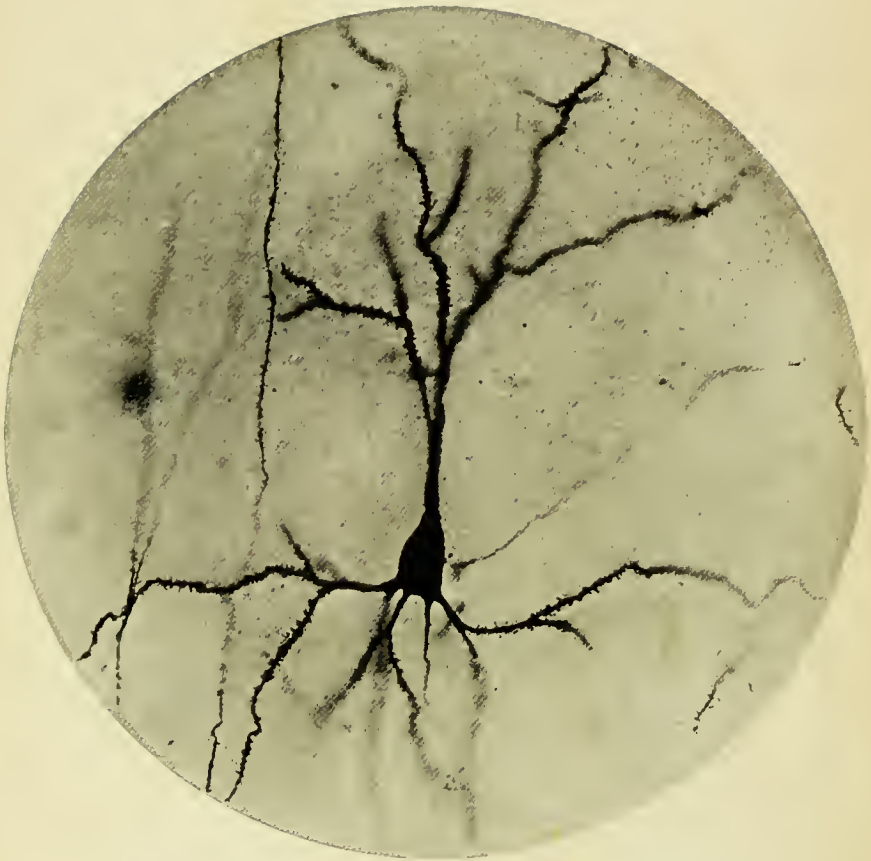
H. Norman Steele.
1901.



Microphotograph of a Pyramidal Nerve Cell, × 550, Reduced.

A TREATISE ON MENTAL DISEASES

BASED UPON THE LECTURE COURSE AT THE JOHNS HOPKINS UNIVERSITY, 1899, AND DESIGNED FOR THE USE OF PRACTITIONERS AND STUDENTS OF MEDICINE

BY

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HENRY J. BERKLEY, M. D.

NEW YORK
D. APPLETON AND COMPANY
1900

TO

PROF. HENRY MILLS HURD,

OF THE JOHNS HOPKINS UNIVERSITY,

AS A TRIBUTE OF AFFECTION AND ESTEEM.

NOTE

The absence from English medical literature of a comprehensive, practical work on mental diseases—one adapted to the needs of the busy practitioner as well as to those of the student of psychiatry—has led the writer to prepare this treatise embodying a consideration of all the principal forms of psychical disturbance. Although it is evident, from the intrinsic nature of the subject, that such an attempt can be only partially successful, it is to be hoped that the book will add something to the certain knowledge of the practitioner, and render more accessible what has been heretofore almost an unknown territory of medicine.

My especial thanks are due to Dr. R. E. Garrett for numerous detailed clinical histories; to Dr. A. C. Thomas for extended urinalyses and the preparation of the casts from which the palatal drawings were made; and to Dr. Frank R. Smith for a careful revision of the text.

Henry J. Berkley.

Baltimore, *January, 1900.*

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Human experience, like the stern-lights of a ship at sea,
illumines only the path which we have passed over.

COLERIDGE.

A TREATISE ON MENTAL DISEASES

PART I

ANATOMY AND HISTOLOGY OF THE CENTRAL NERVOUS SYSTEM

INTRODUCTORY

In mental affections we have invariably to deal with a pathological condition in the brain, either in the cells, in the other component tissues, or in both. Such morbid changes may be so extensive as to be easily made out with the naked eye. At other times, in order to recognise them, we may have to employ the higher powers of the microscope, while again, in other instances, they are so ill-defined as to be beyond the range of the most subtle methods of modern research. Of the various portions of the brain, the mantle or cortex is of most importance in this connection, since its destruction has shown it to be the part of the body whence originates mental activity, where mind and matter are indissolubly connected, "where the life of the outer world finds its daily record, and the field of external impressions is from month to month enlarged," where the paths of afferent and efferent impulses, from constant use, become channels readily stimulated to activity, and where new brain cells are brought into functional activity by the extension of the power of conduction from cell to cell by the collaterals and association tracts. Mental action, as Tuke states, is chiefly a function of connections, or as Obersteiner phrases it, "the gray matter is a field for the association of efferent sensory impulses," the centre of intellectual activity, where the impressions received from the special senses are received, sorted, and arranged into co-ordinate thought. However complex these impressions may be, through the medium of the great central *clearing-house* of the

cortex, they find their appropriate nerve-cell centre, with little loss of time, there to be registered, while new impulses are formed from the centripetal currents, to set in action other groups of the cortical or subsidiary nerve cells, to induce motion or thought, alone or combined, as the case may be.

But inasmuch as a clear conception of the anatomy and histology of any organ must always precede any successful attempt at a study of its pathological conditions, before taking up the clinical aspects of insanity I propose to recall to your recollection a few of the major points in the anatomy and histology of the cerebrum, confining myself, except where other portions are intimately connected with our subject, to our ultimate aim, the cortex.

On removing its outer osseous envelope, we find the mammalian brain covered in by membranes of different aspects and consistency. These coverings are of considerable moment to the student of mental diseases, as they contain the vessels which carry nourishment to the brain, and the lymph channels which provide for the return flow of the effete material, any disturbance of which is fraught with corresponding disorganization of the functions of the gray matter of the mantle. Furthermore, the meninges are prone to take on various inflammatory conditions, infectious or traumatic, with consequent swelling and heaping up of plastic material; or tumours may develop in them, causing local pressure upon the brain surface, and thus equally upset the proper functioning of the organ.

Most externally and in a situation corresponding to that ordinarily occupied by the periosteum of the bones lies a fibrous milk-white membrane, having numerous large arteries set in bony channels, and smaller ones situated more intimately within the laminæ. It also contains many lymph channels of small size, and the *lacs sanguins* to be filled in adult life with the Pacchionian granulations. Veins, large and small, are very numerous, and together with the great sinuses carry the used blood from the encephalon.

After separation from the bones, which under normal circumstances is readily accomplished, this outer envelope, the *dura mater*, when closely examined presents a roughened parietal and a smooth visceral surface. This latter is covered by epithelial cells of a secretory type, and performs the functions of a serous membrane.

Beneath the dura lies a free space, the *subdural space*, which under ordinary conditions contains a small amount of a transparent fluid. Vessels do not pass over from the dura to the more internal membrane.

Beneath the subdural space is seen a thin, transparent membrane containing but few blood-vessels, and these of small size. It is lined upon its outer surface with secretory epithelium, and is intimately connected with a membrane, more deeply situated, by numerous bands and trabeculæ, which, while serving to unite it with and make it a portion of the subjacent lamina, yet leave an open meshwork between to be filled with lymph channels and vessels—the so-called *subarachnoid space*. We have, therefore, an outer and inner layer of the pia mater; the outer—the *parietal pia* or *arachnopia*—thin, transparent, secreting a serous fluid to lubricate the subdural space, and covering loosely the surface of the brain with a uniform single layer; and beneath it a slightly thicker lamina, connected with the former by trabeculæ and fine vessels, the *visceral pia*, an extremely vascular membrane, dipping deeply into the furrows between the convolutions, and sending prolongations from its tissues into the brain substance to form the outer sheathing of the vessels, thus directly forming a portion of the lymph channels belonging to the substance proper of the cerebrum. The pia is, therefore, a double membrane having an interior lymph space into which empties all the used serous fluid coming from the lymph spaces surrounding the nerve cells, as well as from the other intrinsic structures of the cortex cerebri. It also serves to support the vessels as well as the soft tissues of the brain surface.

The Pacchionian granulations, members of the lymph-hosts of the meninges, arise from the parietal surface of the pia in the form of little pedunculated vesicles that traverse the subdural space to adhere to the inner surface of the dura mater at the level of a *lac sanguin* (Van Gehuchten).

Beneath the pia, and separating it from the substance proper of the brain, lies the epicerebral space, a minute cavity, into which flows the returning lymph from the extra-adventitial lymph channels. It communicates directly with the lacuna system of the pia, by means of minute openings.

It will be remembered that at an early period of fœtal life the cerebral vesicle shows none of those depressions and indentations upon its surface that in the adult brain are known by the name of fissures or sulci. At a later date, toward the middle or end of the fourth month of gestation, partly owing to the conformation of the cranial bones, the first of these sulci, the Sylvian fissure, makes its appearance in the form of a wide split on the external aspect of each hemisphere. Within a few weeks other depressions form, and

by the end of the fifth month the principal fissures show themselves, dividing the mantle into definite divisions nearly as in the adult brain. These early fissures are known as primary or complete sulci (His), and enable one to map out the hemispheres into definite regions known as lobes, which, however, have a very unequal importance as regards the functions in which we are mainly interested. In order, the primary sulci are: the Sylvian fissure, the Rolandic or central fissure, the parieto-occipital fissure, the calcarine fissure, and the fissure of the corpus callosum, a portion of which is eventually developed into the fissure of the hippocampus.

In the sixth month of prenatal life other fissures form on the smooth lobes, which serve to further divide them into convolutions. These secondary fissures are subject to variations in the individual brain, and while in a certain sense constant, have not the topographical importance that accrues to the primary sulci.

On further observation of the surface of the cortex of the human adult brain, numerous short, shallow furrows are noticed dividing the convolutions more or less transversely. These are known as the tertiary fissures, and are inconstant, varying in every brain, and are of minor importance for the determination of the topography.

This array of elevations and depressions is known as a whole as the *brain mantle*, and the peculiar arrangement allows of a larger amount of surface material than could have been provided in a similar space if these infoldings had been entirely absent.

The nutrition of the brain, and in particular of the cortex cerebri, is provided for entirely by four trunks, two entering the posterior, two the anterior regions of the basis cranii, and uniting in a middle region to form the circle of Willis, where the blood currents unite, and the pressure from the heart contractions is to an extent modified and equalized. These four arterial trunks are the internal carotids and the vertebrals, the former supplying by far the larger quantity of nutrient fluid (Fig. 1). It will be noticed that all these several arteries are large in proportion to the size of the organ supplied, and that instead of being the "cold and bloodless" viscus described by Aristotle, the brain receives more blood in proportion to its size than any other organ.

From the polygon of Willis three nutrient arteries proceed to each hemisphere ramifying in the meninges, and anastomosing little, if at all, with each other. From the minor branches of each meningeal artery descend perpendicularly through the pia short terminal arteries to nourish the cortical substance. These do

not communicate with one another. The consequence of this non-anastomosis of the pial arteries is that definite areas of the cortex are nourished by a blood supply practically separate from that of the other portions, and as a result when an embolus or thrombus plugs one of the parent arterial stems arising from the polygon, the nutrient supply is entirely shut off from that territory without any possibility of the establishment of a collateral circulation, while the other portions of the hemisphere retain their circulation intact. This condition of affairs is more particularly true for the great central region of the hemispheres than for the anterior and posterior poles, as minor anastomoses between the arteries of the opposite hemispheres are exceptionally found.

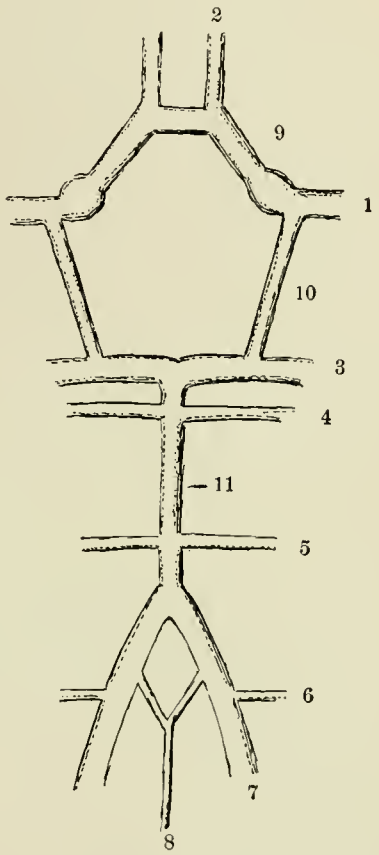


FIG. 1.—DIAGRAM OF THE CIRCLE OF WILLIS. 1, Sylvian artery; the bulbous enlargement represents the confluence of the internal carotid with the Sylvian artery; 2, anterior cerebral artery; 3, posterior cerebral artery; 4, superior cerebellar artery; 5, middle cerebellar artery; 6, inferior cerebellar artery; 7, vertebral artery; 8, anterior spinal artery; 9, anterior communicating artery; 10, posterior communicating artery. After VAN GEHUCHTEN.

The arteries in each hemisphere from the circle of Willis are the *anterior*, *middle*, and *posterior cerebrals* (Fig. 1). Of these the middle cerebral, or Sylvian artery, is the most voluminous, and may be considered as a direct continuation of the internal carotid.

The *anterior cerebral artery*, by its main and terminal branches, carries the blood supply over the whole of the internal aspect of the hemispheres as far as the occipito-parietal fissure, including the corpus callosum; to that portion of the orbital convolutions from the median fissure outwardly to the crucial furrow, and to the anterior pole of the hemi-

sphere; upon the convex surface it supplies the whole of the superior and middle frontal convolutions, as well as the upper third of the anterior central convolution running deeply into the sulcus of Rolando.

The *middle cerebral artery*, larger and carrying more directly the force of the vital stream, provides for the whole of the all-important central region of the hemispheres, the convolutions of the island of Reil, the third frontal and inferior two thirds of the ascending parietal convolutions—the sensori-motor region of the cortex—the parietal gyri, the whole of the first and superior half of the middle temporal portion of the inferior aspect of the hemispheres.

The *posterior cerebral artery* distributes blood on the internal face of the hemispheres to the whole of that region posterior to the occipito-parietal fissure, the cuneus, and lingual lobes, to the convolution of the hippocampus, and occipito-parietal convolutions, the whole of the inferior and dependent portion of the middle temporal, and to the middle and inferior occipital convolutions on the external aspect of the hemispheres (Figs. 2 and 3).

Distribution of the Arteries of the Cortex

All the pial arteries ramify repeatedly, and become smaller and smaller, and from them descend, coming off from the parent stem at right angles, two sets of terminal arteries of medium calibre, a long and a short. The latter are destined to supply the layers of the gray matter, the former to penetrate beyond their laminæ, and find their ultimate divisions among the white fibres lying under the gray substance. The general disposition of both series is similar. Both penetrate the cerebral pulp, subdivide at obtuse angles into numerous branches which become finer and finer as they proceed, and eventually break up into capillaries, which pass on to small veins without any distinct point of demarcation between them, the veins slowly increasing in size from numerous junctures with other veins, until they again arrive at the surface of the cortex and pass outward into the pia. None of these arteries of the cortex anastomose with one another, nor do the veins communicate to any considerable extent. As a result, each little territory of the cortex has its own nutrient blood supply, entirely separate from that of contiguous territories, so that embolism, or disease of the artery distributed to a certain territory, means the death of that area of brain substance whenever occlusion has become complete. All the

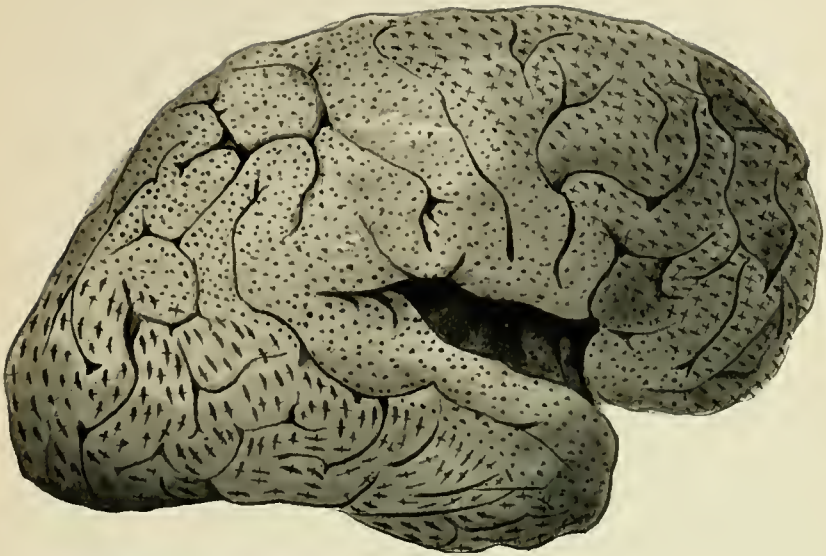


Fig. 2.—Diagram of the Distribution of the Cortical Circulation. External aspect of a hemisphere. + Area of distribution of the anterior cerebral artery. .... Area of distribution of the middle cerebral artery. —+— Area of distribution of the posterior cerebral artery.

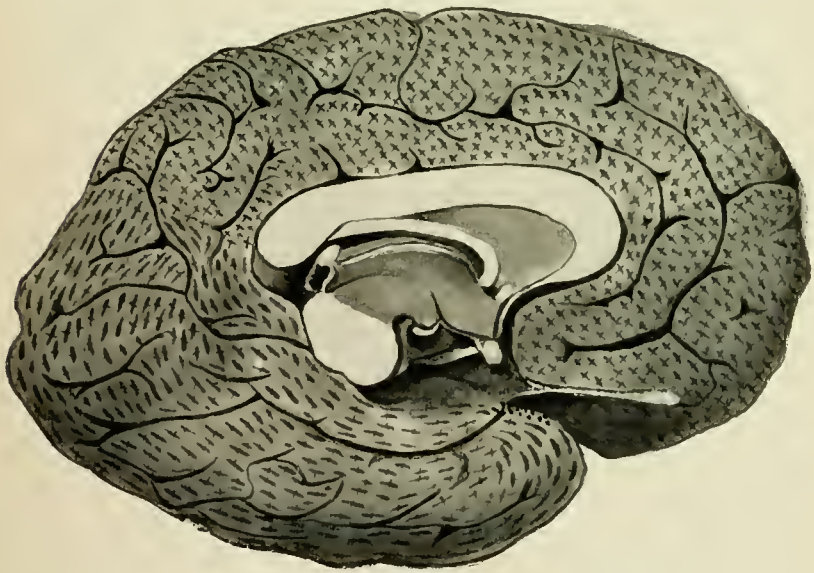


Fig. 3.—Diagram of the Distribution of the Cortical Circulation. Internal aspect of a hemisphere. + Area of distribution of the anterior cerebral artery. .... Area of distribution of the middle cerebral artery. —+— Area of distribution of the posterior cerebral artery.

arteries of the cortex are, therefore, terminal arteries in the sense of Cohnheim. In small areas of the cortex, depending only upon a single vessel, the latter has been found at autopsies obliterated, with consequent destruction of the area involved, while the surrounding regions were intact.

The blood-vessels of the cortex enter its substance at a date subsequent to the development of the nerve elements, among which they penetrate and ramify.

HISTOLOGY OF THE CORTEX

The Component Tissues.—Within the cortical pulp are found two distinct varieties of elements, derived from tissues of widely different fœtal origin—blood-vessels of mesoblastic origin, nerve cells with their dependencies, and neuroglia of epiblastic structure.

Without a sufficient number of arterioles to nourish them and veins to carry off the used blood, the nerve elements could not grow and function. Accordingly, the vascular structures are of an importance hardly secondary to that of the nerve elements themselves. Indeed, *a priori*, it may be assumed that a badly organized or damaged nerve cell might function better than a well-developed cell with an inferior supply of nourishment. Let us therefore turn to the histology of the vessels before attempting that of the nerve cell.

Within the cortex we find medium-sized and small arteries, terminal arterioles, and eventually capillaries and veins of all sizes. The structure of the larger and smaller arteries is essentially similar, only as they progressively diminish in size the several component coats lose their distinctness, until finally the capillary is reached with its single tunic.

On examining a properly stained section of an artery we find the wall separable into four contiguous sheaths, surrounded externally by a space of considerable extent, the extravascular lymph space.

From the lumen outward there are successively the intima, the membrana fenestrata or elastica, the layer of smooth muscle fibres, then a small space, the Virchow-Robin or intravascular lymph space, and, lastly, the adventitia, derived from prolongations of the pial membrane. The smallest arterioles show a progressive diminution in the thickness of the adventitia, as well as of the muscularis, as they approach the calibre of the capillary.

The *tunica intima*, or endothelial lining, is a thin membrane formed of a single layer of long flattened cells, whose boundaries can be defined by impregnation with silver nitrate. Nuclei arranged with some approach to regularity are scattered through it; they have a whetstone or oval form, and always lie in the direction of the long diameter of the vessel. Rounded vacuoles are found in these nuclei, the edge of the figure often looking as if it had been cleanly punched out. The significance of these vacuoles is not known, although it has been observed that under the influence of certain infectious processes they multiply to a considerable extent. The nuclei contain a small number of fine chromophilic granules lying in a clear caryoplasmic substance.

The *membrana fenestrata* lies closely applied to the outer aspect of the intima. It consists of an elastic membrane, which never shows the presence of nuclei, but only a characteristic striped arrangement. It is this membrane that gives to cross sections of the larger arteries the peculiar shirt-frill appearance of the inner laminæ. Under high magnification it is seen to be perforated with minute irregularly shaped openings. As the arteries progressively diminish in size the fenestrata decreases in prominence, until in the terminal arterioles it eventually disappears.

On the outer aspect of this membrane lies a layer of smooth, spindle-shaped, muscular fibres of variable thickness, the *tunica muscularis* or *media*. These muscular fibres are all arranged transversely to the longitudinal axis of the vessel; each fibre is provided with an elongated oval nucleus lying in the long axis of the cell, and at right angles to those of the intima, often being superimposed upon them, and giving star-shaped points in longitudinal sections. In the larger cortical arteries there may be several layers of muscle fibres lying over one another in circular bands; in the smaller arteries the thickness little by little diminishes, and the breadth of the individual cells increases until only scattered muscle cells remain, and even these are finally lost before the capillaries are reached. The nuclei of the muscle cells contain a large number of fine granules, staining deeply with aniline dyes, all imbedded in the nuclear substance.

