grey matter is made up of the delicate sustentacular substance before alluded to as intervening between the fibres of the white matter. In the superficial layers of the convolutions, the cells are small multipolar nerve cells, analogous to the small cells in the posterior cornua of the cord; while in the deeper stratum, or fourth layer of Frey, are found large multipolar ganglion cells 0·025-0·040 mm. in diameter, presenting oval or roundish nuclei. These large cells correspond to the large cells in the anterior cornua of the spinal cord, which, it will be remembered, send out "axis cylinder processes," which are prolonged into the nerve fibres of the motor roots. In like manner we observe under the microscope an "axis cylinder process" given off from these multipolar ganglion cells of the deeper layers of the convolutions of the cerebrum, which process is prolonged into one of the nerve fibres of the corona radiata. It is, I think, demonstrable that there is a lateral anastomosis between the cells of each layer or lamina, and also anastomoses between the successive layers of the convolutions. I desire now to advance the theory respecting the functions of the hemispheral ganglia, or cortex of the cerebrum, which has appeared to me, during my microscopical investigations on brain tissue, to be the most reasonable one. We are already familiar, through the admirable physiological treatises of the present day, with the general description of the structure and functions of the nervous system, so that in speaking of the structure and functions of the grey matter of the hemispheral convolutions, I desire to be understood as referring to the histological elements, the functional activities of which we are as yet comparatively unacquainted with. Of course it is impossible to limit exactly the special attributes of any particular group of cells in the convolutions of the cerebrum; yet, by comparing them with the elements of the spinal cord, may it not be possible to make certain legitimate inductions relative to their diverse activities? I have just stated that the large nerve cells of the convolutions correspond to the
multipolar ganglion cells of the anterior cornua of the spinal cord, which cornua are connected with the motor roots of the spinal nerves; while the small and superficial cells of the convolutions are analogous to the small cells of the posterior cornua of the cord, which are connected with the sensory roots of the spinal nerves. We have also seen that in both the multipolar ganglion cells of the deeper layers of the convolutions of the cerebrum, there exist processes which become the axis cylinders of nerve fibres. I think, therefore, that we may fairly conclude that the superficial layers or laminae of the convolutions of the hemispheres, disseminate the impression of general sensibility, and that the deeper layers, containing the larger multipolar ganglion cells, originate motor impulses.

The cerebral ganglia whose structure and functions remain to be considered are the corpora quadrigemina, thalami optici, and corpora striata. The structure of the corpora quadrigemina consists of a white layer overlaid with a zonal stratum of nerve fibres. Underneath them, the crura cerebelli ad corpora quadrigemina pass on to reach the cerebrum, and should more properly be called, as Frey remarks, crura cerebelli ad cerebrum. Laterally, there enter the corpora quadrigemina from below, the two leminisci arising from the motor tract of the medulla oblongata, and traceable back to the same tract or part of the medulla. In the anterior tract of the corpora quadrigemina a root of the optic nerve, coming from the corpus geniculatum internum, terminates. Small nerve cells are seen in the internal grey substance of the quadrigeminal bodies, with larger multipolar and fusiform ganglion corpuscles, the latter being said by Meynert to be found in the deeper layers of the anterior bodies, about the aqueduct of Sylvius. The functions of these bodies are tolerably well understood, as they give rise to the optic nerves, and act as the ganglia of sight, from which they have been also called "optic ganglia." Destruction of these bodies causes complete blindness. They thus serve as nervous centres for the perception of light, and a reflex action also takes place through them, by which the amount of light admitted to the eye is regulated to accommodate the sensibility of the pupil. The structure of the optic thalami, like the corpora quadrigemina, consists of a white layer overlaid with a zone of nerve fibres. The posterior end of these ganglia has been termed the pulvinar. Internally to it, and more posteriorly, is situated the corpus geniculatum internum; and, externally, the corpus geniculatum externum. Into the latter a portion of the optic tract passes on its way to the pulvinar. Fusiform cells are found more deeply coloured than those of the corpora quadrigemina. The cells of the corpus geniculatum externum are
found to be frequently pigmented, and the internal geniculate body also contains fusiform cells. The thalamus receives numerous white fasciculi coming from the hemispheres. They run towards the superior surface of the thalamus to the superior and internal border and the pulvinar, and are ultimately lost in the same manner as are the fibres continued from the crus cerebri into the corpus striatum; that is, by a sub-division into close plexuses of extremely delicate nerve fibres. The functions of the optic thalami are but little understood. They are not, however, principally connected with vision. From experimental observations which have been made it seems most probable to the writer that the optic thalami receive, preserve, and transform the sensorial impressions, previous to their definitive irradiation to the cortical periphery. It would seem to be proper to regard the optic thalami in four distinct parts or ganglion tracts. The anterior ganglion tract is undoubtedly connected with olfactive impressions. The middle ganglion tract receives the nerve fibres of the second pair and may properly be called the optic tract. The posterior ganglion tract, from its connection with the perception of sounds, may be called the acoustic tract; and there is undoubtedly another tract of the optic thalamus, which, from its close relation to the sensitive fibres of the convergent system, may be called the tract of general sensibility.