The tunica muscularis is not in direct contact with the most external layer, but is separated from it by a narrow lymph split, the intraadventitial or Virchow-Robin lymph channel. This channel is found wherever the muscular fibres are sufficiently numerous to form a complete covering to the intima. The function of this

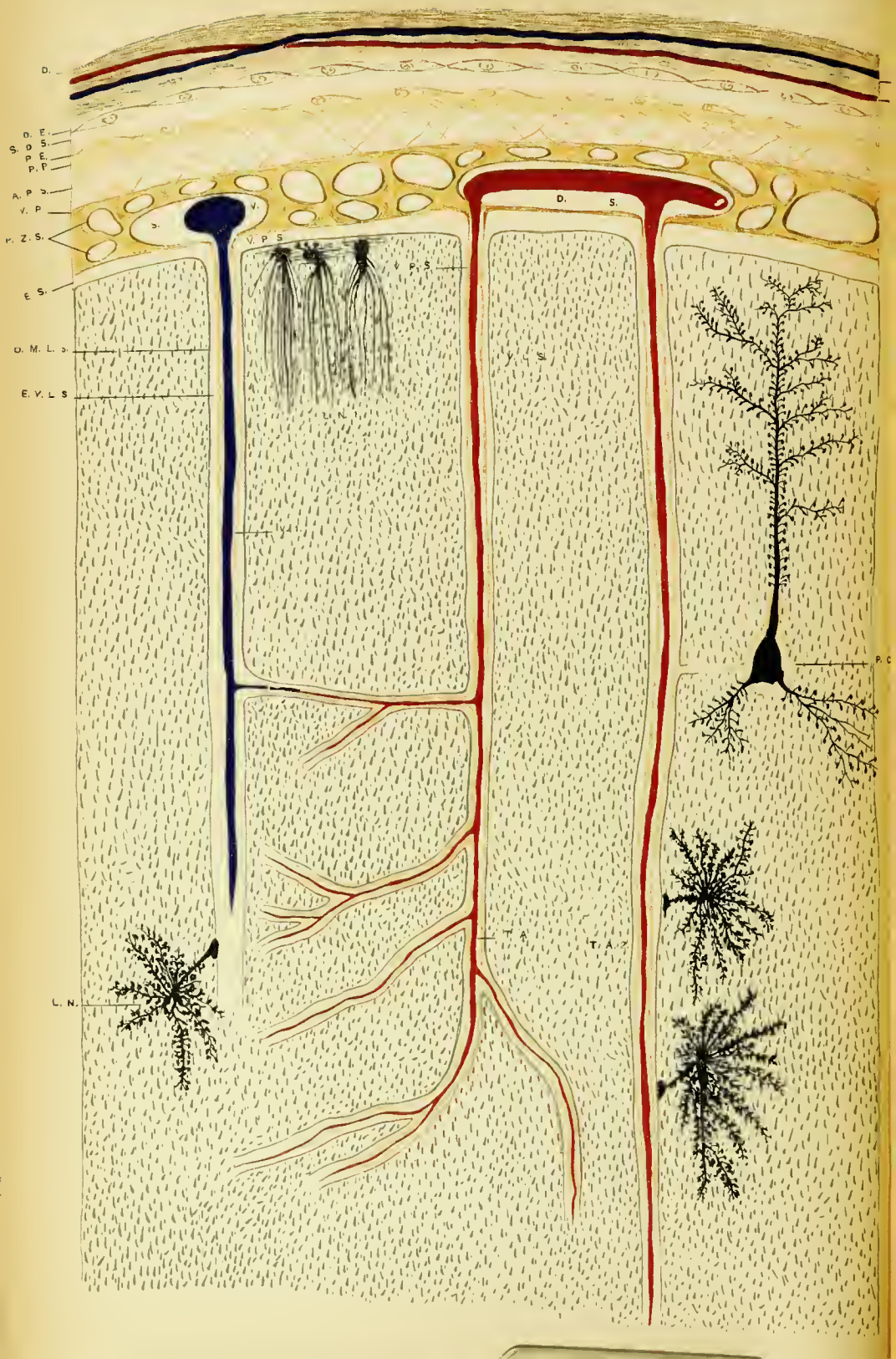
lymph space is probably partly nutritional, and partly to allow of contraction and expansion of the muscular tunic under the influence of a varying blood pressure.

The outermost layer of the vessel consists of a fine connective-tissue membrane, or *adventitial sheath*, derived from extensions of the pia mater, and by its separation from the muscularis independent of the other laminæ. Its thickness varies according to the calibre of the artery, but it is continued over the finest of them to the capillaries, and thence onward to the veins. The adventitia contains numerous round and oval nuclei irregularly distributed, which show rather coarse chromatin particles. Both the inner and outer aspect of the adventitia are supposed to be lined with a fine endothelial-cell covering, demonstrable by silver impregnation. From the external margin of the lamina proceed fine connective-tissue threads, which run to the edge of the adjacent cerebral substance and there end. It is doubtful whether these filaments are a part of the sheath itself; indeed, it seems probable that they belong to the adjacent neuroglia. Quite frequently the adventitia contains fat globules and pigment particles that have no especial significance.

External to the adventitial layer, and separating it from the cerebral substance, lies a space of considerable size, the extraadventitial or lymph space of His. Whether this cavity has an external endothelial lining is doubtful, but there is certainly a fine limiting layer of felted neuroglia fibrils.

In the capillaries the two middle layers completely disappear, the adventitia is reduced to a membrane, almost structureless, and of exquisite fineness; there only remains the endothelial intima with its characteristic nuclei, slightly modified in appearance, their length having been reduced and breadth increased, so that they take on a more rounded form.

The cerebral veins differ from the arteries in possessing only three well-defined coats: an intima having essentially the same characteristics as in the arteries, except that the nuclei are more rounded and less regularly placed; a media made up of scattered muscle cells enveloped in connective tissue fibrillæ, and an adventitia of essentially the same structure as that already described for the arterial vessels. The extravascular lymph space follows the capillaries to the veins, thence to the surface of the cerebrum. The existence of a lining membrane for this division of the lymph paths is not more certain than in the case of the arterial channels.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P. C.
L. N.

PLATE I

Lymphatic Circulation of the Cortex (*Diagrammatic*)

D., Dura mater; *A'.*, *V'.*, dural arteries and veins; *D. E.*, layer of flat epithelium lining the inner surface of the dura; *S. D. S.*, subdural space; *P. E.*, layer of flat epithelial cells covering the outer surface of the parietal layer of the pia; *P. P.*, parietal pia; *A. P. S.*, arachnopial space crossed by trabeculæ passing between the laminæ forming the pia mater; *V. P.*, vascular or visceral pia; *P. L. S.*, lymph spaces in the meshes of the visceral pia; *E. S.*, epicerebral space communicating directly with the extravascular lymph spaces; *O. M. L. S.*, external margin of the extravascular lymph space; *E. V. L. S.*, extravascular lymph space communicating with the pericellular lymph sacs by a hair-fine channel; *V. P. S.*, the adventitial sheath of the vessels is seen to be derived directly from the pial tissue; *P. C. L. S.*, lymph sac surrounding nerve cells and communicating with adventitial space by a narrow channel; *I. V. L. S.*, intravascular lymph space communicating directly with the lymph channels in the pia around the larger vessels; *L. N.*, neuroglia cells belonging to the excretory lymphatic system, communicating with the extravascular lymph system by a channeled foot ending in a knob; *L. N'.*, peridymal glia cells probably belonging to the lymphatic excretory system; *A.*, pial artery; *T. A.*, terminal artery of the gray layers; *T. A².*, terminal artery penetrating into the white matter beneath the convolutions; *V.*, large vein of the pia; *V'.*, collecting vein of the cortex; *S. S.*, lymph spaces around pial veins and arteries.

PLATE I

LYMPHATIC CIRCULATION OF THE CORTEX (Diagrammatic)

D. Dura mater; A. V. dural arteries and veins; D. E. layer of flat epithelium lining the inner surface of the dura; S. S. subdural space; M. E. layer of flat epithelial cells covering the outer surface of the pericranial layer of the pia; P. M. pericranial pia; A. S. arachnoidal space crossed by trabeculæ passing between the laminæ forming the pia mater; P. M. vascular or visceral pia; P. E. S. lymph spaces in the meshes of the visceral pia; E. S. epicerebral space communicating directly with the extravascular lymph spaces; C. M. C. S. external margin of the extravascular lymph space; E. P. C. S. extravascular lymph space communicating with the pericellular lymph sacs by a hair-fine channel; P. P. S. the adventitial sheath of the vessels is seen to be derived directly from the pia; P. C. E. S. lymph sac surrounding nerve cells and communicating with adventitial space by a narrow channel; A. P. E. S. intravascular lymph space communicating directly with the lymph channels in the pia around the larger vessels; E. N. neuroglia cells belonging to the exterior lymphatic system, communicating with the extravascular lymph system by a channeled foot resting in a knob; E. N. perilymph cells probably belonging to the lymphatic exploratory system; A. pial artery; V. A. terminal artery of the gray layer; V. A. terminal artery penetrating into the white matter beneath the convolution; V. large vein of the pia; L. collecting vein of the cortex; S. S. lymph spaces around pial veins and arteries.

The Lymphatic System of the Cortex

With the exception of some unimportant capillary channels in the cortical substance seen by Riedel and Kronthal, lymph passages, in the sense in which they are present in glandular organs, do not exist in the brain. To replace them—for some equivalent is an absolute necessity to the proper workings of any organ to carry off the used and effete material from the percolating serous contents of the blood and to remove the products of normal cell metabolism—are two very extensive systems, the one communicating with and supplementing the other: the first, directly connected with the circulatory apparatus, the intra- and extraadventitial channels, with the pericellular spaces, already mentioned in connection with the vessels; the other, a peculiar system of cells communicating by channelled pseudopodia with the perivascular canals.

The intraadventitial lymph space is of minor importance, and, in comparison with the perivascular space, it is of small size. It communicates with the lymph system of the pia by means of openings near the points of departure of the perpendicular arteries of the cortex, and the fluid contained in it is therefore thrown directly into the pial meshes. The extraadventitial space, on the other hand, is of supreme moment to the nervous tissues, collecting all the outward flow of liquids from cell space, and from nerve and neuroglia tissue. The tube increases in calibre as it proceeds from capillary toward the surface of the brain, where its contents are discharged into the epicerebral space, and eventually find their way through the Arnold lymph splits into the lymph ways of the pia. These facts His discovered by injecting the perivascular canals, whence the coloured material found its way into the epicerebral space, and on through the lacunæ into the lymph channels of the pia.

In the adult mammalian brain the communication between the pericellular sac and perivascular space is difficult to demonstrate, but, as Obersteiner has shown in the newborn child, it is by no means impossible to inject the space surrounding the cell with colouring matter and demonstrate the connection of extraadventitial space and cell-sac. This sac may therefore be considered as the cloaca of the lymph system of the brain. From each cell space comes a fine communicating tube to the adventitial space, into which hundreds of other tubes empty their fluid contents, which are eventually forced along the channel to the epicerebral space, and

thence through the lacunæ into the meshes of the pia. A lining membrane, composed of fine felted neuroglia fibrillæ of extreme tenuity, probably lines the cavity from the cell to the cortical surface, but whether this is again covered by hyaline endothelial pavement cells is unknown. The two vascular lymph channels probably do not communicate with one another to any extent, the function and service of each being different.

The second portion of the lymph system of the cortex is subserved by neuroglia cells. Not all the cells of this kind are employed in the process of excretion, but only certain *podasteroid elements*, which are characterized by a fleshy body with short irregular branches, and a channelled foot that ends in a conical enlargement within the margin of the perivascular space, and a few of the peculiar cells along the margin of the epicerebral space.

The function of these neuroglia cells was first suspected by Meynert, who had observed them to be swollen in cases in which tumours of the cervical glands had retarded the free flow of lymph toward the chest. But it was not until Bevan Lewis gave to the world his studies on the lymph-connective system that these cells attracted more than cursory notice even from pathologists, to whom their altered condition in certain brain diseases should have seemed to call for an explanation. Lewis's first interpretation of their function was not entirely a correct one, since he attributed active destructive powers to the cells; but his researches served to direct attention to them, and a more reasonable explanation soon followed.

It is indeed entirely due to pathological researches that we have any complete knowledge of their function, for they have been observed to be swollen and filled with fine granular detritus in certain diseases of the brain, and in experimental toxine poisoning they have been found (by the writer) to be definitely altered from the normal. Most conclusive, however, is the research of Binswanger and Berger, who found, in a case of meningeal apoplexy, not only the cells adjacent to the cortical vessels, but also the horse-tail cells of the outermost portion of the molecular layer of the cortex, filled with granules of blood pigment that were in process of absorption into the cells, and excretion into the lymph circulation. These podasteroid neuroglia cells, situated in myriads along the margins of the numerous small and large vessels and communicating with their sheaths, are therefore in all probability the active excretory elements for the nervous matter, absorbing and taking up

into their tentacles and bodies the used plasma and detritus of cell waste, and throwing it off into the expansible lymph spaces of His, which are passive in their function, and serve only the purpose of drainage sewers to the surrounding tissues.

The intrinsic nerve supply of the vascular apparatus of the brain, with its connected lymph system, is at present a *terra incognita*. Researches of Tuke, Andriezen, and the writer, have shown numerous sympathetic fibres accompanying the arteries of the pia, as well as in the plications of the choroid plexuses. When the vessels descend from the membranes into the cerebral pulp, these end abruptly at the margin of the brain, and no method of staining yet known has enabled any observer to find a trace of them within the cortical layers. The possibility of staining these nerve fibres up to a certain point, and their abrupt ending, would lead one to infer that some system of control other than the usual one presided over the expansion and contraction of the intrinsic arterioles of the brain substance, but what it is only the future may determine.*

The Neuroglia

In examining sections stained by the silver method, the first of the epiblastic elements one meets with upon the surface of the brain appears in a dense layer of neuroglia cells along the external margin, forming a covering for the contained nerve elements, and communicating directly with the epicerebral space. It would seem most appropriate, accordingly, to begin our study of the epithelial elements with the neuroglia.

According to Cajal, all the neuroglia cells of the brain are derived from modified ventricle epithelium. Indeed, in some of the lower vertebrates this ventricle epithelium does not change during the life of the animal, and no other higher forms of supporting cells are ever developed. Even in as high a vertebrate as the dog, embryonal ventricle epithelium acting as a supporting substance persists in the region of the hypophysis through adult life, as may be readily shown by chrome-silver staining (the writer). It is

* It is possible that the peculiar thick fibres with a plaque-shaped end apparatus attached to the margins of the blood-vessels, described by Vincenzi in the raphe of the medulla oblongata and trapezius nucleus, may be one of the forms of controlling nerve mechanism of the cerebral vessels. Similar end plaques had been previously described by Meyer, Held, and Cajal in like situations, but never before in direct continuity with the vascular sheaths. Anat. Anzeiger, September, 1899.

impossible, however, to believe that the untold myriads of neuroglia cells in the brain cortex are derived solely from outgrowth and division of the primary ependymal cells, and in this view Koelliker and Lenhossék concur. Far more likely is it that, besides the neuroglia derived from the ventricle ependyma, there are hosts of other cells originating from the embryonal elements, which also form the nerve elements, and take upon themselves, in the course of evolution, the function of supporting cells to the other tissues. Nerve cells and neuroglia cells are ofttimes only to be differentiated by the presence of the projection fibre or axis cylinder.

The researches of Cajal, Retzius, Lenhossék, Koelliker, Nansen, Rohde, Van Gehuchten, and others, have shown that in younger embryos the central nervous system possesses only one variety of supporting cell, the ependymal epithelial cell, which has a broad base on the free margin of the ventricle, and stretches to the peridyme or subpial surface, where it ends in a small triangular enlargement. The middle portion of the cell consists of a single fine thread, which near the periphery may split up into two or more branches. The nucleus is situated near the base. At a later stage of embryonic life these epithelial elements grow away from the ventricle centre toward the periphery, becoming roughened, and eventually, before postnatal life, develop into the cells of Deiters, or star-rayed cells. These astrocytes apparently locate themselves in all portions of the cortex, and there are probably successive growths from the selfsame centre.

Within the adult cortex two chief varieties of neuroglia cells are met with, several transition forms, and upon the peridyme, cells with thick, irregularly shaped bodies, and long, hairlike rays proceeding downward from the body into the cortical pulp, presenting an appearance somewhat resembling a horse's tail (Andriezen). In addition there are other peculiar cells with thick, flask-shaped bodies and bushy branches. Besides these various forms a few delicate fir-tree shapes may occasionally be found intermingled with the others.

The chief interest lies with the long and short star-rayed cells (*Langsternstrahler* and *Kurzsternstrahler* of Retzius). They are to be found in all portions of the gray layers. More numerous toward the periphery, they diminish somewhat in numbers in the central regions, to again increase in the lowermost layers. The short-rayed cells are comparatively more numerous in the superior than in the inferior layers of the cortex, and the reverse is true for the long-rayed cells, which increase toward the subcortical white matter.

The difference may be due to the fact that the short-rayed mossy cells are more frequently in connection with the larger vessels of the superior region, and diminish in numbers as the vessels decrease in diameter.

Andriezen considers the short mossy cells attached to the vessel sheaths as being of mesoblastic origin, and as having wandered into the tissues together with the vessels. But this view lacks evidence to support it, and in fact all investigations go to disprove the assumption, since they show that the vessels carry in with them no other than their own proper cells. Koelliker, Cajal, and Van Gehuchten all agree that any theory other than that of the ectodermal origin of the glia must be discarded without reserve.

The very numerous long-rayed glia cells, the Golgi or Deiters' cells, have a body of small diameter, with long, fine, smooth, hair-like streamers, that run for a considerable distance from the cell body, between nerve fibre and vessel, cell body and prolongation. Nowhere do the rays anastomose, either with their companions from the same cell or with the filaments from other cells. In sections stained with hæmatoxylin or aniline, the nuclei of these long-rayed cells dot the surface of the section in large numbers. Weigert, using his peculiar neuroglia stain, only adapted to the human brain, has endeavoured to prove that these fibrils have no connection with the protoplasm surrounding the nucleus, but lead an independent existence. As Koelliker has shown, similar pictures of the fibrillæ passing through the protoplasm may be obtained by immersing the tissues in dilute chrome salts, whereby the differentiation is effected in that the fibril is stained, while the protoplasm of the cell remains transparent.

The Golgi, or long-rayed gliacytes, are important factors in disease. Lenhossék, indeed, goes so far as to state that in all organic affections of the central nervous system they play an important part. Certainly in many chronic affections they multiply to an enormous extent, particularly when there is death of the proper nerve elements, which they replace to a certain extent.

While many stains show them in some degree, the silver methods alone bring them out in their beautiful entirety, distinct and without connection with the surrounding elements. Their function seems to be purely one of support, no recent investigator attributing any nutritional value to them.

The morphological position of the short-rayed astrocytes in the central nervous system is not so clear as that of their long-rayed

companions. From the constant occurrence of transitional forms it is almost certain that they are derived from the same ectodermal elements, but here the resemblance ends. They have irregular, rounded, or triangular thick bodies, often from 20 to 25 μ in diameter; from the body come out short fleshy branches covered by a multitude of irregular knobs, giving them a pronounced mossy appearance. Among these branches nearly always one—sometimes two—may be distinguished of greater diameter and traversing a larger territory than the others, to eventually end in a foot of flattened or conical shape in the extravascular margin of some neighbouring vessel. These are the so-called podasteroid cells, which undoubtedly play an important part in the lymph-glia system already described. No anastomoses are ever visible between them. Very numerous cells of similar aspect are to be found scattered through the cortex, in which no connection with a vessel through a pseudopod can be demonstrated. In these instances it is probable that the stout channelled branch is turned in a direction from the observer and cannot be seen. In the normal brain these short mossy cells are extremely difficult to demonstrate by other than the silver methods, whereas in pathological conditions they are often prominent objects in the microscopic field from their altered staining properties, their swollen condition, and their evident relation to the vascular wall by means of the thickened branch or foot.

In disease they deport themselves differently from the short-rayed variety. Under the stress of toxic conditions, or when there is constant disintegration of the nerve-cell tissues, they enlarge, become filled with fine granular *débris*, and if the morbid process is intense and the strain upon them too severe, they die with the nerve cells; and unless total destruction of the part results, their place is filled by the proliferating long-rayed cells. These latter seem to survive and multiply under most adverse conditions, and cannot therefore be so delicately organized. Parenthetically, they are somewhat analogous to the epidermal cells which proliferate in epithelial growths of the skin, even when the nutrition of the part has been reduced to a very low ebb.

From their situation it is probable that the horse-tail cell, as well as others of similar type along the free surface of the brain, are derived from the external portion of the ventricular astrocyte while it is in process of development. The insertion into the margin of the peridyme of their irregular protoplasmic bodies and the brush extension downward strongly suggest this origin. According to Binswan-

PLATE II

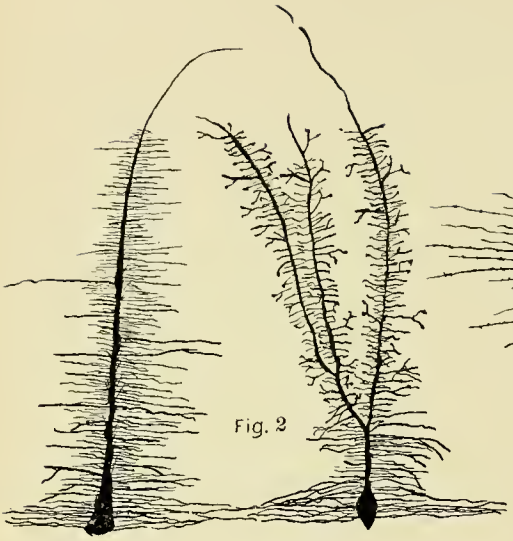

Fig. 2

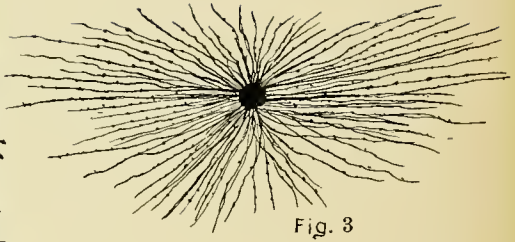

Fig. 3

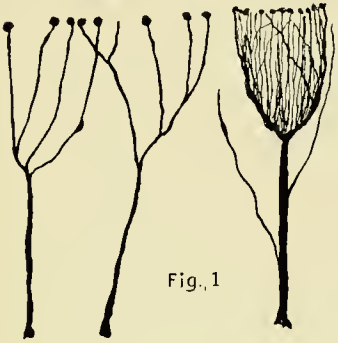

Fig. 1

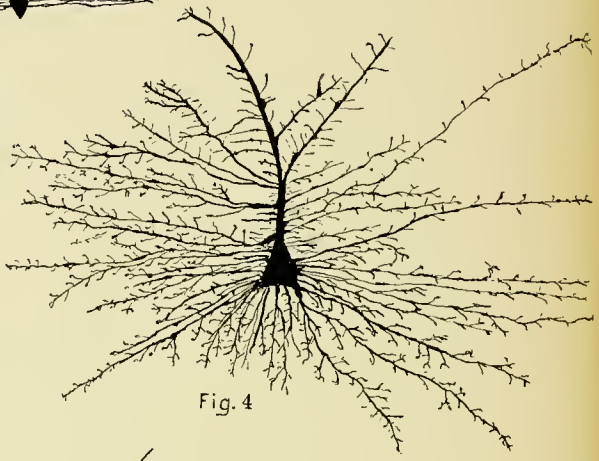

Fig. 4

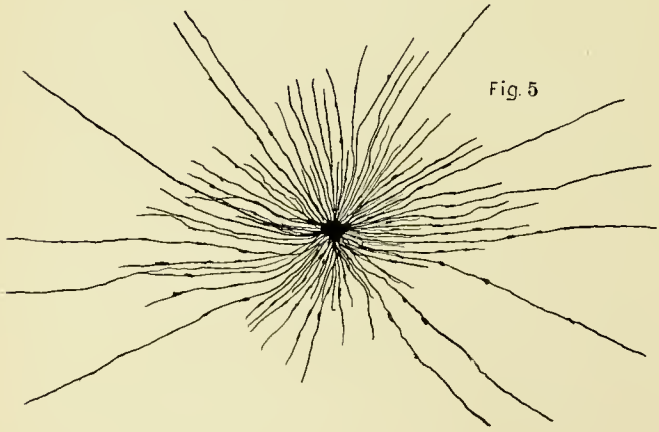

Fig. 5

Fig. 8

PLATE II

The Different Types of Neuroglia Cells seen in Adult Tissues

Fig. 1. Ependymal cell from the pituitary body approximating the embryonic type. Fig. 2. Ependymal cells of fir-tree form from the margin of the third ventricle adjacent to the infundibulum. Fig. 3. Long-rayed neuroglia cell with beaded arms from the gray matter adjacent to the third ventricle. Fig. 4. Long-rayed neuroglia cell from the fourth layer of the cortex, a transition form between the ordinary long-rayed and mossy form. Fig. 5. Long-rayed glia cell from the subcortical white matter. Fig. 6. Another form from the same region. Fig. 7. A similar type from the lower border of the gray matter of the cortex. Fig. 8. Transition form between the short- and long-rayed types. From the gray matter of the cortex. Fig. 9. Long-rayed cell from the optic nerve tracts. Fig. 10. Mossy glia cell from the second cellular layer of the cortex. Fig. 11. A similar cell from the fourth layer of the cortex. Fig. 12. Neuroglia cells of horse-tail form from the peridyme of the brain. The free surface is covered with a felt-work of the longitudinal fibres. Fig. 13. Mossy stellate cell from the second cellular layer of the cortex. Fig. 14. Podasteroid cell attached to the margin of a blood-vessel by a thickened foot. From the gray matter of the cortex. Fig. 15. A mossy cell with knobbed branches from the gray matter of the cortex. Fig. 16. An unusually widely branched mossy cell.

Figs. 1, 2, 3, 4 are from the adult dog, all others are from man.

PLATE II

THE DIFFERENT TYPES OF NEUROGLIA CELLS SEEN IN ADULT TISSUES

Fig. 1. Ependymal cell from the pituitary body approximating the embryonic type. Fig. 2. Ependymal cells of fir-tree form from the margin of the third ventricle adjacent to the infundibulum. Fig. 3. Long-rayed neuroglia cell with beaded arms from the gray matter adjacent to the third ventricle. Fig. 4. Long-rayed neuroglia cell from the fourth layer of the cortex, a transition form between the ordinary long-rayed and mossy form. Fig. 5. Long-rayed glia cell from the subcortical white matter. Fig. 6. Another form from the same region. Fig. 7. A similar type from the lower border of the gray matter of the cortex. Fig. 8. Transition form between the short- and long-rayed types. From the gray matter of the cortex. Fig. 9. Long-rayed cell from the optic nerve trunks. Fig. 10. Mossy glia cell from the second cellular layer of the cortex. Fig. 11. A similar cell from the fourth layer of the cortex. Fig. 12. Neuroglia cells of horse-tail form from the perivascular of the brain. The free surface is covered with a felt-work of the longitudinal fibres. Fig. 13. Mossy stellate cell from the second cellular layer of the cortex. Fig. 14. Podaspiral cell attached to the margin of a blood-vessel by a thickened foot. From the gray matter of the cortex. Fig. 15. A mossy cell with knobbed branches from the gray matter of the cortex. Fig. 16. An unusually widely branched mossy cell.

Figs. 1, 2, 3, 4 are from the adult dog, all others are from man.

PLATE II[a]

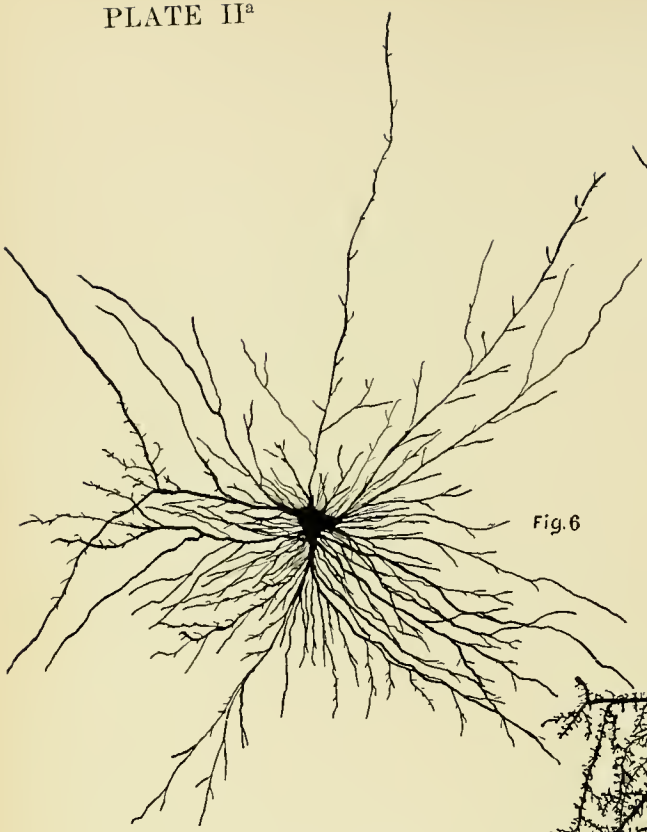

Fig. 6

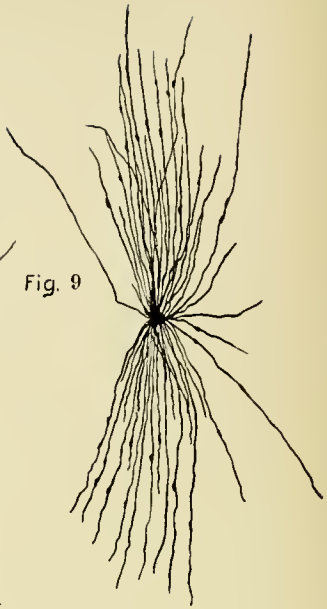

Fig. 9

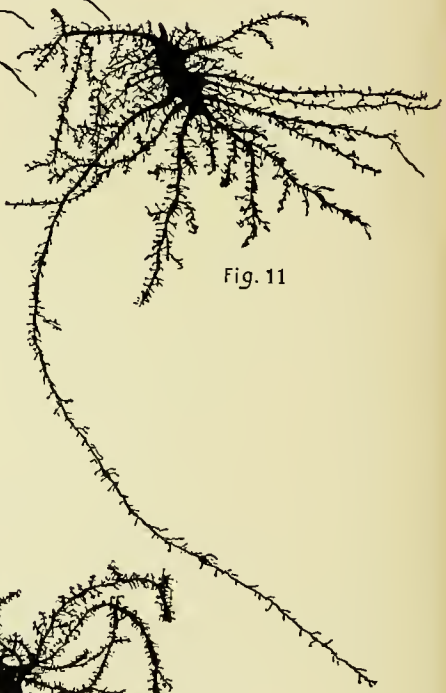

Fig. 11

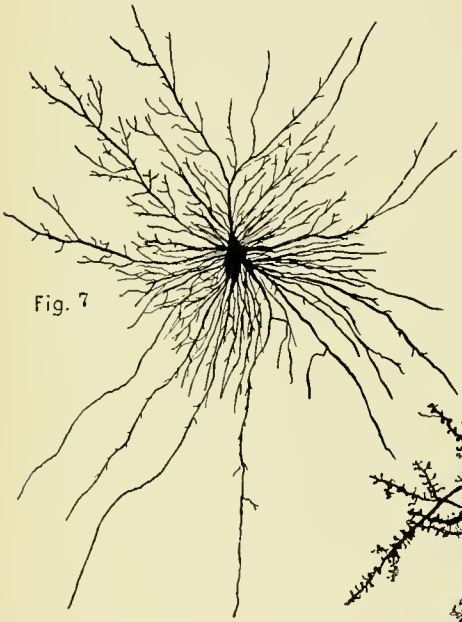

Fig. 7

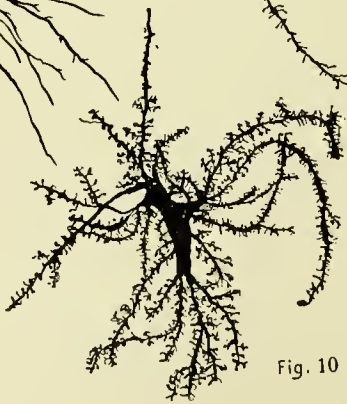

Fig. 10

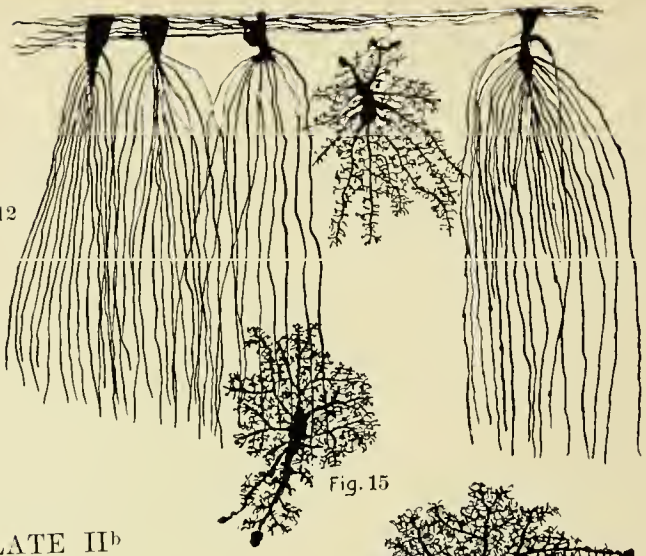

Fig. 12

Fig. 15

PLATE IIb

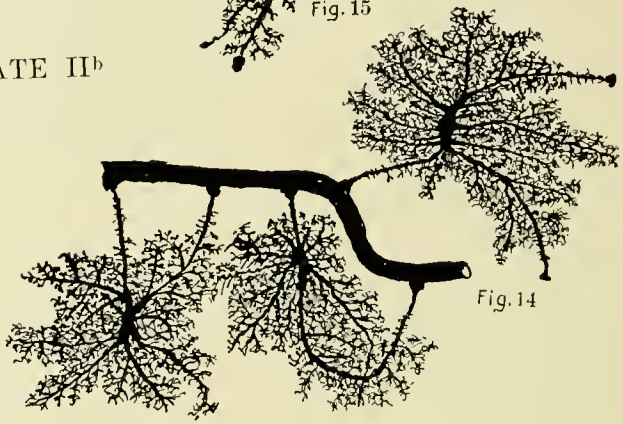

Fig. 14

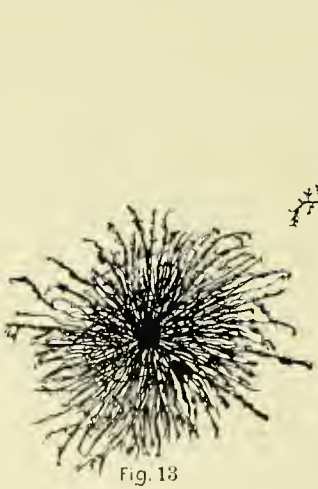

Fig. 13

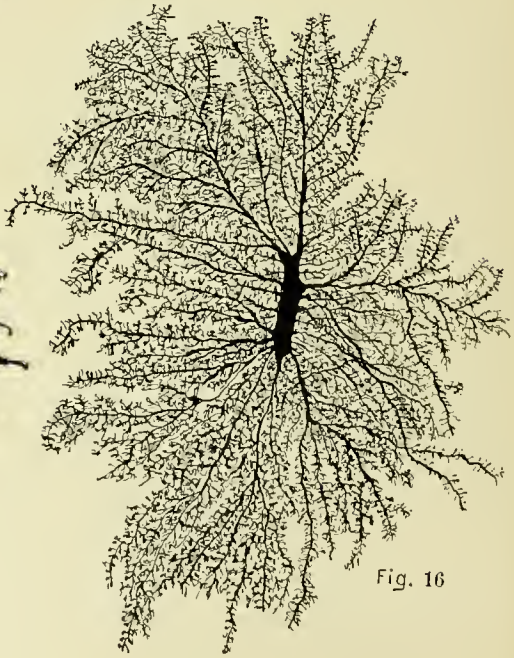

Fig. 16

ger, their function is similar to that of the podasteroid gliacytes; but a double function may well be subserved, and it is probable that they afford support to and separation of the soft terminal branches of the dendrites, so closely packed together in this region, as well as being a protection to the cortical surface by their closely felted marginal branches, while in addition they are factors in the lymph circulation.

The rather infrequent fir-tree and bushy cells along the pial border suggest the incompletely developed cells of an embryonic age, such as are seen more definitely in the region of the hypophysis.

During the last few years not a little has been done to clear away the uncertainty concerning the origin and structure of the neuroglia. Many points in its origin and development have been definitely determined by the Golgi method, but much still remains to be ascertained concerning its after-life and functions in the animal economy that is at present by no means clear.

The very numerous intermediary forms between the proper supporting or long-rayed cells and the short-rayed and other forms would argue a similarity of ultimate functions that we do not at present understand. It may be conceived that under certain nutritional conditions the different forms, more particularly the two chief types, pass from one into the other, and in case of need supplement each other; and although this supposition is not borne out by pathological facts so far as they are at present known, it must be remembered that our methods of investigation are relatively crude, and still in their infancy.

The Nerve Elements of the Cortex

Like the neuroglia, the nerve elements are derived from the ectodermal cells of the medullary plate, and in earliest embryonal life shows caryokinetic division (Koelliker and V. Beneden). In the earliest stages of life the original nerve cells—neuroblasts of His—appear as pear-shaped cells; these soon send out from the pointed end a projecting stem, which afterward becomes the axis cylinder of the nerve cell. Even on the fourth day of embryonic life in the chick the axis cylinders have attained a perceptible length, and have on their distal extremity an irregular conical swelling, the growing end or *cone de croissance* of Cajal. Up to this stage the body of the cell has remained smooth, but during the course of the fifth day (Lenhossék) branches start from the sides

in the form of varicose projections, to be the future processes or dendrites of the cell. These branches become more and more numerous, less varicose and irregular, and though retaining to a much later period some of the aspects of embryonal life, soon assume all the attributes of the perfect nerve cell.

Seen in the pyramidal nerve cell, numerically by far the most abundant nerve element of the cortex, and one giving to it its distinctive character, the development of the neuroblast is peculiarly

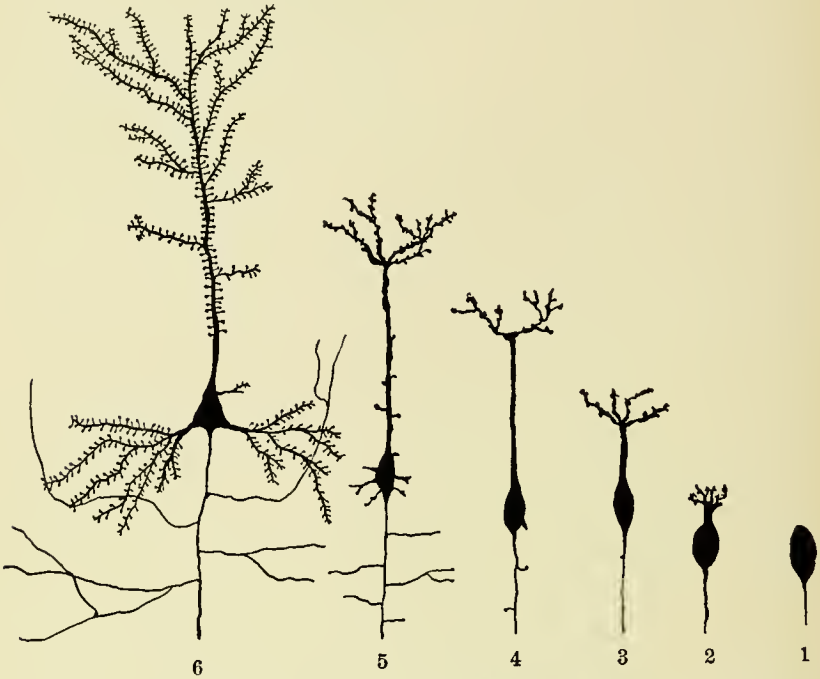

Fig. 4.—Growth of the Neuroblast. 1, Neuroblast of pear-shape with the beginning of the axonal extension; 2, the primordial dendrite is beginning to sprout and show branches; 3, a somewhat later stage; the axone shows budding collaterals; 4, a basal dendrite shows at the lower margin of the body; the primordial dendrite has grown considerably; 5, numerous branches have made their appearance at the sides and base of the body, the primordial process has extended, and the collaterals have branches; 6, full-grown nerve cell of the pyramidal type. Modified from Cajal.

characteristic and beautiful. Like all its congeners, the primitive cell is of pear form, with the axis cylinder proceeding from the thinnest and lowermost portion of the protoplasmic body toward the central regions of the hemispheres (Fig. 4). Soon at the opposite pole appears an outgrowth of protoplasm, surmounted by a tuft

of short branches. This outgrowth lengthens rapidly, extending upward toward the peridyme; the branch-like tufts become better defined and longer, while still retaining the embryonic nodes upon their extensions. The axis cylinder has also been growing rapidly, but remains without branches.

At this stage a new development begins. The inferior half of the body of the cell, before smooth, now commences to give off short side projections, while the axis cylinder discloses nodular thickenings in the course of its stem, from which come out side fibres, the collaterals, which in their turn grow in among the surrounding structures. The development of branches from the apical or primordial stem and the basal or secondary branches, as well as the growth of the collaterals from the nerve root, now proceed rapidly, until the form of the adult cell is reached.

Commencing in the embryo, the evolution of the cell continues until at a period at present unknown, but certainly some considerable time after birth, the final stage is reached. The branches, before tumefied and knotted, now lose these thickenings, and acquire from a point just beyond the margin of the surrounding lymph space to the outermost terminations, minute bud-like projections, inserted at right angles, or at a slightly obtuse angle to the parent stem, and measuring not more than one or two microns in length. They begin at the edge of the dendrite by an extremely fine pin-point insertion, and increase slightly in breadth as they run toward the termination, which is invariably in the form of a minute bulb, lying free in the adjacent tissue (Fig. 5, p. 21). It is probable—although up to the present time the proof is still wanting—that the bulbous terminations of the efferent nerve fibres and collaterals of the pyramidal cells also reach their final development at the same time as the lateral buds, or gemmulæ,* of the dendrites, so that the contact points between nerve ending and cellular protoplasm are ready for the transmission of neural impulses. The probable scheme of the transmission of the nerve force from fibre to cell and from cell to cell will be dealt with in subsequent pages.

The Cell Elements

Within the substance of the cortex are found only two types of nerve cells, and between these is a single prominent distinguishing feature. Morphologically speaking, this sole difference lies in the

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* Gemmula (dim. of gemma), a little bud.

axis cylinder, which in one variety extends for a very considerable distance from the cell body, while in the other it breaks up into fine terminations in the immediate neighbourhood of the cell body, or at least in a not distant territory. Of the former type the best example is to be found in the pyramidal cells, which have a nerve extension downward to the spinal cord, or to the opposite hemisphere through the medium of the corpus callosum.

The cells with the long axis cylinder are known as motor cells, or, as Schaefer has termed them, *projection cells*, the impulse generated in them being carried or projected to other and distant regions.

The second variety, those with short axis cylinders, were first thought to be sensitive cells by their discoverer, Golgi, but this idea has been abandoned, and they are now supposed to play the part of connecting elements between other cells, hence their name *intermediary cells*. They are also known as Golgi cells of Type II. Whatever may be the form of cells of the cortex, star-shaped, pyramidal, piuripolar, ovoid, or other shape, all belong to one or the other of these two types.

When we come to study the fine structure of the cell, we shall see that it is provided with a *nucleus* and *nucleolus*, a protoplasmic body or *corpus*, extensions from this corpus of varying number, the *neurodendrites* or *dendrites*, which give off short bulbar extensions from their sides, the *gemmulæ*, and an axis cylinder, *neuraxone* or *axone*, of varying length. No brain cell can be said to have more than one axis cylinder, and although several have been described as belonging to certain cells of the most external portions of the rind, recent studies have shown that these observations are probably incorrect. The assemblage of corpus, nucleus, protoplasmic arms, lateral buds, and axone, with its collaterals, together form a nerve entity for which Waldeyer has suggested the name *neurone*. Each neurone is separate and distinct from its fellow; it exists as an individual unit, from corpus to ultimate ramification—in other words, it does not unite or anastomose in any way with any other of the vast myriads of neurones in the nervous system.*

* The recent work of Apáthy, who thought he observed the passage of the fibrillæ of one nerve cell into the protoplasm of other ganglion cells, and the researches of Held, who advocates a subdivision of the ultimate axis fibrils within the body of the nerve cell, have not been confirmed by other observers; while the evidence of the silver method, which is clear and distinct in all details, tends to prove conclusively that such views are incorrect, at least for the higher vertebrates, and that the relation of cell to cell is by contiguity, each neurone being separate and distinct. See also the recent articles of Lenhossék in the Neurol. Centralblatt, Nos. 6 and 7, 1899.

What is, then, the connecting link by which impulses may be transmitted from cell to cell to form waves of impulse, resulting in motion? It is supplied, as is shown by the very positive pictures

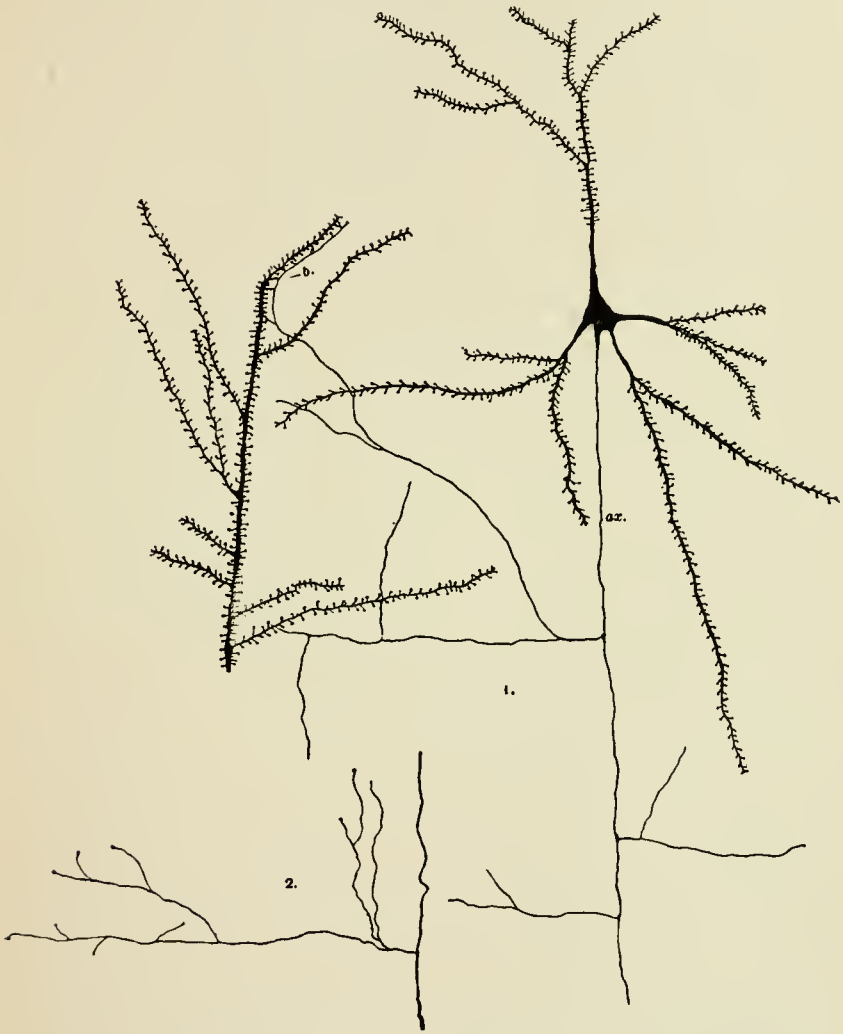


Fig. 5.—1, Psychical Neurone, showing the end apparatus of a collateral situated against the dendrite of another cell. Drawn from a human specimen. 2, Forms of termination of the ascending fibres of the cortex. Guinea-pig.