The structure of the corpora striata consists of a collection of grey matter, nerve cells, and of fine nerve fibres. They contain two larger nuclei respecting which we know very little. The system of nerve fibres is derived from crura cerebri running parallel in a straight direction, entering both nuclei, and ultimately lost in these nuclei. The surface of the corpora striata is grey, and in the grey matter we observe multipolar ganglion cells and smaller cells. The neuroglia is analogous to the neuroglia of the cortex of the cerebrum. There is also another set of fibres proceeding probably from the medullary substance of the hemispheres which ramify in the large nucleus of the corpus striatum. These fibres differ from those derived from the crus cerebri, which in this location are extremely attenuated, and present a plexiform arrangement. Physiologists have supposed the functions of the corpora striata to have some connection with sensation and volition, although they have not attempted to explain the nature of the connection. As experimental observations have proved that destruction of the corpus striatum results in motor paralysis, with the preservation of intelligence depending upon the extent of the lesion; and also as cases have occurred in which the functions of the corpus striatum having been not destroyed, but impaired
by compression or degeneration of its elements, there have resulted disturbances in the motor sphere; may we not reasonably infer that the corpora striata are undoubtedly the centre of the reception, regulation, and elaboration of voluntary motor impressions emanating from the deep layers of the cortical matter whose large cells originate them?

There is no question more interesting to the follower of mental pathology, than that of the connection between nerve function and nerve organisation, and it is only by the better knowledge of the physiological laws of the brain that we can determine that connection; and it is only by patient experiment and observation that we are to fully understand the nature of the relation between the histology of the brain and the physical functions. It is impossible to fully appreciate the pathological changes met with in the brain, until we are in full possession of all the available knowledge of cerebral histology, and of the knowledge of the normal functional activity of nerve cells, and we certainly cannot understand defective intellect unless we are thoroughly acquainted with the ordinary and normal manifestations of intellect. We must therefore clearly understand the physiological laws of healthy mental action before we can comprehend any departure from the healthy working of such laws. With this end in view have the writer's efforts in the direction of the study of the physiology and pathology of the central nervous system been made. It being a very difficult matter to harden the very delicate tissue of the brain, so as to be enabled to cut sufficiently thin sections for demonstrating the finer structural relation of the tissues, the writer gives the formula employed by him for a hardening fluid for the brain and spinal cord, which in its effects surpasses any other hardening fluid, and better prepares the tissues for the reception of staining fluids. It is as follows:

\[ \text{F. H.} \]

Bi-chromate of ammonia.
Methyl alcohol.
Distilled water.

The Pathology and Morbid Histology of Acute and Chronic Insanity.

The morbid histological changes occurring in insanity are, at the present day, undergoing microscopical investigation at the hands of many very skilful observers, both in our own country and in Europe, and these assume great importance when we reflect upon the fact that the pathological phenomena discovered in the brains of persons dying insane, all have for their basis, interference with the due nutrition, growth, and renovation of
the brain cell, which, by interrupting the nutrition, stimulation, and repose of the brain, essential to mental health, results in the impress of a pathological state in the brain and disordered mental function. The investigation of both the normal and the morbid histology of the brain is a work requiring great labour, patience, and perseverance, and also judgment in the recording of observations; and even with the most conscientious and careful microscopists mistakes may be made at times, as to the nature and value of appearances met with in histological research. We may fairly divide the pathological changes met with in insanity into three classes.