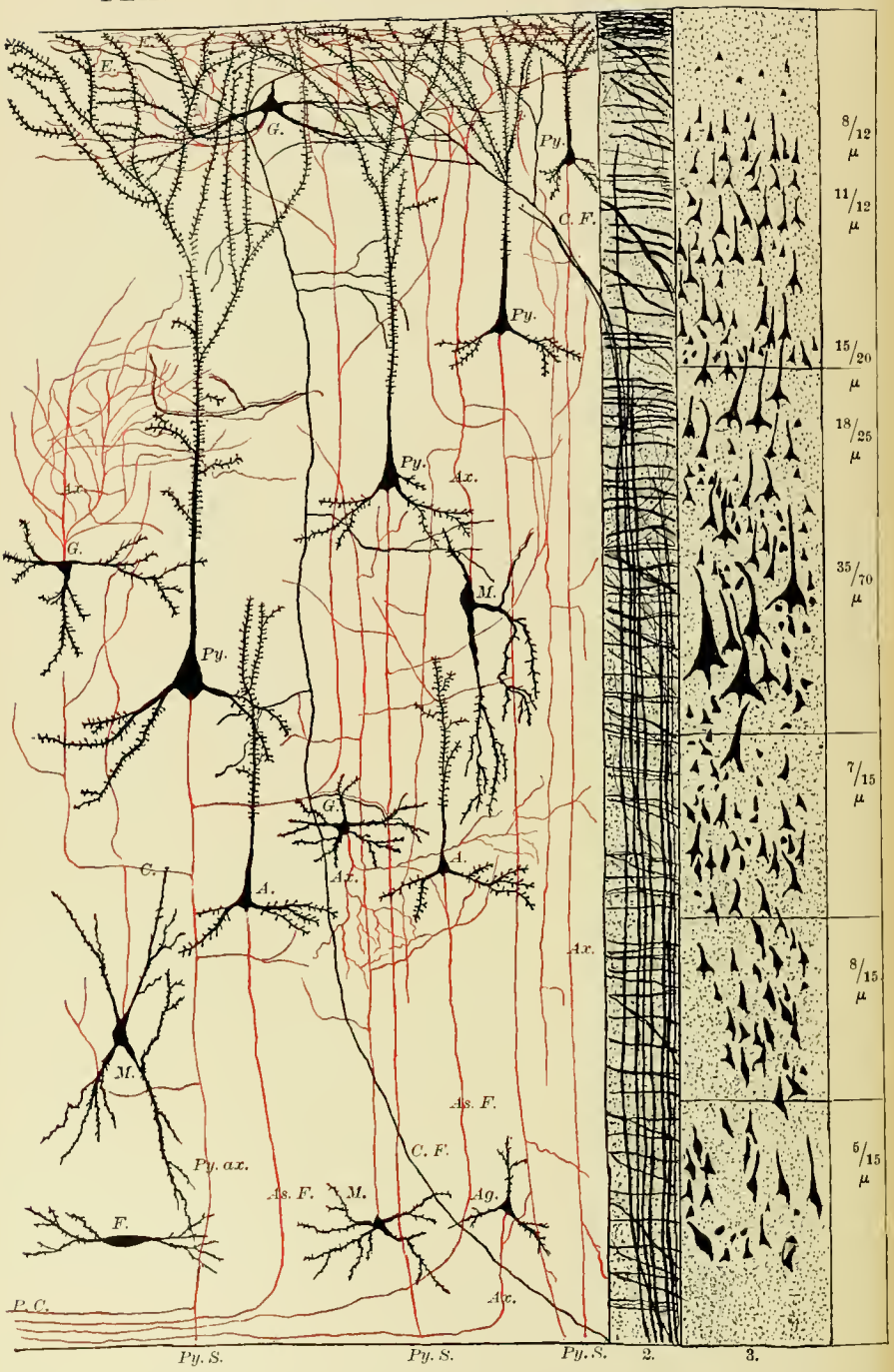
obtained by silver staining, by the contiguity of the protoplasm of the distal extremity of the axone to the protoplasm of the extensions (gemmulæ) of the dendrites of the cell body (Fig. 5). Such an

arrangement is very frequently seen within the cortex, where the terminations of the cellulipetal fibres, in the form of bulbar enlargements, seek close approximation to the substance of the terminal knobs of the gemmules upon the dendrites. This method of termination does not preclude the possible existence of subsidiary ones, but it is certainly the chief and most important.

Direct contact seems to be avoided by the interposition of an infinitesimal space between the two free endings. Contact between the ending of fibre and cell body, or the protoplasm of the thicker portion of the dendrites, cannot be, in the cortex, quite as perfect as between end apparatus and dendrites, on account of the thick neuroglia covering forming the boundary of the cellular space, and because the contained lymph fluid would also act as an insulation to these parts, though it is believed that certain cell bodies are undoubtedly surrounded by a basketwork of fine nerve fibrils. A direct transference of nerve impulse to cell dendrite may be imagined in certain places where very fine unmedullated fibres cross directly over the protoplasm of the extensions, but it has not yet been definitely proved that these fine fibres lose their insulation altogether after they have been deprived of their outer medullary sheath.

Several hypotheses have been forthcoming to explain the transmission of the nerve impulse from fibre to protoplasm over the slight intervening space. Of these, perhaps the most ingenious is that of Rabl-Ruckhard and Duval, which assumes the occurrence of amœboid contractions and relaxations of the protoplasm of the dendrites during intellectual activity, the cell branch and lateral buds swelling up, as it were, to meet the termination of the axone. Odise supposes an even more active movement of the cell and dendrite, which shows itself not only in the altered form, but in the finer protoplasmic structure of the cell. Cajal has built upon the vascular neuroglia cells a different hypothesis, seeing in them contractile elements that expand the blood-vessel and induce congestion of the cortical substance, and, in consequence, closer union of the intrinsic elements—a theory entirely inconsistent with the true function of the neuroglia bodies. It is doubtful, indeed, if the manner in which the nerve impulse passes over from terminal apparatus to dendritic branch will ever be fully understood. Let it suffice at present that we possess the definite knowledge that nerve-end apparatus and protoplasm of cell are in fixed positions as regards one another, and that in some unknown way the impulse, in whatever form it assumes, passes from one to the other.

PLATE III


F.
F.
G.
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Ag.
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Py. S.
Py. S.
Py. S.
2.
3.
8/12 μ
11/12 μ
15/20 μ
18/25 μ
35/70 μ
7/15 μ
8/15 μ
5/15 μ

PLATE III

Diagram of the Nerve Elements of the Cortex

To the left the nerve cells and their connections are seen as defined by the Golgi method. In the middle the density and course of the fibres, with particular reference to the tangential bands at the different cellular levels, are shown; to the right, the forms and sizes of the nerve elements with their average measurements according to Hammarberg.

1. *Py.*, *Py.*, *Py.*, *Py.*, pyramidal cells of the several layers that distinctly belong to this type of cell. All have descending axones, with collaterals either distributed tangentially or ascending among the dendritic ramifications of the cells and forming the connecting links between them. The dendrites of these cells all rise as high as the molecular layer, and some pass to its extreme outer limit. The bulbar endings of the collaterals are seen situated among the gemmules upon the branches of the dendrites. *G.*, *G.*, *G.*, intermediary Golgi cells of Type II, having short axones breaking up and terminating in end-bulbs in the neighbourhood of the cells. *M.*, *M.*, *M.*, cells of the Martinotti type with main axone ascending and collaterals descending. *F.* and *Ag.*, angular and fusiform cells of the deeper layers with descending axones. *A.*, *A.*, association cells of the deeper layer. *Ax.*, axone. *C.*, collateral. *E.*, *E.*, terminal apparatus of the fibres. *Py. ax.*, descending axone from a pyramidal cell. *Py. S.*, straight pyramidal axone descending into the capsular regions. *P. C.*, collateral of a pyramidal cell running into the corpus callosum. *C. F.*, *C. F.*, cellulipetal fibres ascending through the cortex at an obtuse angle, and there dividing into a number of branches which eventually terminate among the dendrites of the pyramidal cells. *As. F.*, association fibres.

2. Section of the cortex from the motor region, showing the relative numbers of the tangential and other fibres at the level of the several cellular layers.

3. The relative size and number of the cells in the various laminæ of the cortex as seen with ordinary stains.

PLATE III

DIAGRAM OF THE NERVE ELEMENTS OF THE CORTEX

To the left the nerve cells and their connections are seen as defined by the Golgi method. In the middle the density and course of the fibres, with particular reference to the tangential bands at the different cellular levels, are shown; to the right, the forms and sizes of the nerve elements with their average measurements according to Hammarberg.

1. P_1, P_2, P_3, pyramidal cells of the several layers that distinctly belong to this type of cell. All have descending axones, with collaterals either distributed tangentially or ascending among the dendritic ramifications of the cells and forming the connecting links between them. The dendrites of these cells all rise as high as the molecular layer, and some pass into its extreme outer limit. The bulbar endings of the collaterals are seen situated among the granules upon the branches of the dendrites. G_1, G_2, interstitial Golgi cells of Type II, having short axones breaking up and terminating in end-bulbs in the neighbourhood of the cells. M_1, M_2, M_3, cells of the Martinotti type with main axone ascending and collaterals descending. F_1 and A_2, angular and fusiform cells of the deeper layers with descending axones. A_1, A_3, association cells of the deeper layers. Ax, axone. C, collateral. E_1, E_2, terminal apparatus of the fibres. P_3, w_1, descending axone from a pyramidal cell. P_3, S_1, straight pyramidal axone descending into the capsular regions. P_1 C_1, collateral of a pyramidal cell running into the corpus callosum. C P_1 C_2 P_2, cellulipetal fibres ascending the nigh the cortex at an obtuse angle, and there dividing into a number of branches which eventually terminate among the dendrites of the pyramidal cells. As P_2, association fibres.

2. Section of the cortex from the motor region, showing the relative number of the tangential and other fibres at the level of the several cellular layers.

3. The relative size and number of the cells in the various laminæ of the cortex as seen with ordinary stains.

THE LAYERS AND CELL FORMS FOUND IN THE CORTEX

Except in the Ammon's horn, the fascia dentata, and a few other localities, there is no very wide difference in the anatomical arrangement of the cellular elements of the cortex, though minor divergencies everywhere abound. It is true that the great central region of the rind bordering on the Rolandic fissure shows a higher development of the great pyramidal cells than the occipital or frontal poles, while at the same time these regions show minor differences in the thickness of the cellular layers, the arrangement of the white traversing bands, and the size of the principal elements, sufficient in well-stained sections to enable one to locate approximately from what region of the cortex the bit of tissue has been derived. The fibre bands of Gennari are always more readily recognised in the posterior than in the frontal region, and help one to differentiate between the two; again, the molecular layer is thicker toward the occipital pole.

It is customary in the cortex to distinguish four cell layers: the outermost containing few neural elements, the molecular lamina; beneath it a layer of small pyramidal elements; next to this an ill-defined stratum of larger elements of the same morphological appearance; and, finally, a layer in which the elements are polymorphous. All these strata are intimately connected by the passage of axones and dendrites from beneath to the superior regions, or from above to the lower layers, while the molecular and upper portions of the second layer form the common meeting ground for the co-ordination and sorting of all the impulses sent from the peripheral nervous system, whether the nerves of special sense or those of common sensation be concerned.

The Molecular Layer.—Excluding the numerous glia cells along the subpial border, we find first a band of moderately coarse and fine fibres running parallel to the surface. In Weigert or Weigert-Pal specimens all these fibres seem to be furnished with a myeline covering. A portion of this band is undoubtedly made up from fibres intrinsic and extrinsic to the cortex passing through the lower layers and bending into it; indeed, as Cajal has shown, the majority comport themselves as if they were the arboreal terminations of axis cylinders. We find among these outermost tangential fibres some that have ascended through the crura and internal cap-

sule, others derived from the collaterals of the axones of pyramidal cells, fibres from peculiar cells with upturned axones lying in the deeper regions of the cortex, and finally fibres arising from the intrinsic cells of the region, which, however, are not numerous, and do not furnish an important percentage of medullated tubes to the band.

In the cortex of small animals, I have frequently traced thick fibres which ascend through the medullary masses at the foot of the convolutions, to enter obliquely the gray layers, and after reaching a certain height break up into numerous branches, some of which ultimately turn into the tangential band. Collaterals from the pyramidal cells, turning upward, may also occasionally be traced as far as the band, though many of them terminate at a lower level. The fibres already mentioned as coming from peculiar cells (Martinotti cells) situated in the lower region of the gray matter may also be seen bending into it.

Cellular Elements of the Molecular Stratum.—Retzius in the human fœtus, and Cajal in the dog and other vertebrate animals, have described certain cells in this lamina, to which they attribute nervous functions. The Retzius cells are most striking structures, with large polygonal or oval bodies, having their principal dendrites running in a direction parallel to the brain surface. From these chief dendrites, as well as from the cellular body, are given off shorter branches which proceed at right angles to the main stem or corpus, and end at the free margin of the brain in a rounded bulb. Inasmuch as no distinct axis cylinder can be determined, and since similar forms of cells of definite neuroglia origin are to be found elsewhere, it is extremely probable that these elements are immature supporting cells that later take on a more definite form.

Cajal in the lower animals has found two types of cell peculiar to this region, to which he ascribes nervous attributes. The first of these are small fusiform or bipolar cells lying parallel to the peridyme, whose processes eventually diminish in calibre and divide into two or more branches, from which are given off short rectangular filaments having somewhat the appearance of axones, and turning toward the surface of the brain, where they are lost. The second form is that of a small triangular-bodied cell with three or more prolongations extending horizontally from its side, which eventually, as in the other form, break up into supposed axones which turn at right angles toward the surface, and are lost after running some distance parallel with it. The apparent presence of

at least two axones to these cells throws doubt upon their being nerve cells. Koelliker, indeed, in a careful review of the literature, considers them to be of neuroglia origin—an opinion which has been confirmed by later researches.

In the adult mammal, in man or inferior animals, only one distinct type of nerve cell can be found within the molecular layer by the silver method, while staining by other formulæ sheds no light on the origin or function of the other types of cell.

These last are rather small polygonal cells having four, six, or more protoplasmic extensions of medium length arising from the body, covered by fine, thorny projections. The cells lie along the inferior border of the stratum, with dendrites occasionally extending among the smaller pyramidal cells of the second layer. The axone is fine, coming off either from the cell body or from a main branch near the body, and after traversing a variable distance parallel to the surface of the brain, breaks up into numerous ramifications which mingle among the ascending dendrites of the pyramidal cells. They are accordingly cells of intermediary function, or Golgi cells of Type II.

The Pyramidal Cell Layers.—Morphologically as well as anatomically there is little distinction, except in point of size, to be drawn between the larger and smaller pyramidal cells. The former, however, are situated more deeply in the gray substance, although their branches, by their greater length, rise to the same elevation beneath the peridyme as those of the smaller type, with which they are intermingled. Together they make up the great bulk of the nerve-cell elements of the cortex, and if there be such a thing as a distinctive psychical cell, the pyramidal cells may without dispute claim that eminence. We shall therefore call them indiscriminately pyramidal or psychical cells. From the stratum zonale to the beginning of the so-called fourth layer the arrangement of the pyramidal cells shows (1) a thick layer of moderate-sized pyramidal elements, (2) a thinner layer of much larger ones, and (3) a zone of more scattered pyramidal forms (Hammarberg), intermingled to some extent with polygonal cells.

The bodies are very uniform in shape, though no two have identically the same measurements. The outline is conical or pyramidal, the base being directed toward the deeper regions, the apex toward the surface. From a definite part of the base, easily recognised by the presence of a little hillock of nervous matter, is given off the axis cylinder. The protoplasmic expansions are numerous,

but the chief ones extend from the angles of the cone, and render the pyramidal appearance, both in carmine and in silver staining, more accentuated. Finer extensions are given off from the sides in comparatively small numbers. (See frontispiece.)

The dendrites may be distinguished, according to their origin, into apical or primordial dendrites, usually the longest and thickest cell extension coming off from a point at the upper pole of the cell; and basal or secondary dendrites, having their origin in the lower portion of the cell body. The thick primordial extension runs upward some distance from the main protoplasmic mass before losing the protection of the surrounding lymph space, and then begins to throw off, at right or obtuse angles, lateral arms, which in their turn divide and redivide into branches. As the main stem proceeds upward it gives off more and more secondary dendrites, until just beneath the border of the molecular layer the main trunk splits up into a number (two or more) of chief branches, which penetrate high up into the molecular lamina, ending among the numerous terminations of the several fibre systems entering therein (Plate III, *Py. Py.*). The primordial process, as well as all of its several branches, are irregularly studded with the small bulb-ended lateral buds—the gemmulæ—described on a previous page. Those on the thicker portions of the apical stem are somewhat larger, and have their insertions more constantly at a right angle than those upon the secondary and tertiary stems.

Except in situation, the basal processes do not differ histologically from the apical, and are likewise thickly studded with the pin-headed gemmulæ. The chief stems customarily divide at obtuse angles to the parent dendrite, and extend for very considerable distances from the cell body. The free end of the various dendritic stems is usually marked by a slight conical enlargement with a needle-point termination; or the stem may become finer and finer, still being covered with the buds, until it comes to a free needle-point termination. Anastomoses between the finer branches are never found; coarse junctures between the bodies of cells are, however, occasionally met, and may be looked upon as an evidence of imperfect development in individual cells, and accordingly must be regarded as monstrosities.

Like the dendritic extensions, the axone, within a moderate distance of the cell body, begins to throw off, at very irregular intervals, lateral branches—the collaterals (Plate III, *Py. ax.*). Their number varies greatly with each cell, especially in the human being,

seldom exceeding four, although occasionally I have counted as many as ten proceeding from the same fibre. In the occipital region they are more numerous than in the anterior and motor areas. At the point of departure of each collateral there is developed in the substance of the main fibre a small triangular thickening, out of which the daughter fibre grows. These knots have some likeness to the nodes of Ranvier in the peripheral nerves, and doubtless fulfil a similar office. Cajal has occasionally seen a fibre bifurcate, but this must be very exceptional with the axone, though frequent with the collaterals. Both axones and collaterals are furnished with a myeline sheath for insulation, a point to which we shall presently return.

The collaterals of the axones of the psychical cells in man may be separated into two divisions: 1. Those that shortly after leaving the parent stem curve obliquely upward, or proceed laterally to break up into numerous subdivisions, finer and finer, until they end in a terminal apparatus, closely approximated to the gemmulæ of cells other than that from which it was originally derived. 2. Those which pursue a course at right angles to that of the axone, or even descend at an oblique angle to a lower plane, there to ramify, and end apparently among the branches of the cells of the inferior third of the gray substance, though their ending is rarely so well defined as that of the ascending collaterals.

The pyramidal nerve cell, taken in its entirety, is of a beautiful arborescent form, the body with the thicker portion of the apical process representing the trunk, the expansion of the primordial extension the foliage of the tree. The basal dendrites correspond to the surface roots, while the axis cylinder forms a magnificent taproot, conveying in this instance not nutriment from the blood, corresponding to the sap of the tree, but the impulse of a nervous activity generated in the body of the cell, finally showing itself in the distinctive attribute of man—logical thought.

In the layers of the psychical cells few other elements of nervous structure are found. Scattered polygonal cells of the intermediary type are occasionally seen, but these are rare until the lowermost portion of the cell layer is reached. In the lowermost regions pyramidal cells are intermingled with those of the polymorphous elements, so that actually there is no well-defined boundary between the several cell layers, although certain types of cell are prominent at distinct levels of the cortex.

A slight digression may be made at this point to consider briefly the function of the dendrites of all the cortical cells, and more espe-

cially those of the pyramidal variety, as they are the largest and best defined. At the inception of the silver method, Golgi and his scholar Martinotti thought they had determined connections between the dendrites and the sheaths of blood-vessels, and attributed to the dendrites a purely nutritive function. Other observers failing to demonstrate these vascular connections, the pendulum swung to the other extreme, and their function was determined to be solely nervous—namely, to convey impressions from the terminal apparatus of the nerve fibres to the body of the cell—cellulipetal conduction. From the anatomical relation of end apparatus and dendrite it would appear evident that they must possess this nervous function (Fig. 5); but this view in no wise precludes the possibility that the dendrites may also serve a purpose in the nutrition of the cell body itself. Their vast expansion would allow of the absorption of no inconsiderable amount of nourishment from the plasma permeating the tissues, and there is nothing inconsistent in the idea that the power of furnishing food to the body of the cell might not be associated with the cellulipetal conduction of impressions received from efferent nerve fibres. The basal dendrites seem to be lacking in numerous points of contiguity with nerve endings, though this does take place; and their connection with the cell body is more direct than through the long apical process, and through them therefore would be provided a shorter tract for nourishment to reach the cell centre.

These food paths can be of only secondary importance to the unit, the body being constantly bathed, through the medium of the pericellular sac, with nutrient fluid; and as the protoplasm lies apparently free in it, a cellular membrane having never as yet been demonstrated, communication between protoplasm and plasma is direct. The dendritic branches are, furthermore, probably covered with an insulating membrane (the writer, Rosin) which prevents direct contact with the fibre network surrounding them, and limits direct conduction of the cellulipetal neural impulses to the naked protoplasm upon the extremities of the gemmulæ.

The few nerve cells mentioned above as occurring in this layer, besides those of conical form, merit a short description. They are both elements of the intermediary type, but differ widely in the morphological character of their neuraxones. The first is the true cell of the Golgi type II, with a star-shaped or polygonal body, set with many fleshy dendrites, and having an axis cylinder that breaks up, after coursing a short distance, into a multitude of short and long nerve fibres (Plate III, *G. G.*) that pass in all directions among the

lowermost branches of the apical and basal dendrites of the pyramidal cells. Their probable function has already been mentioned.

Besides the above-described cell there exists another, first depicted by Martinotti and Golgi, belonging to the intermediary variety of nerve elements, characterized by an ascending axone, which passes entirely through the zone of pyramidal cells to the band of nerve fibres in the stratum zonale, where, after dividing into a number of filaments, it bends at an obtuse angle and is lost among the fibres of the band (Plate III, *M. M.*). Some of these cells show collateral branches from the axones which, instead of ascending to a higher level, descend into the lowermost zones of the cortex, where they vanish. The cells have oval, angular, or rounded bodies, and are universally of small size. The main dendrites are not very numerous (three or four), and break up into a great number of smaller branches that show thorny projections extending from their protoplasm.

The **fourth layer**, or polymorphous zone, contains a great variety in the forms of the contained cells. Those of the pyramidal type are not entirely lost, but are seen scattered here and there. They preserve the same general character as those in the higher regions. Other cells, more peculiar to the region, now abound. They are oval, fusiform, triangular, or star-shaped (Plate III, *F. Ag.*). Among them may be recognised cells of the intermediary type, but in the majority the axone is directed downward to the subjacent white layer, where it is no longer traceable among the closely packed tubes. The protoplasmic arms of these polygonal and other cells are usually thick, but not numerous; they ramify in all directions, but never pass beyond the lamina. The function of these cells is unknown. Cajal and Koelliker believe they have traced their axones into fibres running over the corpus callosum, and at right angles to the transverse bundles of that body, and that they serve as association fibres between convolutions of the same hemisphere.

The Subcortical Zone of Medullated Fibres and their Relation to the Cortical Cellular Layer.—In man this mass of fibres lying beneath the gray substance seems hopelessly intricate, but by selecting the brains of small animals, in which the distances between the several regions are not so great, a differentiation of the component nerve tubes may be determined.

The Weigert and similar methods show that all the coarser fibres of this zone, as well as of the cortical layers, are medullated. Furthermore, the chrome-osmium-copper staining and the method

of Flechsig determined all the collaterals and the finest nerve fibres to be covered with a protective sheath. About a portion of them there still remains some doubt, but their numbers are comparatively small. This knowledge, that the nerve fibrillæ even to the finest varieties are insulated, is of great importance, showing, as it does, that the fibre conveying the impulse from the periphery to the cortex, or the fibre of the collateral, does not come into direct contact with the protoplasm of the dendrite at the many intersecting points, but that contact or contiguity between protoplasm of nerve cell and substance of axone is limited to certain definite points. Thus a fibre passing from the skin to the cord and reaching indirectly the cortex, may break up into numerous collateral filaments, which cross cell body and dendrite indiscriminately, so that if the fibre were not insulated by some material, the impulse, whatever be its nature, might as readily pass from the unprotected fibril to a series of cells to which it was not destined, as to another in which its proper end apparatus was stationed.

We find, accordingly, by the silver stain, a definite bulbar ending, the terminal apparatus of the fibre, and by another stain a complete insulation of the vast majority of the nerve fibres. The logical inference is, that the impulse derived from peripheral excitation is to be expended, not on every cell by which the fibre may pass, but to definite cells, located in especial subterritories to which the excitation is directed. The efferent impulse is definite, not chaotic, leaping from element to element, producing confusion, not order.

Within the white substance four kinds of fibres are to be distinguished according to their anatomical connections, and most of them may be determined in man as well as in the lower animals, since the key to the labyrinth has been supplied by comparative investigation: 1. Projection fibres descending from the pyramidal, and perhaps other cells, through the thalami and corpora striata, some of which are to pass onward through the crura into the pyramidal tracts of the cord (Plate III, *Py. ax. Pys.*). 2. Callosal fibres derived mainly from the pyramidal cells (Plate III, *Py. c.*). 3. Association fibres, coming in all probability from the irregular cells of the lower layer, and connecting convolutions of the same side (Plate III, *A. S. F.*). 4. Fibres from the basal regions, the bulb, and spinal axis, conveying impressions from special sense organs and cutis to the psychical cells (Plate III, *C. F.*). Intermingled with these fibres, within the cortex, are the numerous collaterals from pyramidal and other cell axones, together with those of the intermediary cells, the

assemblage forming a fine and confused network around the dendrites and corpora, in which collaterals of local cells and fibres from extrinsic sources seem indistinguishable.

1. *The Projection Fibre System.*—Arising in all regions of the cortex, these fibres assemble themselves to pass through the corpora striata, and onward to the crura and tracts of the spinal cord. Some of them are fine, the majority coarse, and occasionally one is seen

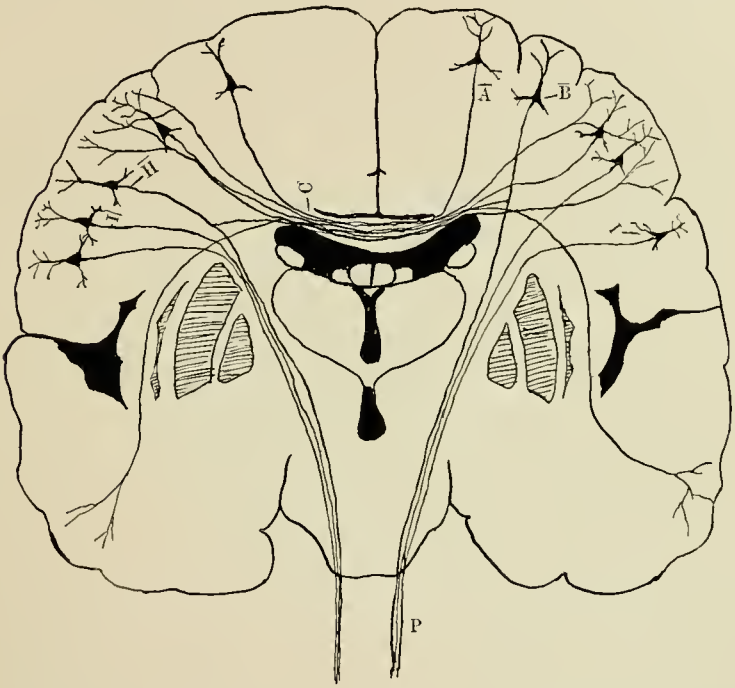

FIG. 6.—DIAGRAM SHOWING THE ORIGIN AND COURSE OF THE PYRAMIDAL AND CALLOSAL FIBRES. *P*, Pyramidal tract; *C*, callosal commissure: *A*, cell sending an axone directly to the contralateral hemisphere; *B*, *H*, cells having branched axones; the main fibres descend into the pyramidal ways, and the collaterals cross to the opposite half of the brain through the corpus callosum: *I*, *I*, cells sending fibres directly into the pyramidal tracts without branching.

to give off a collateral, or to subdivide at the level of the corpus callosum into two branches, one pursuing a descending course, the other running horizontally. In man their origin is extremely difficult to determine, but sections from small mammals—the mouse, for example—show that the majority come from the great pyramidal cells, and another portion from the smaller cells of the same type. I have never been able to trace descending axones from the fourth

cell layer far into these tracts, but Cajal holds that they are derived also from the polymorphous cells. Von Monakow thinks that they all originate from the larger psychical elements, and Koelliker has also been unable to determine axones from the polymorphous cells below the level at which the callosal fibres are given off. Degeneration researches, as well as the evidence of pathological findings, show distinctly that the fibres forming these tracts pass downward throughout the entire length of the pyramidal tracts (Fig. 6).

2. *The Callosal Fibres.*—The nerve threads of this great association band between the two hemispheres are derived in part from axones that pass directly from one lateral half to the other, and in part from collaterals from axones that descend through the internal capsule. One origin of these fibres is to be found with certainty in the larger pyramidal cells, from which they may be directly traced. Their numbers would imply that other cortical cells also send fibres into the callosal system. Koelliker and Cajal ascribe their origin also to the polymorphous layer, and indeed the last-named observer favours a common origin from cells of the several layers. The final ending of the callosal fibres has not yet been fully worked out. It is probable that just below the gray matter of the opposite hemisphere they break up into a number of branches which penetrate and end upon the cells of the different layers. This would imply that all the cells of the contralateral halves of the brain were in relation one with another, in order to correlate thought and motion.

Besides the great association system there are two others, the anterior and posterior commissures. The latter is composed entirely of association fibres passing from one sphenoidal lobe to the other, but the origin of the former is far less certain. Van Gehuchten regards at least a portion of its fibres as forming a kind of chiasma for the olfactory bands analogous to that of the optic nerves. These fibres, instead of running directly from the olfactory bulb to the cortex of the temporal lobe of the same side, pass, in part at least, by the anterior white commissure into the gray matter of the opposite temporal lobe.

3. *Unilateral Association Fibres.*—Over the corpus callosum, in the mouse, passes a thin band of fibres from before backward, apparently destined to connect the anterior convolutions with those situated more posteriorly on the same side. They are probably derived from the polymorphous and pyramidal cells, Cajal ascribing the larger number to the former variety, and from what may be

termed the long fibres of association of the same hemisphere. Other systems of extended association fibres unite the occipital and the tip of the temporal lobe, the frontal and temporal lobes, the region of the third frontal with the point of the temporal lobe, while bands pass between distant convolutions upon the superior external aspect of the hemispheres (Van Gehuchten) (Fig. 7).

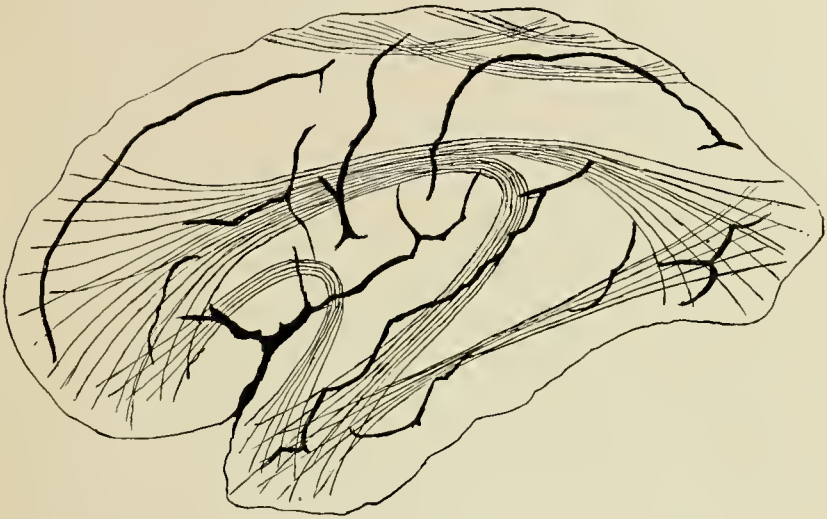

FIG. 7.—DIAGRAM SHOWING THE DISPOSITION OF THE ASSOCIATION FIBRES OF A HEMISPHERE. After VAN GEHUCHTEN.

Shorter bands of association fibres connect the gray matter of adjacent convolutions one with another, forming a complete system of intergyral correlation. They are probably derived for the most part from the smaller and polymorphous cells.

4. *Terminal Fibres.*—The last of the subcortical medullated fibres that form a distinct system in all likelihood belong to the spinal-sensory, or terminal system, from the peripheral organs to the psychical centres. Cajal and Koelliker have especially studied these centripetally coursing fibres in the lower animals. They may be found in the projection bundles of the corpora striata and in the capsula externa (Koelliker), out of which they stream into the gray matter of the cortex. The diameter of the axones of the fibres composing these rays is sufficiently large to enable the observer to recognise them readily (Plate III, *C. F.*). They enter the cortex at an obtuse angle, and on reaching the level of the middle and smaller pyramidal cells split up into very numerous branches, ramifying

between the cells, ascending finally to the level of the upper tangential fibres, into which a part of the branches bend, while others running horizontally at a lower level are distributed among the dendrites of the lowermost psychical cells. All the terminal branches bear end knobs upon their extremities.

In sections of the human brain these fibres are quite as readily made out as in the lower mammals. Their connections with the fibres of the external capsule, owing to the distance, are of course not apparent, but arising out of the medullary masses in exactly similar fashion, they pursue an oblique direction through the lowermost gray layers, and break up into great numbers of branches, some running horizontally among the cells, others continuing toward the tangential fibres of the brain surface. In Weigert-hæmatoxylin preparations, owing to their oblique direction and heavy myeline sheath, they can be distinguished from the radial fibres, and can be followed as high as the small-cell pyramidal layer.

THE RELATION OF THE ELEMENTS OF THE CORTEX TO ONE ANOTHER

From what has already been said, it can be readily seen that of all the regions of the cortex the stratum zonale with the immediately subjacent territory is most important, so far as the connections of cells and terminal fibres are concerned. Here meet on a common ground terminal fibres from most distant regions, the cord, cerebellum, bulb, etc., the fibres of the various short and long association systems, the fibres of the interhemispheric connecting medullary bands, and, lastly, the ascending axones from autochthonic cells of the middle layers, and the ascending collaterals of the pyramidal axones. Penetrating among and filling the spaces between the threads of these myriad fibres, some of which form bands upon the surface, others a loosely arranged meshwork more centrally situated, are the branches of the apical processes of the large and small pyramidal cells. The great cells send their trunks and branches high upward among the outer tangential bands; the uppermost smaller ones reach the same altitude, but quite a number of those situated at a lower level attain only the inferior border of the molecular stratum, and find their proper fibre connections at this level. Many-branched axones from the intermediary cells along the lowermost border of the molecular zone intermingle their filaments in the common plexus.

The question of the carrying of the nervous impulse from terminal axone to cell corpus is most important. Evidence has been accumulated little by little in the past few years, especially from research work by Retzius, Koelliker, Van Gehuchten, and Lenhossék, and, for the human brain, by the writer, that the dendrite is the chief means of communication between the central region of the cell, the nucleus, and adjacent protoplasm, and the terminal ending of the centripetal and intrinsic fibres. Thus it seems certain that a stimulus, for example, starting from the pricked skin of a limb, is carried by the posterior root fibres into the posterior root zones of the cord, whence the impression is passed on through the ascending lateral fibres by means of new cell series to the cortex. There the fibres coursing cellulipetally to the pyramidal cell dendrites end in close approximation to a gemmule or series of gemmules upon an apical dendrite, by whose agency the impression derived from the peripheral excitation is carried over the dendrite to the cell body; here new impulses are formed, the mechanism of the axone is set into action, the wave is carried cellulifugally down the axone, side waves pass to the collaterals to excite neighbouring cells, while the main one continues downward through the pyramidal paths to the anterior horn. The motor cells of the horn receive the excitation projected from the brain, impulses are propagated along the motor roots to the muscles nearest to the point at which the original excitation arose, the muscle fibres belonging to the part are set in motion, and the limb is drawn away from the irritant. The chains and links of this hypothesis have been worked out sufficiently to insure its partial, if not absolute, accuracy.

Whether all the dendrites of the pyramidal cells are capable of receiving impulses and conducting them to the corpus is not known, the difficulties in staining and the complexity of the connections precluding the possibility of making all the relations of the neuroprotoplasm visible at one time. Dogiel's researches on the retina, as well as the anatomical relations of the mitral cells in the olfactory bulb to their nerve connections, would tend to show that perhaps only a portion of the dendrites are in relation with the nerve endings. Terminal arborizations are far less frequent upon the basal than upon the apical dendrites of the pyramidal cells, a fact which would also seem to prove that there is some selection. The relation of nerve ending to cell body, particularly within the brain cortex, is by no means entirely certain, despite the recent work of Held on

the passage of nerve fibres into the protoplasm. By the silver method, bulbous endings of fibres are occasionally seen lying close to the body of the cell; but this body is so protected from without by a feltwork of fine glia fibres surrounding the lymph space, that a direct ending of fibre in approximation to the nervous substance of the cell is doubtful, and it would at least seem that the naked protoplasm of the gemmules upon the dendrites is the chief point of selection for the transference of the nerve wave.

From the manifold connections of the pyramidal cells one with another by means of their numerous collaterals, it would appear that groups of cells might be readily excited and set in action by the carrying of an impulse to a single cell, and the transplanting of the same to all or any of the numerous surrounding cells with which the collaterals of this particular cell were interconnected, and that from these irritated cells impulses might again be started to set in excitation, by means of their association fibres, cells of other convolutions, or, through the agency of the fibres of the corpus callosum, those of the contralateral hemisphere. In this way could be induced an unity of action among the nerve elements of the entire brain. Impulses may apparently also pass downward by way of the pyramidal collaterals to the cell of the polymorphous layer to excite elements of the same hemisphere, but somewhat distantly situated. The function of the ascending axone cells of Martinotti is not clear, beyond the possible office of connecting, through their ascending collaterals, the dendrites of the highest lying pyramidal bodies with the elements of the polymorphous layer, the connecting link being the descending collaterals from these cells, which apparently do not penetrate beyond the gray laminæ. Likewise the function of the intermediary cells would seem to be in relating cells lying in the same neighbourhood, but functionally separated.

These theories may have to be largely modified as a result of future research, but the anatomical facts made plain by the great gift of Golgi to the neurohistologist will remain undisputed.

THE FINER STRUCTURE OF THE NERVE CELL

For more than thirty years, since the discovery of the so-called primitive fibrillæ in the protoplasm of nerve cells, bitter polemics have been waged concerning the structure of the ganglion cell, and to-day the strife has by no means been settled. First of all the fibrillar structure of the axone came into dispute, until eventually

the presence of the primitive fibrillæ was settled. With the cytoplasm of the cell the growth of proof has been slower.

The chief exponents to-day of the fibrillary structure of the nerve cell are Nissl, Benda, Bethe, Apáthy, Lugaro, Van Gehuchten, Flemming, and Marinesco; while among those on the opposite side may be numbered Arnold, Butschli, Held, Altmann, and Cajal. The former have recently won over to their side a powerful supporter in the person of Lenhossék, who at the meeting of the Anatomische Gesellschaft in Kiel, in 1898, admitted the presence of fibrillæ in the cell.

Examined in fresh preparations with physiological salt solution, the cytoplasm of the cells shows a well-defined finely granular appearance extending from a lighter inner ring around the nucleus, in which the granules are less prominent, in unbroken series to the periphery. The addition to the imbedding fluid of fixing salts, or even of aniline dyes, seems to change the character of the cytoplasm in a remarkably short time, and bring into view peculiarities unknown in other cell structures. The immersion of the cell for a few hours in watery methylene-blue solution (Wright) brings out certain well-defined granular particles arranged parallel to the long diameter of the body, or concentrically to its nucleus, as well as showing that certain parts of the cell do not absorb the dye. By an equally simple procedure (Arnold), the immersion of the fresh cell in weak potassic-iodide-iodine solution, the same granule heaps are shown, imbedded in a ground material finely granular in character.

These granule heaps above mentioned appear to have been first seen by Flemming in 1882, who pictured and described them as peculiar light-refracting bodies in the protoplasm. In 1885 Benda described them as chromophilic concretions in the cell body, but it was not until Nissl, by a new method of staining (alcohol hardening and magenta tingeing), described them more in detail that their presence in the cell attracted universal attention. To Nissl, therefore, is due the honour of giving the histologist and pathologist an insight into a department of the intimate cell structure never before attained or equalled by any other method. Nissl has modified his earlier method to that of a methylene-blue staining, which shows more clearly than the magenta these peculiar bodies that are known as granula, Nissl bodies, or tigroids, from their resemblance to the spots on a tiger's skin (Lenhossék).

By the Nissl method, the all-important nucleus, to which we shall presently return, is not so well stained as by safranin-hæma-

toxylin in alcohol preparations, or by the chrome-osmium fixation of Flemming, and tingeing with carbol-fuchsin or safranin; but in the protoplasmic substance are shown the irregular granula (Nissl bodies), arranged concentrically or in rows. Their appearance is constant, and while it is possible that they may be productions of the various reagents used in hardening and staining, and therefore in a certain sense artefacts, yet they are nevertheless perfectly definite in form and disposition in the principal types of cell—the pyramidal cells of the cortex, or motor cells of the anterior spinal columns; and when deviations from these fixed forms are found they are undoubtedly of a pathological nature.

Between the granula lie longitudinal rows of a substance unstainable by the methylene blue, though reacting to other methods.

We have accordingly by this method two divisions of the cell protoplasm—one stainable by the blue dye, the chromatic substance, the other non-stainable, the achromatic substance. Of their chemical properties nothing positive is known.

As mentioned above, the chromatic substance manifests a certain disposition or arrangement in the body which varies with the variety or location of the cell under examination. Thus in the olfactory lobe, the distribution of the granula is netlike in the cells (according to the nomenclature of Nissl, arkychromic cells), while the cortical and motor cells of the cord have them mainly arranged in rows (stichochromic cells). Furthermore, the various types of cell in the cortex and elsewhere are divided by Nissl into several main groups according to the varying relations of the cell protoplasm to the nucleus. Thus the cytochromic cells (nerve granules) are bodies having a nucleus the size of a leucocyte with a small amount of stainable protoplasm surrounding it; caryochromic cells have nuclei of the usual nerve type, and but little protoplasm; and somatochromic cells, or nerve bodies, have a nucleus of moderate size with a considerable amount of protoplasm surrounding it, having a definite contour.

In this study of the cortex our main interest lies in the somatochromic cells of the stichochromic group. These comprise all the important cells of the brain rind, in which the definite arrangement under normal conditions enables one to detect the slightest pathological modification.

In the meshes or intersections of the achromatic substance lie the Nissl granula. These knots of chromatic substance vary greatly in size and arrangement, being round, angular, etc., while still pre-

serving the general appearance of rods or triangular particles set in a clear field.

The ultimate discernible structure of the bodies consists of agglomerations of rounded granules, set in an unstainable substance, which seems to throw off fibrils that pass into the achromatic material. Each single Nissl body accordingly is made up of a multitude of fine grains, rounded in form, and each separated from the other by the intervening substance. Numbers of the granules are adherent to the edges of the surrounding achromatic trabeculæ, making them appear rough and irregular.

The setting of the granula from the edge of the nucleus to the protoplasmic extensions deserves some comment. Around the nucleus is a clear ring of extremely limited extent devoid of chromatin (Fig. 8). Closely adjacent to this the granula are arranged around the margin of the nuclear ring in an irregular circle, outside which appears a space for the most part devoid of granules. Beyond this, passing outward, the main masses of the Nissl bodies are situated, arranged in a general fashion parallel to the long diameter of the cell. At the outermost border a zone is found of limited extent, free from granula, except at the giving off of a prolongation, near which one or more granules of small size may be found. Into the main protoplasmic branches the granula may be traced for a short distance, but are now altered to rodlike forms arranged parallel to the axis of the dendrite. As the dendrite diminishes in size they rapidly decrease in numbers and finally disappear. In general the remaining portions of the protoplasm of the dendrites have a somewhat striped appearance.

The axis-cylinder pole of the cell, or *cone of origin*, presents an altogether different appearance from the other cell extensions. The aggregations of granula have entirely disappeared, with the exception of numerous long, narrow, chromatin rods, which probably correspond to the neurosomes of Held. The cytoplasm is clear for a considerable space above the nerve hillock, showing that the architecture of this part of the cell is essentially different from that of any other portion. In the other regions of the axone proper, according to Lugaro, Flemming, Cajal, and others, the structure is fibrillary, but this is not evident in the ordinary alcohol preparations of the motor cell.