First. Those which may be considered accidental.
Second. Those which are found in other diseases yet appear to be concerned in the production of insanity.
Third. Those essential to mental disease.

In the first class we may enumerate cerebral hæmorrhages, softening of the white substance, and disease of the cerebral vessels. In the second class we meet with thickening and opacity of the arachnoid, hyperæmia of the pia mater and of the brain, serous infiltration of the pia mater, and collections of fluid in the arachnoid cavity. In the third class, or the changes essential to mental disease, I would enumerate sub-arachnoid ecchymosis, and a partial punctiform injection of the cortical surface, with or without softening; extended softening of the middle portion of the cortical substance; adhesion of the pia mater to the surface of the brain; different discolourations of the cortical substance; loss of colour of the cortical substance; atrophy of the convolutions; and, lastly, induration of cerebral tissue.

The naked eye appearances which may be met with in the bodies of those dying insane, are chiefly peculiarities in the form of the cranium, of which the most frequent is want of symmetry between the two sides; the shrunken and shrivelled ear in chronic insanity, consequent upon hematomia auris; variations from the normal standard in the thickness or thinness of the cranium; changes in the membranes as to appearance and structure; and, finally, changes in the cerebral substance itself. In acute insanity the changes or prominent alterations in the brain—as will be seen in the appended cases illustrative of the pathology and morbid histology of insanity*—met with by the writer have been—hyperæmic conditions of the brain and its membranes, which latter are often thickened and opaque; injection and softening of the cortical substance, and pigmenta-

* We regret to say that the copies of the photograph of the microscopic structure of the brain, forwarded to us with this paper, have not reached us at the moment of going to press. We propose to publish them in our next number.
tion of the cortical grey substance. While the dura mater is very rarely thickened, its vessels are found to be dilated and irregular, and the coats of the vessels much hypertrophied. The arachnoid I have found to be thickened, to be the seat of hæmorrhage, and have often found it covered with fine granulations on its surface. The blood vessels of the brain I have found to present thickening of the coats, thickening of the sheath or hyaline membrane, deposits between the adventitia and sheath, and proliferation of nuclei. The neuroglia has been found to be the seat of various lesions in insanity, the principal of which are disseminated sclerosis or grey degeneration, atrophy, miliary sclerosis, and colloid degeneration. The cerebral cells I have found to be the seat of atrophy, pigmentary or granular degeneration, calcification, and hypertrophy. Microscopical examination of the spinal cord in the insane has revealed to me very little, except in paresis generalis, where an atrophoid condition of the cells of the posterior columns has been found, with an increase of connective tissue which seems in most instances to commence externally and extend inwardly. I think it is proper to call this lesion of the cord the distinguishing lesion of general paresis. The cells of the cervical sympathetic have also been found undergoing pigmentary granulation in general paralysis, and also in epileptic insanity.