What especial office in the cell economy do the Nissl granula subserve? Their pre-existence in the cell architecture may be fairly assumed from the fact that they are demonstrable in the fresh cell

body after immersion in a fluid as little capable of inducing chemical changes in the protoplasm as a weak solution of methylene blue (Wright). Van Gehuchten, Apáthy, Marinesco, Cajal, Quervin,

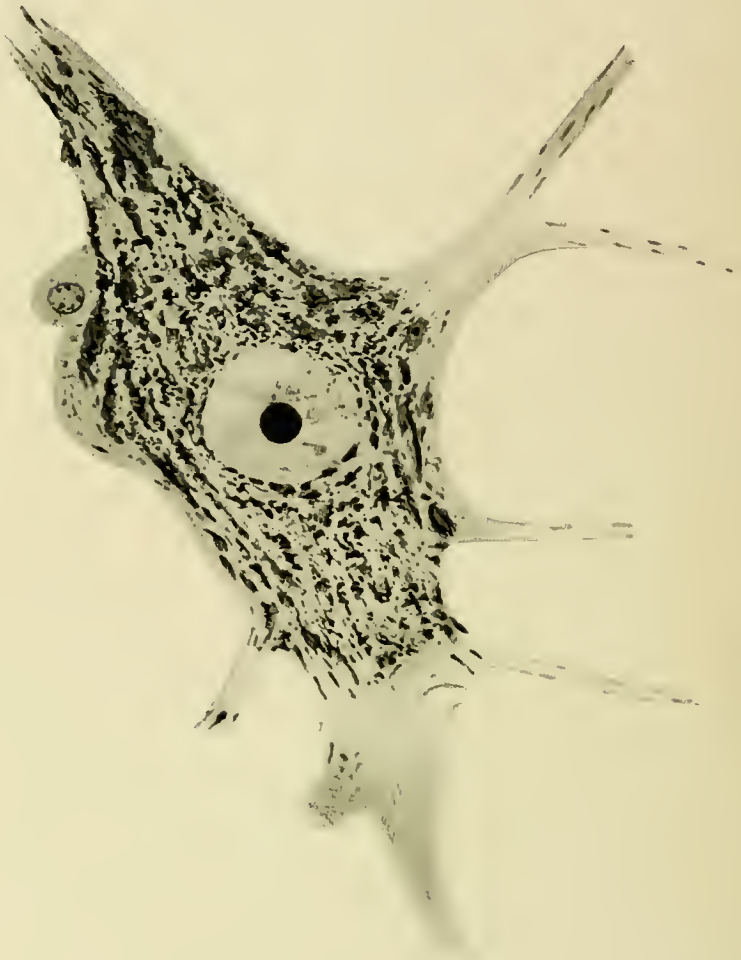

Fig. 8.—Normal Giant Pyramidal Cell, showing the arrangement of the Nissl granula. The axonal cone is situated at the most dependent portion of the body. After Adolf Meyer.

Benda, Becker, and others, all assume their preformed condition. The function of the chromatin particles remains in doubt. Nissl plainly states that he does not know the nature of the stainable substance. Friedmann and Kronthal identify the Nissl body with

the conducting substance—a manifest error, as is shown not only by the location of the granula, but by more positive methods that will be referred to later. According to Cajal, Van Gehuchten, and Lugaro, the chromatic substance represents a reserve of nutrient matter for the cell; by others it is referred to as a catabolic product. Marinesco looks upon the chromatic substance not only as a nourishment reserve, but also as having a functional activity. Amid all this confusion of theories one point is fairly unassailable. The experimental work of Nissl, Van Gehuchten, Goldscheider, Flatau, Marinesco, and others, show that the exhausted nerve cell presents a decrease in the amount of the chromatic material with changes in the staining—an observation which would certainly tend to prove that the stainable substance does serve some purpose in the cell nutrition, even though its functional field may be wider.

To return for a moment to the granula of the individual cell. It is evident, on close examination and comparison of a number of cells of the same morphological type, that there are differences in the staining properties dependent on a smaller or more abundant richness in the chromophilic particles. Nissl classified the cells in the several groups according to these varying conditions, each supposedly representing some functional state, the pyknomorphous (dark) representing the quiescent, the apyknomorphous (light) the exhaustion stage of the cell. Van Gehuchten rightly asserts that these diversities occurring in the cell granula under physiological conditions belong to the most difficult subjects in cytology.

The structure of the achromatic is of even greater complexity than that of the chromatic substance. To abstract in the shortest space possible some of the views of the principal investigators who have made especial study of this portion of the cell architecture will not be without interest.

Held and Butschli assign a honey-comb structure to the cell substance, and according to their views even the radial arrangement of the cone of origin of the axone is in the form of a meshwork. Held also finds in the meshes of the network, besides the granula, long rodlike bodies, which lie between the Nissl granula in threadlike form, which he names neurosomes. These neurosomes do not differ essentially from the similar rodlike bodies more clearly seen in the dendrites.

Marinesco separates the cell protoplasm into a chromatic, achromatic, and an amorphous substance. The chromatic and achromatic substances are interbound one with another. The fibrillary

elements lie between the granula, and ramify through the cell. Of the presence of these fibrillæ, according to Marinesco, there can be no doubt, and he is furthermore convinced that the fibrillæ give off collateral branches. The arrangement of the granula in the cell depends on that of the fibrillary structures. Cajal distinguishes in the cytoplasm, chromatin granula, an achromatic network or nervous spongioplasm, and the conducting tracts lying between the granula, which are formed of pale membrane-like trabeculæ.

Apáthy, in vertebrates, found the somatoplasm of the cell to be composed of primitive fibrils, which entered at the axonal pole, and then splitting up into their neuro-fibrillæ, formed a lattice-work in the plasma. The elementary fibrils of this lattice-work again collect into primitive fibrils before leaving the cell body. The neuro-fibrillæ are seen in every portion of the protoplasm, and are not confined to certain zones. No connection is present between axoplasm and somatoplasm, and centripetal and centrifugal fibrillæ are usually not united in the same dendrite.

Bethe and Lenhossék adhere to the principle of the fibrillary structure of the achromatic substance, while Van Gehuchten and Flemming think that the somatoplasm is as complicated as Cajal describes it—a netlike organized mass, and an unorganized mass, in which the protoplasmic net lies embedded. Both formations are in relation with one another in the dendrites and the axis-cylinder process. The organized part forms the chief portion of the processes. The fibrillæ showing in the dendrites have a more granular structure than in the axone, which appears to be formed of thread-like bundles.

Mann, the latest writer on the fibrillary structure of the nerve cell, gives the following summary of his results: 1. The periphery of all nerve cells is surrounded by a broad zone, especially developed at the axonal cone, which is entirely free from Nissl granula. 2. The fibres passing through the cell body have a wavy outline, and do not branch either in the dendrites or at the periphery of the cell. They are always arranged in bundles. 3. Fibrillæ pass from one dendritic process to another, and also to the axone process, and in the same dendritic process from one branch to another (pyramidal cells). 4. The fibrillæ are bathed in a lymph fluid, and are never attached to the Nissl granula. Lastly, the fibrillæ are the only elements that pass through the Ranvier nodes of the medullated fibres unbroken.

The accompanying photograph (Fig. 9), reproduced from one by Becker, is perhaps more convincing of the fibrillary structure of

the cytoplasm than are the writings of all the above-cited authors, and shows very clearly the disposition of the fibrillæ within the cell boundaries.

The results attained by these various researches, as well as by the older methods of Koelliker and others, are decidedly in favour

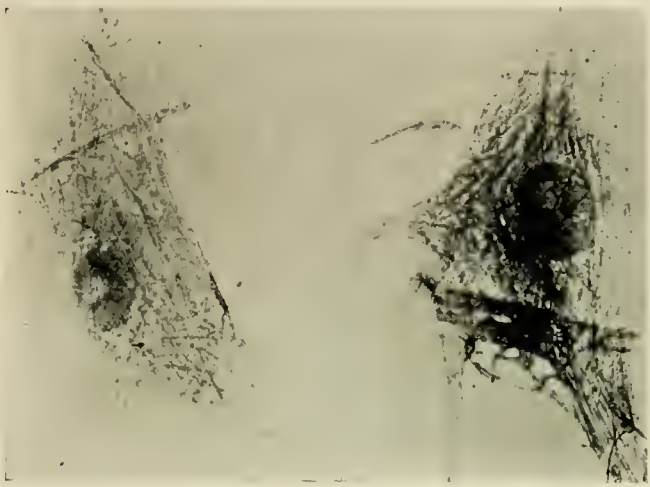

Fig. 9.—Reproduction of a Photograph by Becker, showing the disposition of the fibrillæ in the body of a nerve cell.

of the fibrillary structure, as against the honey-comb arrangement of Held and others; but the existence or nature of any further complicating elements, other than the Nissl granula, entering into the cell architecture, seems as yet uncertain, and needs the evidence of further research.

The Nucleus of the Nerve Cell

It is with considerable pleasure that one passes to the cell nucleus, for here we are on more certain ground than when considering the structure of the protoplasm, inasmuch as a well-defined anatomical formation is shown by almost any good method of research. The nucleus is all-important to the life and function of the cell; it shows a definite arrangement of its structures during health, and under pathological conditions well-marked alterations, better defined and quite as important as those of the somatoplasm.

The nuclei of the somatochrome cells, with which we at present have mainly to concern ourselves, have been especially studied by Flemming, Nissl, Van Gehuchten, Lenhossék, and others. The

nucleus appears as a refractile vesicle of round or rounded-oval form, containing chromatic and achromatic portions arranged according to a very definite system. From the periphery to the centre its architecture is seen in the following order: A distinct but fine nuclear membrane, rich in chromatin, separates the nucleus from the protoplasm of the cell. Attached to the inner surface of the membrane are numerous fine granular chromatin particles. From the membrane to the centre of the vesicle extends a chromatin framework, distributed irregularly through a fluid substance—the caryoplasm—which holds more or less numerous dust molecules, some of which are aggregated into larger clumps—the adnucleoli. In the central region of the nucleus lies the mass of chromatic particles known as the nucleolus, which does not seem to be essentially different in structure from the structures embedded in the caryoplasm, but rather to be formed by definite aggregations of them. Near the centre of the nucleolus may often be seen a light space or vacuole which absorbs nuclear dyes to a less extent than the surrounding granules. Its significance is unknown. In the above description of the architecture of the nucleus I have given the results obtained from fresh preparations, and from chrome-osmium hardened tissues rather than alcohol preparations, as the several details are not brought out so definitely in the ordinary Nissl sections, though they may be seen with almost the same distinctness as in chrome-hardened tissues, when the specimens are treated with safranin and hæmatoxylin in combination.

The nucleus of a somatochrome cell of the cortex is always single, and situated under normal conditions near the central region of the cytoplasm. The nucleus in the large cells of the cortex measures up to 18μ in size, with a nucleolus varying from 4 to 7μ in diameter. Except in the brains of idiots, displacement of the vesicle toward the periphery always indicates the presence of defective nutritional states, the nucleus wandering toward the periphery in search of nourishment.

GROWTH OF THE INTRACORTICAL NERVE FIBRES AND CELLULAR LAYERS

I cannot leave this short study of the human brain without a passing reference to some of the work by which in recent years additions have been made to our knowledge of the cell layers and of the growth of the nerve fibres from fœtal life to advanced age.

Very important information concerning the cellular structures was gained by Hammarberg, of Upsala, in the course of his studies on the pathology of idiocy with investigations on the normal anatomy of the brain rind. On a previous page it was stated that on the convex surface of the brain the distinctions between the various convolutions of the anterior, middle, and posterior portions were of a minor character. While this is true, in so far as the cortex is everywhere formed of an outermost zonal layer, with subjacent layers of pyramidal and more deeply situated polymorphous cells (Hammarberg's stellate cells), differences in the thickness of these several layers, in the size of the cells, and in their disposition in the layers are characteristic of different parts of the brain.

The zonal layer in the anterior and mid-regions is thinner than in the temporal, parietal, and occipital regions, as Cajal's investigations also proved.

The large pyramidal cells are best developed in the frontal, though in the parietal region they are also prominent. The giant pyramidal cells have only a restricted distribution in the areas bordering on the Rolandic fissure. This generally accepted idea has been confirmed by the researches of Bevan Lewis. The layer of deep-lying small pyramidal cells is now known to contain more numerous elements than had previously been ascribed to it. Their number varies very greatly in different regions. In the forebrain they are scanty, in the central regions much more numerous; they decrease somewhat in the temporal areas, to again become prominent in the parietal and occipital convolutions. What is usually called the fourth layer, that of the polymorphous cells, is far more extensive than has usually been thought. Hammarberg's studies prove fairly conclusively that the degree of mental power depends directly upon the number and perfection in development of the cortical cells, for in the brains of idiots these are far fewer in number than in normal man, as well as less perfectly developed (see Plate III).

The researches of Flechsig on postnatal medullation have also furnished the psychiatrist with material for a conception of the carrier paths of intellectual activities. At the time of birth the human infant has only a narrow region bordering on the Rolandic fissure, and comprising portions of the central convolutions and the paracentral lobe, which contains medullated nerve fibres—a region corresponding strictly to the sensori-motor area of the cortex. In the first month two other small areas in the cortex show beginning

medullation of the fibres. The former consists of a small tract on the inner aspect of the hemispheres, corresponding to the inferior half of the cuneus and superior border of the lingual lobe along the margin of the calcarine fissure. This medullated territory gradually spreads to the external aspect of the occipital pole, where it is found over a very small area, which, according to the most recent work on brain localization, corresponds with the visual sphere. Still another small area on the outer aspect of the brain now begins to show medullated fibres. It occupies the upper half of the first temporal convolution, a portion of the region appropriated to the auditory centre. On the inner aspect of the hemisphere an area no larger than a silver ten-cent piece contains at this time fibres that show advancing medullation. This is situated at the anterior end of the gyrus uncinatus (centre for smell). Accordingly, in the earliest stages of the brain growth, when the nerve cells have grown almost up to their adult proportions, Flechsig finds only four centres that show signs of a tendency toward individual insulation of the nerve fibres of the cortex—a part of neural development, when we consider the carefully protected condition of even the finest fibres of the cortex in the adult, that must be of supreme importance in the function of the neurones, and one that it is fair to infer must mark the inception of its active life.

In the great regions of the anterior lobe, from the ascending frontal convolutions to the pole, in the immense territory comprising the parietal, the outer aspect of the occipital, the greater portion of the sphenoidal lobe, and the præcuneus, at this epoch of life there are developed nerve cells in myriads, but the conducting element is as yet incomplete. Flechsig has named these great regions of later development *association centres*, the bands of connecting fibres passing first to them out of the sensori-motor, auditory, and other tracts. Righetti (1896–'97) has fully confirmed Flechsig's discoveries.

The further growth of the medullated areas is shown by these two observers to be as follows: At the beginning of the second month, besides the already medullated motor-sensory region, the foot of the frontal convolutions, and the orbital portions of the first and third frontal convolutions, then the cuneus and lingual convolutions, the first parietal, first and second temporal gyri, the gyrus of the hippocampus, and the Ammon's horn show medullation. In the third month medullated fibres appear in the remaining portions of the frontal and parieto-temporal lobes.

With the exception of the region of the insula, the radial (projection) fibres of the cortex always develop first, and later the tangential fibres of the several bands. Those of the deeper striæ are formed by the time of birth in the superior third of the central gyri; in the second month they appear in the insula and Ammon's horn, and in the third month in the vicinity of the calcarine fissure. The superficial tangential fibres are found in the horn of Ammon and in the gyrus dentatus as early as the second month.

According to d'Abundo, there is a vast difference, as might be inferred from the varying rapidity of the mental development of infants, in the time at which myelinization of the nerve tubes of the cortex and pyramidal tracts begin. For example, in two children of five and seven days of age respectively, he found the nervous system similar to that of a seven-months-old fœtus, while in another, eight days old, it was as far advanced as is usual between the ages of three and five months. At times the pyramidal tracts of the brain also develop abnormally early. In one child nineteen days old, the tract in the cerebral peduncles, in the pons and bulb, was fairly well medullated, but the covering of the fibres did not extend into the cord, while in other children from nine to fourteen months old the pyramidal tracts were not so well developed as those of the cerebellum, but had numerous fine fibres intermingled with the thicker ones.

The advance in facilities for staining and rendering the finer medullated fibres of the cortex visible has also added to the knowledge of the after-growth of the fibre elements of the brain. These researches are tedious, and but few investigators have undertaken them. Vulpius, Kaes, and Passow have so far occupied exclusively this important field. Their investigations to a limited extent—limited because of the comparatively small number of the brains examined: by Vulpius twenty-two, from the thirty-second fœtal week to seventy-nine years; by Kaes thirteen, from eighteen months to thirty-eight years; and by Passow two, fifteen months and thirty-three years—tend to prove that there is a gradual increase in the abundance of fibres of the cortex of the brain from birth up to the thirty-third or thirty-eighth years of life, after which time there ensues a gradual decrease toward old age.

Allowance for individual differences is not made in these researches, but it is natural to suppose that an individual with a high intellectual development would possess more intracortical fibres than the man of poor mental accomplishments. Nevertheless, certain general deductions may be drawn which are of the deepest

interest. As the functional activity of intellectual life expands, it is not the cells that grow and multiply, but their dependencies, the collaterals and distal terminations of the axones. The matrix for the reception of efferent impressions is accordingly preformed, ready to receive the conducted impulses from special sense organs; but the elaboration of these impressions only comes at a time after the association tracts have developed to a sufficient extent to allow their excitations to be correlated, so that one cell, by means of the numerous collaterals and their branches, can act upon the protoplasm of perhaps hundreds of other cells, associating, sorting, sitting in judgment upon present impressions, comparing them with others that have preceded them and are retained in the cell memory for present and future service.

In every individual of normal mental activity there are two periods in life in which there appears to be more rapid intellectual progress than at any other, namely, about the seventh year and at the time of puberty, the latter epoch being somewhat varied according to the hereditary qualifications of the person, be it man or woman. Let us see how these two epochs correspond with the increase in the number of nerve fibres.

The results of Vulpius, based upon the examination of a fairly large number of brains, is most interesting:

The fibres with which we are mainly concerned comprise the outer, middle, and inner tangential intracortical bands situated in corresponding parts of the layers of the cortex. As already mentioned, their medullation begins in the inner and outer layers in the third or fourth month, and in the middle layer in the eighth month.

The fibres of the stratum zonale show a considerable increase in the third frontal convolutions only in the second year, while in the first frontal the increase is delayed until the third year of life. In the first and third frontals they reach their maximum in the thirty-third year, and at the age of seventy-nine years have perceptibly diminished in numbers. In the occipital lobe they also increase until the thirty-third year.

The middle layer, in the anterior, central, and the temporal convolutions, remains undeveloped until the seventh year; in the occipital lobe until the tenth year; in the first and third frontals until the seventeenth year, but thereafter the fibres neither increase nor diminish until very advanced age.

The innermost layer of tangential fibres shows, in contrast, a rapid fibre increase beginning from the eleventh month, until in

the sixteenth month the maximum is reached in the central and occipital convolutions, while in the first temporal it is attained in the twenty-second month. In the first frontal the maximum is, however, not reached until the seventh year, while in portions of the third frontal the growth is not completed until the tenth and seventeenth years.

Kaes's results confirm those of Vulpius, though his work was less extended. By the thirty-eighth year of life the central motor regions, the temporal lobes, and the occipital regions have attained their maximum fibre development, while at eighteen years the temporal regions are behind the motor in the perfection of the fibre bands, the latter having already attained their full growth.

The work of Passow is principally interesting in that it shows, by means of accurate microscopic measurements, that there is a constant increase in the breadth, size, and general density of the fibre bands of all the three layers, from the anterior edge of the motor region to its posterior third, then a thinning of the bands, and posteriorly a small increase in the numbers of the contained fibres.

These studies must necessarily be of extreme interest to the student of mental diseases. Not only is it apparent that up to the best years of a man's life there is a steady increase of the means of association between cortical cells, but also that in large part these connections are retained until the most advanced age, even when under ordinary circumstances senile changes in the vascular and lymph channels have induced catabolic alterations in the cell protoplasm. The function of the cortex, as was stated on a preceding page, is chiefly that of associating and directing excitations carried by nerve fibres from peripheral cellular protoplasm to central nerve cell protoplasm, where they are intensified by conjunction and union with the dynamic forces arising from other cell protoplasm set in action by the nerve elements first excited. In this way both remembrance and motor activity are called into being.

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PART II

GENERAL PATHOLOGY

INTRODUCTORY

The pathology of mental disorders may be roughly divided into two parts, the one belonging to the so-called functional maladies, from which recovery is not unusual, the other that of organic-degenerative types, in which an eventual restoration to mental health cannot be expected. The boundary line between the two forms is not always sharply drawn, inasmuch as cases which apparently begin as a primary form of insanity may, by repetition or continuance, pass over into the second classification.

Even among the organic-degenerative types an absolute pathology—such as is found, for example, in pneumonia, in which definite clinical symptoms accompany certain pathological states existing in the lung—is very rare. It is true that in mental disorders we oft-times have quite as precise symptoms as those present in more purely physical disease, and one might expect that these clinical pictures would correspond with certain definite changes in the cerebral nerve cell. Such, however, is not the case, except in rare instances. Our main difficulty in this connection lies in the fact that the nerve cell has but few ways of showing in its structures the presence of deteriorative processes, and even such changes as are recognisable may, for reasons with which we are entirely unacquainted, in different persons, give rise during life to quite inconstant and contradictory clinical symptoms. Take, for example, so coarse a lesion as a tumour pressing upon the cortex; in one individual its presence may produce a condition of deep depression, while in another it is associated with states of excitement; and yet in each case the tumour may have a precisely similar situation and size.

Of the cell lesions in simple insanities (mania, etc.) we have but the most vague ideas, beyond that, during life, we are able to note

temporary congestions, vascular hyperæmias, and conditions suggestive of œdema cerebri, or the reverse, arterial spasm. With the hyperæmias and œdemas we know that there can be disturbance of the important outward flow of the lymph from the intrinsic cerebral tissues, and retention of products of tissue waste which can seriously interfere with the proper working of the nerve cell. Of their etiology we have no accurate conception, although we have good grounds for assuming that storage of toxic products from the alimentary canal, and disordered products of the secretory glands, or the converse, diminution of the secretions, perhaps also defective elimination of urates and the ammonium series by the excretory organs, may periodically take place in the animal economy and cause the disturbance.

But again, as is well known, these latter conditions are present in certain other affections in which there is ordinarily no evidence of grave mental disturbance (gout, etc.), while the hyperæmias and œdemas are often seen in the essential fevers without any disturbed mentalization on the order of an insanity. We are, then, obliged to assume—and the conclusion is one that admits of little dispute—that there is a predisposing element, pre-existing *ab ovo*, or acquired through toxæmias, or habits of life, that lessens the resistance of the psychical cells, and renders them liable to ready disturbance of their normal functions. This tendency, although it may sometimes be acquired, is much more frequently born with the individual, so that in the majority of the mentally afflicted we find a directly inherited predisposition to insanity. In the clinic this is only too clearly apparent in the hundreds of individuals standing just above the limit line of the imbecile, who, as the result of some unusual strain, overwork, bad or insufficient food, sexual over-excitement, or a febrile disease, fall by the wayside and become insane.

A very fair illustration of the instability of the nerve tissue of one individual in comparison with that of another is seen in some children, who under febrile conditions become delirious at a bodily temperature at which others possessing more stable nerve matter will show no signs of mental disturbance. Again, in certain temperaments pain will occasion disorder of the brain functions. At the present time I have under my charge a lady who, whenever she has a severe attack of colic, will exhibit the most vivid hallucinations and become highly excited. Under the quieting influence of anodynes this excitement quickly passes, and the patient returns

to her normal condition until the next attack. It is hardly necessary to mention that in her case there is a strong family history of insanity.

Heredity, therefore, is by far the most important factor with which we have to deal in the consideration of the pathology of the main types of insanity. Its influence may be recognised in divergencies from the normal in the structure of the brain convolutions, or in the very numerous abnormalities that may be noted as every-day findings in the cerebral vessels of those dying insane. Hereditary defects show themselves also in the form of premature senescence, a striking example of which is supplied by the extremely early arteriosclerosis, even between the twelfth and twentieth years of life, that is so frequently to be observed in the imbecile class. Other beginning lesions in the brain tissues may certainly be assumed when we find so coarsely ordinated structures as those of the vessels degenerating at this early age; indeed, examples of retrogression of the mental functions at the age of puberty or thereabouts are of not infrequent occurrence in practice, the victims being usually the children of intemperate or hereditarily burdened parents.

In the grosser forms of degeneracy, in the idiot and in the imbecile, macroscopically, deviations from the normal in the development of the brain, the convolutions, cells, or association fibre bands, defects in the architecture of the tissues or of the bony envelope—in a word, malformations of the most diverse kinds—show the retrogressive type of brain, and account fully for the deviation from the physiological in the mental functions. Microscopically, divergences from the normal in the principal types of cell are not rarely demonstrable, the embryonal form being retained, while, as Hammarberg has shown by careful count, the idiot brain does not contain the same number of nerve units as that of the better developed person. Even the coarse Golgi method shows abnormalities in the form and component parts of the cell, the feeble protoplasmic extensions showing an infinitely smaller number of the gemmules than cover the dendrites of the highly developed normal psychical cell, while many of those present are malformed.

But despite the fact that in the consideration of the pathological substratum of insanity many points are still obscure, there are not a few sign-posts that point out the lanes and by-ways by which one may reach something approaching a high-road to the goal. For example, in the various dementias, notably in the so-called paralytic form, in the states of exaltation and depression from gross lesion of

the cerebrum, and in toxic insanities, a fair conception of some of the processes inducing mental disease is to be ascertained.

Foremost among the actual lesions of the cerebral structures that predispose to degenerative insanities are those of the vascular structures that we ordinarily class as periarterial, endarterial, and atheromatous changes, but which comprise a vast number of separate and distinct vascular lesions, which will be treated of more in detail toward the end of this chapter. These various lesions may be found in persons showing the most diverse mental disturbances, but all, with the exception of fibrosis, occur in the post-adolescent age.

Such degenerative changes affecting the walls of the vascular channels react upon the brain tissues in two ways, and in either case may be of vital importance to the cell. In the first place, the supply of nutrient plasma may be shut off to such a degree that the cell suffers from hunger, and, as happens in the last moments in the life of all tissues, a struggle to obtain nutriment ensues. This is shown clinically as a stage of excitement, after which the animal dies or becomes demented. Equally sure in their eventual results, but slower in bringing about dissolution, are the injuries resulting from a damming back of the return flow of the used nutrient plasma, lesions upon which too much stress can hardly be laid, as they are found in the majority of chronic insane cases which come to the autopsy table. Here we have to deal not only with a retardation of the return lymph flow, but also with the effect upon the delicate nerve cell of the waste tissue products that are evolved in the process of constructive metabolism.

One of the most frequent causes of the retardation of the return flow lies in proliferative diseases of the adventitia with the accompanying heaping up of round nuclei within the perivascular space, until they partly or completely fill it. Occasionally, in acute infectious diseases, the obstruction is caused by aggregations of white blood cells which have transuded into the space, where they disintegrate, the detritus mingling with that from the adjacent nerve tissues thrown into the lumen by the action of the vascular gliacytes. In experimental toxæmias this degeneration and subsequent disintegration of the lymphoid cellular elements plays an important part in the general disturbance, and undoubtedly helps to disorganize more rapidly the nerve unit. Not alone in the brain tissue is the lymph flow retarded, but in the vascular pia the channels are more or less obstructed by detritus, and disintegrating elements of an epithelial and endothelial nature.

In many chronic diseases of the brain the disturbance of the lymph flow by the presence of degenerated and proliferated elements, with accumulations of hæmatoidin, both crystalline and amorphous, is the striking histological feature in sections from the pia and from the cortex cerebri. These changes are much more definite and comprehensible than the vague alterations seen in the nerve cell, that only mark the presence of an atrophic process, and which in most instances have resulted from the preceding vascular alterations.

In some of the acute mental troubles (*delirium grave*, febrile and confusional insanities) the chemical and bacteriological examinations of the blood and excretions have shown the presence of bacilli and poisonous substances (the products of the organisms or the consequences of defective elimination or of intestinal putrefactions) which have been absorbed into the system, and circulating through the blood have induced alterations in the cell sufficient to cause disturbance of its vital properties, shown clinically in excitement, followed by some phase of stupor. In these cases we possibly have to deal with a rapid degeneration of the elements of the vascular wall, accompanied by cell fragmentation and necrosis, death or recovery following according as the infection is mild or severe.

Let us consider for a moment the probable effects of vascular lesions that induce a partial stoppage of the nutrient supply to the psychical nerve cell and its supporting tissues.

Monti, among others, has shown that, as a consequence of the artificial induction of minute embolisms of the cerebral arteries, the nerve cells practically die within a period of from three to twelve hours after the blood supply has been shut off. It is no less true that with an inadequate supply of nourishment an equally certain though slower progress toward cell death must be induced. The nerve body gradually loses its activity; changes, beginning in the more distal portion of the cell, proceed toward the centre, until finally the nucleus becomes implicated.

It is exactly this lack of a sufficient nutrient supply that gives a distinctive pathology to the frequent types of dementia that begin after the middle period of life. Furthermore, I fully believe that in these slowly progressive vascular changes we shall finally determine, from a pathological standpoint, the origin of the majority of the various types of the organic-degenerative forms of mental aberration, the first alterations in the vessels inducing the gradual change from perfect sanity to the slight mental obliquities, irritability with-

out cause, forgetfulness, perverted impulses, and similar minor signs, that stamp the beginning of the first stage. Later, when the lesions in the vessel walls have progressed, the nutrient plasma transuding through them being altered both in quantity and quality, we find a rebellion of the brain cell to the lack of its accustomed food showing itself in a stage of acute excitement; and lastly, when the nutrient supply has sunk to a point barely sufficient to maintain the cell alive, and chemical and histological alterations have been induced in its protoplasm, there results the final stage of terminal dementia.

Objection to this scheme may be made on the ground that all dements do not show signs of pronounced vascular lesion, which is true, the theory being strictly limited to cases occurring in the retrogressive period of life, the others being accounted for by the original defective construction of the neurone. Toxic conditions, gastro-intestinal or otherwise, may play an important part in the dementias of earlier life which occur mainly in hereditarily burdened persons. We know that in these individuals moderate doses of alcohol are fraught with disastrous consequences, showing that even minute quantities of the poison act as an irritant, and circulating with the blood are capable of inducing permanent lesions of the nerve cell, lesions too fine to be discovered by our microscopes, and probably in the nature of a chemical alteration in the molecular substance. Again, changes in the sheaths of the vessels are probably induced at any period of life by the infectious diseases, some of which may cause a permanent disability of the tissue.

The hyaline degeneration of the vascular walls so often found in the insane may be reproduced experimentally in animals by repeated inoculations with cultures of staphylococcus pyogenes aureus (Davidsohn), so that one may readily understand how, in a human subject in whom there exists an ever-present instability of neural tissue, changes both rapid and pronounced may follow an infectious disease. After typhoid fever, after pneumonia, and a host of other maladies due to the action of pathogenic organisms upon the general system, there occur forms of mental disease, pronounced and characteristic in type; and while many of the pathognomonic lesions have vanished in the months or years of life succeeding the illness, enough remain at the time of autopsy to satisfy us that the original process of all was a lesion of the vessel walls antecedent to or concomitant with that of the psychical affection. In those already insane we often see that, with a comparatively slight infectious

process affecting primarily the chest or abdomen, the stress of the disease is readily transferred to the brain, so that the chronic maniac or dement becomes actively excited, or falls into an unconscious state, with frequent attacks of an epileptiform nature. Seitz has applied the definition "toxæmia cerebro-spinalis" to a similar group of cases, a term that it would be advisable to extend into general use.

While the insanities from intestinal infection, or from the waste tissue products stored up in the body owing to imperfect action of the renal apparatus, are probably the most frequent of the toxic psychoses, there are undoubtedly others that have their origin directly in the poisons generated by streptococci, staphylococci, bacillus coli communis, and bacillus lanceolatus, the last organism having been isolated from the meninges more frequently than any other. Even at the present day our knowledge of the infectious processes in the meninges and brain substance is often sufficiently accurate to allow of a diagnosis of insanity as the result of the effect of bacterial toxines upon the cerebral pulp; and it seems probable that further research on those lines will lead us to look upon not a few of the mental diseases as only part and parcel of the reaction of the general organism to these poisons, and to treat them accordingly with a larger hope for success, than when we regarded mental symptoms solely as the outcome of a diseased brain, an organ which in common acceptance has nothing in common with the remaining portions of the body.

GROSS PATHOLOGICAL ANATOMY

An examination of the outer envelopes of the brain often yields information of very considerable importance; indeed, it is quite possible, when certain lesions of the meninges are ascertainable, to foretell accurately the condition of some of the most important portions of the nervous tissues.

The Cranial Bones.—These structures may present a variety of conditions of morbid import. The bones may be uniformly thickened to an excessive degree, or may present numerous local thickenings and irregularities. The converse may also hold, the bony plates being sometimes thinned so that their cross section does not exceed that of a sheet of paper. Undue density, from absence of the diploë, is a rather frequent finding. Unusual friability is found in some cases of degenerative insanities from changes common to all the tissues of the body. The cancellated tissue may be free from

blood in anæmic conditions, or suffused in inflammations or congestions of the deeper structures. Thickening of the skullcap with adherence to the dura is frequently found in cases of chronic insanity and in the epilepsies.

On the whole, lesions of the cranial bones are of little moment, beyond marking the fact that alterations in other structures are to be found in insanity besides those in the cerebral substance.

The Dura Mater.—The dura may be the seat of varied lesions. Moderate thickening of the membrane with strong adherence to the bone is of great frequency. Inflammatory exudates, hæmorrhages from dural and pial vessels, cover it and form cysts and discolourations. Adhesions between the dura and pia are found, but are somewhat rare; they denote a local or general inflammation of the serous surfaces of the meninges. Plaques of ossification are now and then seen, but have little significance, as they usually do not interfere with the outflow of venous blood. A lesion narrowing or obliterating any of the numerous exits through the dura for the venous blood or the lymphatic circulation is of the utmost importance to the nutrition of the cerebral tissues; hence the very striking effect upon mentalization of dural tumours so situated as to interfere with this circulation.

Pia Mater.—Far more important, from their clinical significance, than the lesions above recorded—for it should be remembered that into the pial meshes flow all the return blood and lymph from the cerebral substance—are the various forms of milky gelatinous thickening of the membrane. A milky cloudiness of the pia is found in the meninges of nearly all persons that come to the section table after middle age, and with increasing years there is increasing opacity. The degree is, however, insignificant, and the process is not necessarily connected with the lesions found in so many of the chronic insane (fifty per cent, Lewis).

The gelatinous thickening of the pia is characteristic of a single lesion, namely, disturbance of the vascular lymph system, a damming back and congestion of the lymph flow, leading to atrophy of the cerebral tissue. The thickening of the membrane is always most apparent over the vertex, particularly in the immediate neighbourhood of the Pacchionian (lymphatic) granulations, although the greater depth of the membrane immediately over the fissures may make its apparent density in these latter localities more striking to the eye. When the membrane is closely examined, one sees a large number of dilated veins interminglcd with arteries, together form-

ing meshworks, while along the edges of each vessel of considerable size lies a fine grayish line—the lymph space—dilated, and filled with leucocytic and endothelial *débris*. These white lines form the distinctive lesion of this form of meningeal thickening, which is non-inflammatory and strictly degenerative.

In examples that show but little thickening, the first appearance of the milky deposit is along the course of the largest pial veins. Later the exudates from the engorged lymph vessels become diffuse, and more and more prominent, until in the course of time they give the widespread turbid appearance to the whole central region of the brain, somewhat rarely extending to the anterior and posterior poles. Through the channels of the pia, arranged for the flow of the lymph currents (see Plate I), and now more or less obstructed with *débris*, the fluids percolating from the interior structures are retarded and dispersed, subjecting the delicate nervous organs to a bath of effete tissue products, some of which, the altered albumins, must be exceedingly poisonous, so that finally there results atrophy and disorganization of the neuroglia and nerve cells. Adhesions between the cortex and pia are infrequent in the large percentage of instances of non-inflammatory thickening of the membrane. Hæmorrhages into the pia are common at all ages, and leave traces behind in the form of brownish discolourations and hæmorrhagic cysts, which are mainly located upon the vertex, the site of the most active mental processes, where damage to the tissues is of most importance to the life of man as an intellectual being.

Adhesions between the pia and cortex are infrequent in the common gelatinous thickening of the membrane. On the other hand, whenever we find indisputable evidence of pre-existing inflammation of the membranes, such as is ofttimes present in chronic mania, dementia paralytica, and sometimes in alcoholic insanity, we may expect such strong adhesions between the membranes and the subjacent brain tissues, that when an attempt is made to remove the pia it strips off, bringing with it shreds of the brain substance. This so-called condition of *meningo-cerebritis* has to the naked eye little in common with an ordinary inflammatory process, but rather represents a pronounced degree of gelatinous thickening. The membrane is vascular, the veins are large, tortuous, and dilated, apparently paralytic; their margins are overlapped by broad lines of grayish-white infiltrations which spread throughout the surrounding membrane meshwork, while the trabeculæ extending into the brain substance, in contrast to those in the gelatinous thickening

from simple atrophic conditions, are now hypertrophied, and cannot be torn away without bringing with them bits of cortical substance. Partly organized lymph, with numerous minute, newly formed vessels, covers the vascular pia, chiefly in the furrows and over the central portion of the brain convexity, being mainly confined to the distribution of the middle cerebral artery. Purulent infiltration following the destruction of the feebly organized false membranes upon the visceral pial surface is rarely found, and, when present, is due to a secondary infection.

On microscopic examination the meshes of the pia are found to be œdematous, and filled with proliferating round nuclei, thickly aggregated upon the sheaths of the vessels. Much *débris* of destroyed cells is also seen in the pial meshes, the particles having a tendency to blacken with osmic acid, which is in some measure an evidence of their fatty nature. The connective-tissue framework also undergoes morbid alteration, becoming thickened, fibrillated, or even hyaline in appearance. The middle coat of the arteries almost always shows evidence of the hyaline or colloid degeneration. Both changes extend into the brain substance. Brownish discolourations from transuded red-blood cells are also seen over localized areas of the membrane.

Ruptures of the tortuous and distended arteries, succeeded by extensive hæmorrhages, are only moderately frequent in these various abnormal conditions of the pial membrane, but when they do occur they are usually followed within a few days by dissolution. The exudates which accompany diapedesis of red and white corpuscles, on the other hand, are found with great frequency in all forms of rapidly advancing cortical disease.

The macroscopic appearance of the substance of the brain is rarely characteristic of any single form of mental disease. In the chronic insanities, atrophy of the entire cortex, shown by the increase of straw-coloured serum and non-inflammatory thickenings of the pia, is almost universal. Localized atrophies follow thrombosis or embolism of nutrient vessels, or partial occlusion of a main artery near its origin in the circle of Willis. Reduction of the calibre of a vessel to that of a hair from arteriosclerosis or syphilitic disease may also result in the localized atrophy of the area supplied by the artery. Vascular dilatations, engorgement of arteries and veins, with varicose twistings, are frequent, being a post-mortem evidence of the occurrence of hyperæmia of the brain so often noticed as a clinical symptom. The opposite condition, an anæmic state of the cortex,

is perhaps more frequent than the vascular engorgement, and results from the morbid thickening of the vessel sheaths.

Localized cerebritis, except as the result of thrombosis, tubercular or cancerous growths within the brain structures, is of extreme infrequency, and when present points to a septic or traumatic inflammation. The tissues involved are occasionally rosy red, but may be even paler than the adjacent healthy substance. Only with the microscope is it possible to demonstrate degenerating nerve cells, varicose medullary fibres, and *débris* of lymphoid cells, with the presence of numerous leucocytes.

Atrophy of the Hemispheres.—As a sequel to all the forms of prolonged chronic insanity, in paretic dementia, especially when of long standing, after the senile psychoses and dementias, also in cases of chronic alcoholism, there is seen at the autopsy table a wasting of the gray and white medullated structures that is usually diffuse, less frequently localized in one or more lobes. In the majority of such cases there is compensatory thickening of the soft membranes upon the surface of the brain with exudation of a straw-coloured serous fluid into the arachnopial space.

The wasting of the tissues usually affects cortex, medullary matter, and the basal ganglia about equally, the result being that the gray rind is reduced perceptibly in thickness, while the ventricles become more or less widely dilated from shrinkage of the white substance and ganglia without any necessary granulation of the ependyma or inflammation of the choroid plexuses.

When the membranes are removed, the convolutions are seen to be thin and pointed, or flattened when there has been considerable increase of fluid upon the surface, and on section the cortex is reduced in thickness. Microscopically, within the gray layers the tangential bands are thinned, and the remaining fibres present an unusual degree of varicosity, while similar though less pronounced conditions prevail within the medullary substance. The nerve cells are often pigmented, or show atrophic changes. The neuroglia elements of the star-rayed class show an apparent multiplication, resulting possibly from the disappearance of the other elements.

In some cases of paretic dementia, the atrophy, while general, may be more pronounced in one portion of the hemispheres than in another, or the two halves of the brain may be unequally affected. Wasting is more frequent in the tip of the frontal lobes than elsewhere, and next in frequency come the motor region and occipital zones. Patches of markedly wasted convolutions are sometimes seen

surrounded by other gyri in which a diminution of the substance is less noticeable.

Strictly localized atrophy signifies either an antecedent inflammatory process resulting from infection, or a vascular lesion leading to closure of an artery, from thrombosis, embolism, or endarteritis obliterans. The thrombotic and endarteritic changes are frequent in senile dementias, but atrophy consequent to an inflammatory process is rare.

SPECIAL PATHOLOGY

Pathology of the Nerve Cell

With the older methods of staining and preparation the observer at the end of his examination of a nerve cell was always left in doubt whether the changes seen, unless indeed they were of the grossest nature, were artefacts or the result of disease. Even at the present time, about a pathological examination of the human brain much the same has to be said, though slowly the veil is being withdrawn and we are becoming able to distinguish the true from the artificial lesion. Much, or indeed the greater part, of this progress is due to experimental pathology where the tissue can be obtained in a perfectly fresh condition, and full control of the after-examination is possible.

Not only has the advance in experimental technique enabled us to determine definite changes in the brain cells of animals, but the increased knowledge of the architecture of the cell obtained from them has rendered possible, by the use of relatively simple methods, the recognition and interpretation of the changes found in the daily microscopic pathological work. Experimental investigations upon the lower animals cannot be overestimated in their future effects upon the study of human pathological material, and accordingly become a factor of the utmost importance in the ultimate aim of all medical knowledge, the cure of the ills of mankind.

In the research work of the last decennary three distinct divisions may be recognised according to the procedures employed. Thus we have (1) the Nissl alcohol-methylene-blue method; (2) the chrome-silver method and its modifications; and, lastly (3), the customary hardening by chrome salts, alcohol, etc., with staining by aniline colours, hæmatoxylin, carmine, and similar dyes. Before taking up the examination of material from the brain of man, let us glance for a moment at the results obtained by the first and second of the above special methods.

Nissl, Marinesco, Schaffer, Colenbrander, Van Gehuchten, Pandi, Goldscheider, Flatau, Dutil, Ballet, Sarbo, Lugaro, and others, have studied the changes in the granula and achromatic substance of the cell by the methylene-blue method, and have arrived at quite definite results. The alterations in the nucleus have been investigated with success more particularly by Sarbo, Nissl, Marinesco, and the writer. The neuroglia cells do not show, by this method, their departures from the normal with equal distinctness as does the nerve cell, yet under favourable conditions pathological changes in them may be recognised with certainty.

The manner of experimentation upon the cell has been in two ways: first, by bringing about indirect disintegration of the protoplasm of the nerve cell by section or ablation of the root fibres, for example, of the facialis or hypoglossus, the axone degenerating upward and downward, a secondary alteration of the protoplasm of the cell being thereby induced; or, secondly, by directly acting upon the protoplasmic substance by toxines, alcohol, lead, phosphorus, the cultures of tetanus or other bacilli, the injection into the animal of irritant alkaloids (ricin, abrin), the poisoning of the animal by large doses of some common medicament, kalium bromide or morphia, or the temporary or absolute withdrawal of the blood supply by the ligation of a nutrient artery, causing an artificial ischæmia.

Under the first category, where the nerve trunk is severed and degeneration of the cell results, there is found chiefly an alteration of the chromophilic elements, attended by swelling of the corpus, and an excentric position of the nucleus. This displacement of the nucleus is always found where there is a denutritive process going on in the cell. The alteration of the chromophilic particles is shown by a breaking down of the granula into fine dust grains, a chromatolysis. The striped appearance of the cell is lost, and the staining now shows a uniform light blue cloud, as if of dust particles, covering the cell. The chromatolysis begins invariably at the axonal end of the cell, and spreads from that point along the circumference. The progression of the chromatolysis in secondary alteration is accordingly from the periphery to the centre. The alteration of the cytoplasm begins about forty hours after the section of a nerve, and lasts for a period of from fifteen to twenty days (Van Gehuchten), to give place to a restitution stage. Only slowly, however, do the nerve bodies regain their normal condition, both as respects chromatin and volume. By the ninetieth to one hundred and tenth day

the cell shows a complete return to the natural or pyknomorphous state.

With respect to the reaction of the achromatic substance, Van Gehuchten and Marinesco hold opposite opinions, the former finding no alteration, the latter stating that the achromatic substance also undergoes molecular disintegration, and becomes stainable. My own observations have led me to adopt this latter view.

In the primary degeneration of the cell protoplasm, from compression of the aorta or embolism, or from intoxications in the widest sense of the word, the picture of protoplasmic alteration varies considerably. In this artificial anæmia the breaking down of the chromatic particles begins, as a rule, at the periphery in the form of a finely granular chromatolysis, accompanied by an œdematous condition of the protoplasm, which may attain a considerable degree (Sarbo). The cells take on the appearance of being covered by a cloud, the colourable substance is not sharply defined, and the remaining central chromatin particles look as if they were compressed together.

In the intoxication degenerations the picture is somewhat varied, according to the nature of the poison. The most frequent one (after intoxications by the injection of certain bacillary products into the animal body, equivalent to an infectious process) shows a rarefaction and disappearance of the chromatic substance, mainly toward the periphery of the cell. In advanced stages one sees irregular masses of darkly stained particles, or even an entire pulverization and equal distribution through the protoplasm of fine dust-like particles, while later on the formation of vacuoles in the cell substance is noticed. The process is usually most intense near the axonal cone, where it is frequently impossible to recognise anything of the former cell structure. The axis cylinder also shows alteration, having a light granulation, and greater receptivity for the colouring matter. The process may indeed exhaust itself entirely in the neighbourhood of the axonal cone, the remainder of the cell presenting an almost normal condition of the granula (Van Gehuchten). In other instances the whole of the peripheral portions of the cell show distinct chromatolysis, while the central regions are uninvolved. At other times, again, although the whole central region of the nerve body shows chromatolysis, the peripheral portions retain almost their normal aspect. Still other forms of poisoning show deformation of the granula, and partial chromatolysis; or the granula lose the sharpness of their contours, are much smaller than nor-

mal, lose their regular position in the cell, and look as if they had been packed into an irregular mass. Fibrillar substance and nucleus are strongly stained, a fact which indicates a more profound disturbance of nutrition.

When the changes have not been very profound, the nucleus showing but slight disturbance, a *restitutio ad integrum* in the cell is possible, but in such cases the functional activity begins again long before the histological alterations have entirely disappeared. The pathological alteration in it is therefore no positive indication that the cell was incapable of performing at least a portion of its usual functions, a fact which is quite in accordance with our conception of the minor importance of the granula in the cell life. It is far otherwise when other changes are accompanied by indications of alterations in the achromatic substance and nucleus. This latter portion of the neurone is of all its component parts the most important, and the one from which we can draw positive conclusions as to the actual functional activity of the cell up to the time of death.