In chronic insanity the changes chiefly met with in the brain have been atrophy of the convolutions and brain itself, induration of both white and grey matter, thickening and opacity of the membranes, chronic hydrocephalus, effusions into the sub-arachnoid space, pigmentation of the cortical substance, and extended and profound sclerosis of the brain. The pia mater is found to be thickened and adhesive to the brain, and its vessels tortuous and thickened in their walls. I have also noticed atheromatous and fatty degeneration of the walls of the cerebral capillaries. Having devoted considerable time and thought to the microscopic investigation of both the normal and morbid histology of the brain, I desire to call particular attention to an appearance which I have noticed in the brains of those dying insane, and to which my attention has been drawn from the interest it assumes when viewed in the light of the probable ultimate cause of the nutritive defect which results in chronic insanity. We know, that for the proper nutrition and healthy functional activity of the brain cell, is required the proper nutrient supply, and that we cannot have healthy mental function without a due supply of healthy blood to normal and healthy brain substance. We also know if any agent operates in the influencing of the circulation unfavourably, so that a morbid condition of the cerebral capillaries be induced,
that we shall inevitably have resulting morbid changes set up and maintained in the cerebral cells. In previous writings on insanity I have called attention to the fact that a microscopical examination of blood from insane patients, as compared with an examination of blood from the same number of healthy persons, revealed in the blood of the insane a marked increase in the number of white blood corpuscles. In making microscopical examinations of brain tissue from chronic insanity, I have noticed repeatedly in different cases lymphoid cells or white corpuscles, and also red corpuscles in small numbers, in the membranes and in the substance of the brain itself, evidently having emigrated from the blood vessels. From what I have observed, I think, that under conditions of inflammatory irritation of the brain, an emigration of lymphoid cells takes place on a large scale, the cells or corpuscles, by virtue of their vital contractility, passing through the walls of the vessels and penetrating into the brain tissue. It will be remembered that both Dr. Bastian and Dr. Blandford have noticed a plugging up of the blood vessels by small embolic masses composed of aggregations of white corpuscles in insanity. Ekké found that the vessels of the grey matter more generally dilated in insanity, and Ramaer also noticed the same thing in the vessels of the pia mater, while Dr. Major has described a dilatation of the arteries in "brain wasting," a condition which appertains to chronic insanity. We have here two factors which operate, I think, in the production of the appearance in the pia mater and the brain of the lymphoid cells and in some cases of the red corpuscles—first, the undue predominance and accumulation in the blood vessels of the white corpuscles, which obstruct the capillaries, giving us as a result an impeded circulation and an increased pressure in the coats of the vessels; and second, the dilatation of the vessels before alluded to. These two conditions are favourable to the rapid emigration of the white and also the red corpuscles through the walls of the vessels; and also, perhaps, the same condition may be produced at times by the obstruction in the capillary vessels, becoming great enough to rupture them. Such lymphoid cells must act undoubtedly as foreign bodies, and a slow course of inflammation is set up. Such an inflammatory process must necessarily be of slight intensity and long duration, and these collections of lymphoid cells undoubtedly tend to become developed into a fibroid structure, resulting in the induration of the brain which we meet with in chronic insanity. I am also forcibly impressed with the idea that we have here the solution of the problem as to the relation which exists between tuberculosis and insanity. Dr. Clouston, in the Journal of Mental Science for April 1863, showed
that of 828 patients who died with tubercular disease at the
Royal Edinburgh Asylum, 153 passed rapidly into the state of
chronic insanity; the acute stage being of very short duration,
the patients all manifesting a decided tendency towards chron-
icity. He also noticed that the prognosis relating to mental
recovery was eminently unfavourable, and that apparent re-
coveries proved to be only remissions. In these cases, where
the development of the two diseases seemed to Dr. Clouston to
be nearly contemporaneous, was not the tuberculosis the result
primarily of the escape or emigration of the lymphoid cells
into the connective tissue of the lungs, owing to this state of
leucocythemia in the patient? I think that this condition
occurs more frequently than we are aware of, especially in
persons who inherit the predisposing neurotic element or
morbific force. That there exists such an hereditary neu-
rotic or morbific element or force, present in both insanity and
phthisis, I most firmly believe; and I also believe that there
is a correlation of morbific force which renders these diseases
mutually convertible. I have repeatedly seen this borne out
by undeniable facts, children of one family being affected with
both insanity and phthisis, in many different instances.* To
return, however, more immediately to our subject. Respecting
the dilatation of the vessels, which I before alluded to, it
appears to me that the general obstruction in the capil-
laries of the brain causes primarily, probably, a compen-
satory hyperemia, and as this gradually becomes permanent,
the small arteries would naturally become enlarged, as they
have been found to be by Ekker, and Dr. Major, and also
myself, and their walls would become thickened, as we find
them to be, post-mortem, in chronic insanity. Such long-con-
tinued mechanical hyperemia causes an impairment of vitality
and function, and this we find exemplified by the retrogressive
changes which occur in the substance of the brain in chronic
insanity—viz. atrophy, induration, and degeneration of the
nervous elements of the brain. With the exception of cases of
apoplexy in which large clots have been discovered post-
mortem, I am not aware that any observer has described any
such lymphoid deposit in the brain, which may or may not
have undergone fibroid metamorphosis or degeneration. I
think therefore that from both a physiological and pathological
standpoint these observations become of the highest clinical
significance. I desire not to be misapprehended as regarding
the presence of the lymphoid desposits in the brain as the

* We are glad to find Dr. Winn's theory, that "hereditary diseases" depend
on a correlation of morbific forces, is recognised in America (vide Nature and
Treatment of Hereditary Diseases with reference to a Correlation of Morbific Forces.
London: Hardwicke. 1869).—Ed.
ultimate cause of insanity. I do, however, think that by their presence we are enabled to explain many of the changes incident upon chronic insanity, and think their presence must affect very materially the ultimate molecular changes in the brain, upon which its functional activity depends, and regard it as a very strong probability that such foreign deposits in the brain, may, by interfering with the molecular changes just alluded to, destroy both functional excitability and activity. It would appear very probable that the prominent alterations taking place in chronic insanity—viz. atrophy of the convolutions and of the brain itself, and induration of the two substances, with degeneration and atrophy of nerve cells—may be considered fairly to depend upon this abnormal state in the mutual relationship between the blood and the tissues, which becomes the ultimate cause of the nutritive defect which results in chronic insanity.

Cases Illustrating Pathology and Morbid Histology of Insanity.

Case I.—Melancholia with Delusions. Death resulting from chronic meningitis. C. Mc., male, aged 44 years, single; occupation porter. Upon admission was noisy and maniacal. This state lasted but a few days and he then became depressed and melancholy. He refused food for a number of days and had to be fed artificially. The melancholia assumed an acute form, and he had hallucinations of sight and hearing, causing at times great terror and mental excitement. At such times, when he imagined that he saw devils in the ward, his face would assume an aspect of the utmost fear and distress. He often expressed a wish to commit suicide. He died quite suddenly about five months after his admission, having eaten and slept but little for some days previous. Post-mortem.—Upon removing the calvarium, the dura mater was found to be adherent to it; the pia mater was thickened, infiltrated, and hyperæmic; the arachnoid was clouded and covered with granulations; the brain was hyperæmic and the cortical substance softened; the lateral ventricles were filled with fluid; the lungs revealed commencing tuberculosis; the kidneys, spleen, and liver were normal.

Case II.—M. H., male, aged 31, single, and by occupation a labourer. Admitted to asylum with melancholia. Had delusions of fear and persecution, and had suicidal impulses. Often refused food, saying he wished to die. The mental faculties were very feeble, and the enfeeblement gradually increased. The bladder became paralysed, and the health gradually failed
for about eight months, when he died from exhaustion. Post-mortem.—The membranes were found to be adherent to each other, and the pia mater was thickened and adherent to the surface of the brain. Throughout the brain were small miliary tubercles; the substance of the brain was softened near the base; there was also considerable effusion about the base of the brain, and effusion in the lateral ventricles; lungs normal, kidneys congested, spleen, liver, and heart normal.

Case III.—Melancholia with religious delusions and hallucinations of sight and hearing. Death resulting from acute tuberculosis and rupture of pulmonary artery. J. S., male, aged 20, single; occupation labourer. Upon admission to asylum was in poor physical condition, having never regained his strength since an attack of pneumonia, some months previous. There was dulness at the apices of both lungs, and a prolonged expiratory murmur with difficult respiration. He was very much depressed and melancholy, and said that he had committed unpardonable sins, and should be eternally lost. At night he imagined he was visited by evil spirits, who tormented him. He died suddenly five months after admission. Post-mortem.—Dura mater firmly adherent to the skull; the meninges were congested and the vessels enlarged; the brain revealed softening of the cortical substance and effusion of fluid in the lateral ventricles. Examination of the lungs revealed the existence of tuberculosis. The upper and the middle lobes of the right lung were partially destroyed, and the sudden death was found to be the result of rupture of the upper branch of the right pulmonary artery in the middle lobe of the right lung.

Case IV.—Dementia and paresis. Death resulting from pulmonary hæmorrhage. T. A., male, aged 22 years, single; occupation waggon maker. Upon admission to asylum was demented, with symptoms of paresis. Laughed vacantly when addressed and stared unmeaningly about him. No appreciation of condition or surroundings. His gait was staggering, and his lips and tongue were affected with muscular tremors. He never spoke but once and that was upon the occasion of a visit from his brother. His speech at that time was hesitating and trembling. He had an attack of sub-acute meningitis four months after his admission, and died three months later from an exhausting hæmorrhage from the lungs. Post-mortem.—The membranes were found to be adherent to the skull; there was sub-arachnoid effusion, and a large effusion between the pia mater and the brain. The pia mater was thickened in patches. There was effusion at the base of the brain, fluid in the spinal canal, and the spinal cord was atrophied. There was
a miliary tuberculosis throughout the brain. Upon making an examination of the chest, the left lung was found to be partially destroyed by the breaking down of the caseous products of pneumonia, as a result of which large cavities were formed. The heart gave evidence of recent endocarditis. The surface of the heart and endocardium were covered with miliary tubercles. The walls of the heart were atrophied and exhibited traces of fatty degeneration. The kidneys, spleen, and liver were all normal. Upon hardening the spinal cord and making thin sections, and employing carmine staining, there was found to be, upon microscopical examination, atrophy and degeneration of the nerve elements of the posterior columns, with increase of connective tissue. Sections of hardened brain tissue being made, there was observable in the cerebral cells of the frontal convolutions (after staining) a diffused granular degeneration. Also diffused collection of the lymphoid cells, alluded to previously in this paper, most of which had undergone a fibroid metamorphosis. No change could be detected in the cells of the cervical sympathetic, which was carefully examined.

Case V.—M. A. R., female, aged 29, single; occupation servant. Admitted to asylum with dementia, which ended in paresis. Speech was slurring and hesitating, and her gait was staggering. She would become very angry at trifling incidents, and then would relapse into silence which lasted sometimes for weeks. She suffered from gradually progressing paralysis, which involved the sphincters of the rectum and bladder. The cutaneous and muscular sensibility was impaired, and likewise there was loss of electro-muscular contractility, so that disease of the antero-lateral and posterior columns of the spinal cord was diagnosticated before death. The paresis was attributed to spinal injury received when quite young. She died from exhaustion four months after admission. Post-mortem.—The dura mater was firmly adherent to the cranium; the pia mater was thickened and infiltrated, and the arachnoid thickened and opaque. The convolutions of the brain were atrophied and the brain substance indurated. There was fluid in the spinal canal and the cord was slightly atrophied and softened in patches. The heart was small and flabby, spleen atrophied, stomach, liver, and kidneys, normal. The uterus was in a rudimentary condition, apparently never having been developed properly. The spinal cord, after being hardened and sections being made, revealed, upon microscopical examination, loss of neuroglia and connective tissue, and degeneration of the posterior columns, and loss of nerve tubules of white substance. The ganglion cells of both anterior and posterior cornua were
disintegrated and atrophied, and granular and fatty matter occupied their place.

Case VI.—Dementia and epilepsy. Death taking place during a succession of paroxysms. O. M. S., male, aged 19; occupation gardener. Was admitted to asylum with epilepsy associated with mania, which preceded and followed the paroxysms, requiring sometimes mechanical restraint. Dementia soon resulted from the mental deterioration. The patient had epileptic fits nearly every day, which condition had been going on for years. He also inherited the predisposition to epilepsy. During the mania he imagined himself to be the Emperor of Germany. The paroxysms increased in frequency and intensity, in spite of all medication, for eight months, when he had a succession of fits lasting thirty-six hours, during one of which paroxysms he died. Post-mortem.—Membranes of brain thickened; arachnoid opaque; pia mater thickened; brain atrophied and indurated; lateral ventricles filled with fluid; spinal cord normal. Upon hardening the brain tissue and medulla oblongata, and examining microscopically, there was seen to be some vascularity in the fourth ventricle which extended through the medulla, the capillary vessels of which were somewhat thickened and enlarged. The cervical sympathetic was also subjected to a careful microscopical examination, but without satisfactory results.

Many more interesting cases might be given, but want of space forbids. The writer has never entrusted the making of post-mortem examinations to assistants, and in each case the brain and spinal cord have been immersed immediately in the hardening fluid before alluded to. In closing, I desire to insert the post-mortem record of a very interesting case in which insanity and phthisis were contemporaneous in their development. Girl, aged 23. Dementia, paresis, tuberculosis. Post-mortem.—Pulmonary tuberculosis, with cavities at apices of both lungs. Brain atrophied, anemic, and indurated, being the result of the lymphoid deposit, as proved by microscopic examination. Upon hardening the cord, the posterior sections of the lateral column were found to be affected. The posterior column presented atrophy and disintegration of nerve elements, and plates of connective tissue in different places. In the postero-lateral column were granular and fatty corpuscles and new bands of connective tissue.