In comparison with the chromatin structures, the nucleus has been given but little attention in its intimate details by most of the writers on experimental cell lesions. This is probably owing to one of two causes: either the chromophilic substance and clear caryoplasm are seldom altered in mild forms of intoxications, changes being absent from the nucleus except in the final stages where the protoplasm is actually disintegrating; or the finer alterations of the vesicle are overlooked in the commonly used Nissl stain, as it affords very poor definition to everything in the vesicular contents beyond the nucleolus.

Friedmann, in 1891, writing on the degenerative lesions of the ganglion cells in acute myelitis, states that dendrites and nucleus conduct themselves absolutely passively in the process of cellular necrosis, and that they do not die simultaneously with the cell substance, but subsequently to its death. Friedmann is, of course, in error. All portions of a cellular structure are subject to the same laws governing their growth and death, and while the periphery may antedate in its breakdown the central regions, cell destruction, providing the injurious process is sufficient to occasion death (acute anæmia from thrombosis, for example), progresses from the periphery toward the centre until all portions of the protoplasm are involved. Again, Ströbe, in 1895, in analyzing the literature of degenerative and regenerative processes in the central nervous sys-

tem, gives the cell nucleus only the most scant attention. In his description of nuclear alterations he mentions loss of the sharply rounded contours of the vesicle, loss of the definiteness of the contours, so that nucleus and protoplasm are no longer sharply differentiated, and certain chemical changes in the caryoplasm by which there takes place a greater absorption of the staining material. He regards variations in the position of the nucleus in the protoplasm as an evidence of the presence of a degenerative process.

Sarbo, in 1895, in an experimental work on the pathology of the ganglion cell after ligature of the abdominal aorta, shows conclusively that nuclear changes are to be found at any stage of the degeneration induced by the artificial anæmia. In the early stages of cell deterioration the achromatic substance becomes homogeneously stained, the dark nucleolus remaining sharply defined, while the borders of the nucleus are blurred and lost in the dull blue of the changed protoplasm. At a later stage the nucleus takes up large quantities of the dye, progressively grows smaller, and stands out sharply from the surrounding cellular substance. In the final stage, when vacuoles are beginning to appear in the protoplasm, which is in process of disintegration, the nucleus loses its rounded or oval form, becomes angular, grows smaller and smaller, until nothing remains but a pinhead dark-coloured point in the centre of the shrunken protoplasm.

In my studies on the action of ricin and alcohol on the cortical nerve cell, I found a most intense and definite change in the nucleus, which had not been previously described.

In the less pronounced forms, those found in acute and chronic alcoholism, the chromatin particles within the nuclear ring assume a coarser aspect, and the nucleolus looks as if it had short sprouts protruding from its sides. In a more advanced though still early stage, the nucleolus as a whole is somewhat swollen, and the buds from it have extended some distance from the central mass, and are now separating from it, though the line is still marked by the presence of fine grains in the caryoplasm. The nuclear substance has not become altered to any extent; possibly there is a little more affinity for the dye than natural, but the absorption is not great. In further advanced examples the outlines of the nucleus do not appear to be decidedly altered, but the chromophilic particles have among them a considerable number that are of unusual size and irregular form. The nucleolus is also swollen, and covered by thickly set chromatic granules. Outside of the irregular masses of

chromatin, the caryoplasm is free from the usual dust-like grains, and has assumed a very refractile character.

In ricin poisoning the nuclear changes are most pronounced, but of a similar order to those from alcohol. In staining with Heidenhain's hæmatoxylin the nucleus assumes a uniform deep blue, loses entirely its refractile properties, but is sharply differentiated from the protoplasm of the cell by the intensity of the staining. The outline of the nuclear ring has not altered perceptibly, except that it does not stand out sharply; the edges are not serrated or thickened, but within are a multitude of deeply stained, extremely fine dust particles, with the caryoplasmic substance between them almost as deeply stained. Imbedded among the stained dust particles one no longer sees the ordinary single nucleolus, but either one or several large corpuscular bodies that fill up a considerable portion of the ring, all highly stained. These chromophilic bodies are round or irregularly rounded; they are sharply defined, and occasionally there is the appearance of a vacuole within their substance. One, two, three or more of these bodies are found within the ring, the most common form having a single large corpuscle looking like a huge altered nucleolus filling up more than half of the nuclear ring, and surrounded by caryoplasm filled with dust grains (Fig. 10). It

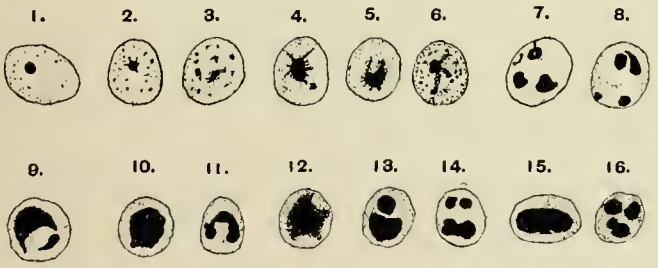

FIG. 10.—NUCLEAR CHANGES FROM IRRITATION OF THE CELL. 1, Normal nucleus; 2 to 8, alterations of the chromatin contents of the vesicle in chronic alcoholism; 9 to 16, alterations of the nuclear chromatin found in ricin poisoning.

is not entirely clear in what manner these large intranuclear bodies arise, whether they are formed by a tumefaction of already present nucleoli and adnucleoli, or whether they are composed of aggregations of metamorphosed molecular dust particles. In some, one might suppose an extreme swelling of the nucleolus, but in others there are several almost equally large corpuscles, and we cannot presume—at least there is no warrant for the supposition—that all these bodies have arisen by a process of budding from a single

centre. It is more probable that the nucleolar bodies are formed from the nuclear moleeular particles which have aggregated together and fused, leaving the earyoplasm free from dust, but at the same time changed in properties, as is evideneed by the greater absorption of the dye.*

In a recent work by Wright, on poisoning by bromides, the material for the investigation being both human and experimental, almost precisely similar changes to those above mentioned were noted, but in addition there was a crenation of the nuelear ring, while in some places the nuclear margin was hardly distinguishable, owing to the deep staining of the whole mass.

The most recent works on cell degeneration—those of Lenhossék, Marinesco, Flatau, and Ballet—all mention the eceentric position of the nucleus as an indubitable proof of an existing lesion. The nucleus may pass to the extreme periphery of the protoplasm, and even raise a hillock upon its side. These authorities also state that the nucleus beeomes at first swollen and diffusely stained, but there is no account of the deportment of the chromatin contents or of the caryoplasm, beyond that it assumes a diffuse staining.

Studies by the Nissl method upon material obtained from the autopsy table have not been fraught with the same positive results that are obtained in experimental investigations. This is probably due to minor post-mortem changes beginning within the first few hours after death. Nevertheless, the findings have not been without interest. Nissl has extensively investigated the cells in brains of those dying of dementia paralytica and other mental diseases; and in this country Meyer, Hoch, the writer, and others, have obtained some fair results from similar studies.

The limits of the applieation of this special stain in the human being are very narrow, and only when the material is of the most immaculate freshness can positive details be hoped for. This has been very definitely shown by Campacci, who killed guinea-pigs by bleeding, and left their bodies at a temperature of 72° F. for from three to twenty-four hours, and then examined the nerve eells by the Nissl method. The granula beeome paler and paler as post-mortem changes set in; they show an irregular disposition, mainly gathering around the nucleus in a whirlpool arrangement, leaving the periphery without chromatin. In advanced stages (twenty-four hours) the granula disintegrate into a finc blue-stained dust. The

* Vol. vi, Johns Hopkins Hospital Reports, No. 1.

protoplasm shows the presence of vacuoles, irregular networks and meshes, and eventually presents a cheesy aspect. The nucleus is not entirely spared; it becomes lighter and less distinct in its contours; the chromatin fibrils are lost, and in their place appears dust detritus. The nucleolus is the most resistant portion of the cell, and only in the advanced stages of cell decay does it lose its chromatin properties and wander to the periphery of the vesicle.

As a mark of chronic progressive decay, Nissl, in 1896, laid stress upon the pigmentary degeneration and breaking up of the protoplasm with alterations in the nucleus of the cell. The morbid process, when intense, ends in necrobiosis of the entire cell body, the corpus retaining its form, owing to the accumulation in its substance of calcareous deposits. These chalky concrements show themselves in the cell cytoplasm in the form of very fine granules, or in plates or masses, which take an intense staining with methylene blue. The whole, or only a portion, may become calcareous; not infrequently the process is confined to parts of the dendrites, or even to the nuclear membrane.

In his later writings (1898) Nissl admits that he is sceptical as to the value in mental diseases of minor alterations of the cell protoplasm, such as differences in the staining qualities of the granula or a breakdown of the same, since these alterations are found in the brains of individuals who have exhibited no signs of mental disturbance. Nor is he willing to draw any close deductions from one type of cell degeneration when the clinical pictures that result are so extremely varied. Even in the experimental work on animals this is also evident, since section of a nerve trunk, and toxic substances acting directly upon the cell, produce almost precisely the same forms of alteration.

The lesions most frequently mentioned by the writers on pathological investigations by the methylene-blue method are: 1. Pigmentary degeneration of the cell body with dissolution of the granula, a more or less positive lesion. 2. Reduction in size of the granules to dust particles, eventually chromatolysis, leaving in places areas of an almost homogeneous character with general swelling of the body. 3. Irregular gyration of the granula (undoubtedly a post-mortem alteration) and overstaining of the achromatic substance.

The value of alterations of the nucleus is much more positive. In very many cases of mental disorder I have been able to demonstrate a dislocation of the nucleus to the periphery, or even into the primordial process. In other instances the nucleus appears swollen

and the caryoplasm rarefied. Sometimes the reverse occurs; the nucleus diminishes in size, becomes irregular in outline, stains more deeply than normal, and eventually may atrophy to a small irregular mass. Alterations of the membrane are also found; it may be thickened, irregular, or serrated in outline, with local calcareous deposits along portions of its margin. Sometimes the chromatic contents also suffer. The threads may either swell or diminish in size, and show loss of staining properties. The caryoplasm may take up considerable quantities of hæmatoxylin or aniline stains, and present a homogeneous appearance. Rejection of basic and acceptance of acid stains rather frequently occur in advanced diseases of the cell. Dust-like grains may be scattered through it, giving to the previously clear substance a uniformly dotted aspect. The nucleolus, too—the portion of the cell most resistant to the influence of deteriorative agents—not infrequently shows the presence of irritative or degenerative processes. It may be uniformly enlarged, while still retaining a smooth outline; or it may swell, and the edges be roughened and spongy. It may wander to the margin of the membrane, or may become of an oval or horseshoe form, and occupy a large part of the nuclear ring. Finally, its central core may show in disease a difference in receptivity for the dye from that exhibited by the more external portions, taking now the acid stains in the place of the basophile ones.

It is often impossible to interpret correctly the significance of all these various lesions. Many of them, probably the majority, are induced directly by the insufficiency of the supply of nourishment to the cell body, others by the irritant qualities of a virus permeating from the blood channels, as in syphilis or chemical intoxications. In conclusion, it may be said that the pathology of the nucleus is far more definite than that of the protoplasm, and while at the present time we may not be able to correctly interpret the meaning of the lesion, we are at least able to recognise when the most important portion of the cell structure is involved in a degenerative process.

The staining of the entire neurone by the chrome-silver method of Golgi should apparently offer a splendid field for pathological research. But while this is entirely true for experimental work, unfortunately, when we come to the brain of man, we are again hampered by factors with which we do not have to deal in the lower animals—the presence of post-mortem products, and the difficulty in obtaining fair staining of the preparations. Again,

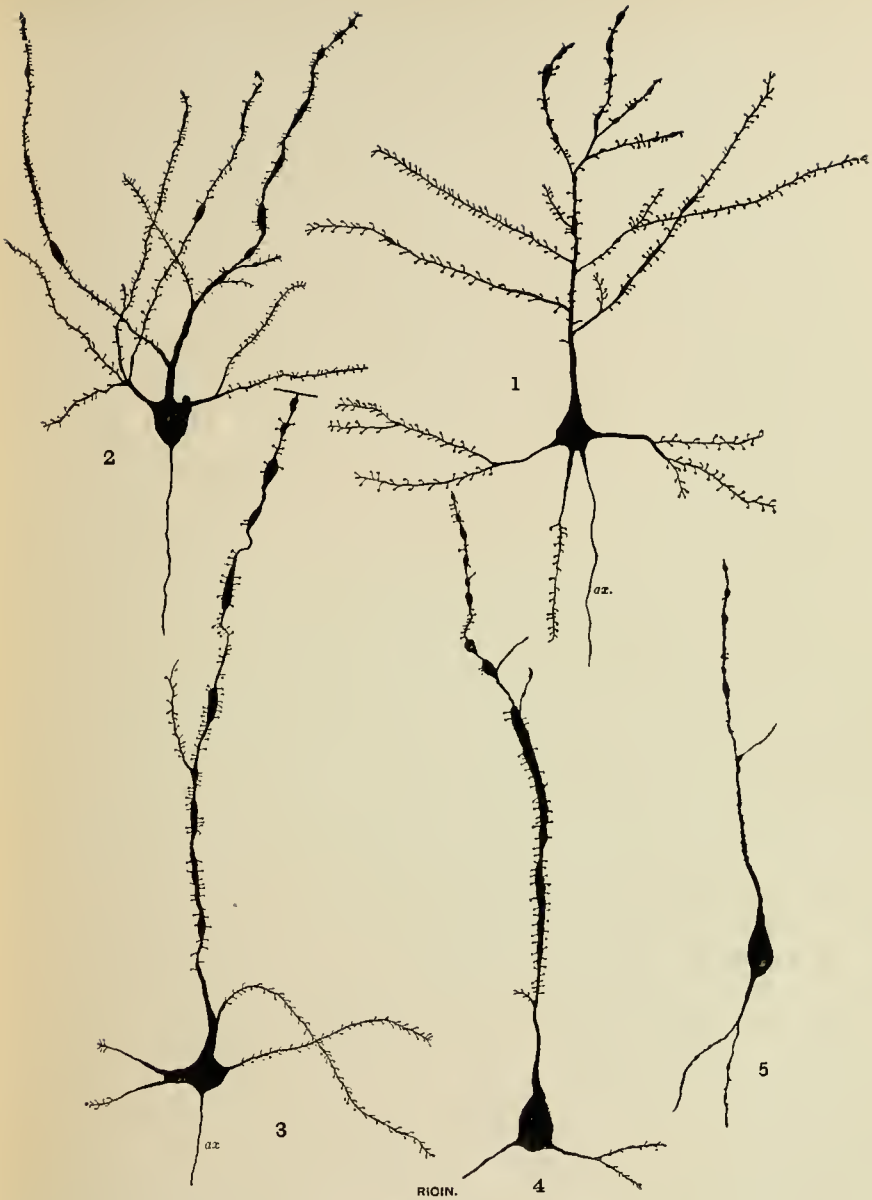

FIG. 11.—DESCRIPTION OF THE DRAWINGS. No. 1. Psychical cell from the second cellular layer of the cortex, showing a few pathological tumefactions on the uppermost branches of the apical dendrite. Otherwise the cell is normal. Ricin poisoning of 36 hours' duration. Subcutaneous injection of 0.5 milligramme ricin. Compare frontispiece. No. 2. Projection cell from the second layer of the cortex, showing an increased number of pathological swellings on the finer stems of the cell. There is now distinct diminution of the gemmulæ wherever the swellings are found. Ricin poisoning of 48 hours' duration. Subcutaneous injection of 0.25 mg. ricin. No. 3. Projection cell of the long apical process variety, showing numbers of large swellings of the protoplasm of the apical dendrite, thinning of the protoplasm of the stems in the interval between the nodules, and considerable loss of the gemmulæ along the margins. The lateral branches have mainly disappeared. The basal processes are retained intact. Ricin poisoning of 72 hours' duration. Subcutaneous injection of 0.125 mg. ricin. No. 4. Long apical process pyramidal cell with extensive swellings, chiefly fusiform in character, along the trunk, with entire destruction of the lateral branches and very great atrophy of the lateral buds. Ricin poisoning of 14 hours' duration. Intravenous inoculation of 1 mg. ricin. No. 5. Small pyramidal cell in advanced stage of degeneration. Ricin poisoning of 14 hours' duration. Intravenous injection of 1 mg. ricin.

the cellular changes shown by the method, while of extreme importance, are limited to lesions of a gross character, none of the finer detail of the nucleus or protoplasm being brought into view.

The chrome-silver staining shows conclusively that the neurone body degenerates from the periphery to the centre, the finer portions of the dendrites being first attacked, and later the corpus. The form of degeneration is extremely constant, both in artificial anæmias and in intoxications. The degeneration may take place in an extremely limited time, twelve to seventy-two hours, as in ricin poisoning,* where the lesions may be graduated in severity according to the amount of poison administered, and according to the duration of the poisoning (Fig. 11).

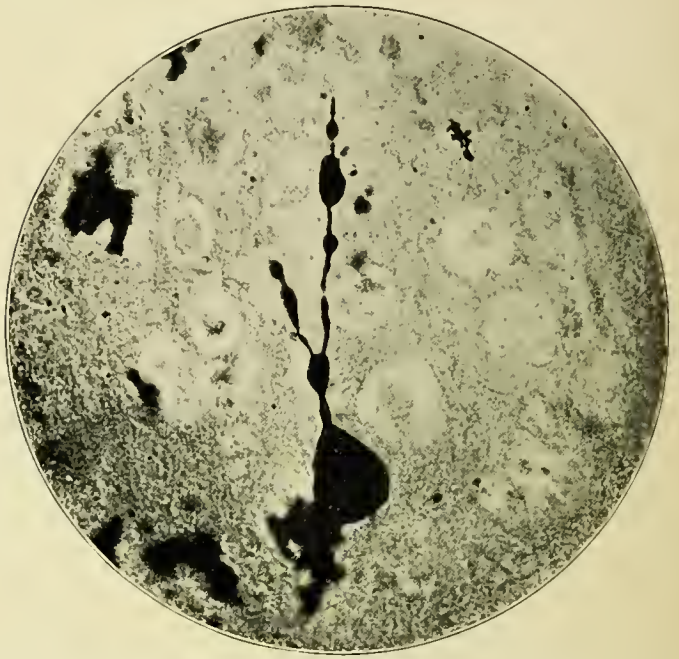

FIG. 12.—PYRAMIDAL CELL FROM THE SECOND LAYER OF THE CORTEX IN AN ADVANCED STAGE OF DEGENERATION. Acute ricin poisoning of 14 hours' duration. Intravenous inoculation of 1 mg. ricin. Enlarged about 500 diameters. Photo. by Dr. A. G. HOEN.

The research field in this department has been occupied by only a few investigators, among whom may be mentioned Golgi, Monti, Ceni, Vincenzi, Wright, Scagliosi, Agapoff, the writer, and a few

* Johns Hopkins Hospital Reports, vol. vi.

others. The articles most convincing are the one by Monti on artificial embolism, and that dealing with the ricin work above referred to. The photomicrograph (Fig. 12) shows the condition of a pyramidal cell fourteen hours after the injection of one milligramme of ricin into the body of a rabbit, while adjacent were numbers of other cells less advanced in decay.

In the earliest stages of the action of any strong cell poison, numerous swellings appear on the dendrites while the intervening portions of the stems retain their normal calibre. The gemmules over these thickenings soon show signs of disintegration, losing their property of reacting to the silver salt, and falling off from the parent stem, which in these places is soon left bare (Fig. 11). As the destructive process extends, larger tumefactions grow out of the dendrites closer to the cell body, while at the same time the outermost branches begin to disintegrate and break up (Fig. 11). Finally, the neurone is reduced until the dendrites are mere stumps, varicose and atrophied, the gemmulæ have almost disappeared from them, and the cell body, while still retaining its pyramidal form, looks rounded and tumefied. Complete destruction of the corpus of the neurone is rarely witnessed by the observer, but for all functional purposes the cell may be considered as inert, although it still retains its axis cylinder and collaterals either intact or but slightly swollen.

The mental condition of the animals that form the subjects of the experimentation is not uninteresting. For hours before death they are absolutely lethargic, sit huddled together in their cages, take no notice of external stimuli, and recover themselves with difficulty when displaced from their sitting position.

Precisely similar conditions of the nerve cells have been found in diphtheria, tetanus, serum, and other toxæmias, as are demonstrable after artificial embolism and ricin poisoning.

As already mentioned, the chrome-silver method applied to the cortex of man has not been prolific of good results. The post-mortem changes interfere in somewhat similar fashion here as with the methylene-blue stains. In the freshest and best obtainable preparations the alterations in the cell are never so pronounced as those found after ricin poisoning or the induction of acute ischæmia.

The alterations in the neuroglia structures as brought out by the various methods of staining, particularly the chrome-silver method, and under certain pathological states by carmine and safranin, are distinctive and interesting. According to their anatomical

character, whether they are supporting elements or belong to the lymphatic system, the cells conduct themselves entirely dissimilarly in disease.

In all forms of infective processes, both by the silver and safranin stains, the bodies of the vascular neuroglia (podasteroid glia) cells appear swollen, with more or less thickening of the pseudopod and other tentacles. Under these conditions within the margin of the extravascular space, particularly near the apex of the conical foot, deposits of a granular detritus are found which would seem to have been ejected from the footed extension. By the same methods the cell is seen to increase in size, and, when the process is very severe, to break down into detritus. With the safranin stain, in instances in which there is extensive destruction of the brain cells going on in subacute form, in dementia paralytica or cerebral syphilis, for example, the neuroglia of the vascular system, which under normal conditions is not visible in the section further than as indicated by the presence of the nuclei, shows decided enlargement of the protoplasm, and an equally striking change in its tingibility. Everywhere through the preparations, but in particular within the three outer layers of the cortex, these glia cells are seen sending their swollen tentacles to the margin of the vascular space. Besides the swollen condition of the bodies another change occurs. Both tentacles and cell body are now filled with minute grains deeply stained by the aniline, and in the perivascular space similar particles are noticed. The presence of the stained molecules is most noticeable in the pseudopod, where they are arranged toward its central portions in a somewhat thick row, indicating that the process is channelled. The most striking pathological notice, to be found in the literature, of the absorption of foreign material into the bodies of the vascular neuroglia, is one by Binswanger and Berger. In their case, after a subarachnoid hæmorrhage, blood pigment was extensively found in the bodies and tentacles of all the neighbouring cortical cells of this glia type. The further deportment of the vascular neuroglia cells in disease seems to be similar to that of the actual nerve element. In destructive lesions of the tissues of the brain substance they die and are removed by a process of gradual disintegration and absorption, so that they are no longer found where there is advanced sclerosis of the part.

The support cells, on the other hand, seem to possess much more vitality than their sister elements. In the sclerosis which follows so many forms of degenerative lesion of the nervous system, in

place of dying out and being absorbed, they apparently multiply and proliferate until they form a thick felt-work of matted fibrillæ, among which an occasional nucleus may be seen.

In nearly all the degenerative types of insanity, when there is advanced destruction of the cellular elements, this multiplication of the neuroglia fibrillæ is found, especially in general paresis or syphilis of the brain, where there is evident macroscopic shrinkage of the tissues of the cortex. In the white fibres at the foot of the convolutions, where the cells become sparse, under these conditions there is often the most extensive felting of the fibrillæ.

Cell Degeneration as seen with Ordinary Stains

Very varied types of nerve cell degeneration are found within the cortex by the ordinary carmine, hæmatoxylin, and aniline stains, but unfortunately it is very difficult to decide whether they are of primary or of secondary origin. It is certain, however, that they mainly follow a primitive lesion of the blood-vessels.

The most frequent form of pathological alteration found in the brain cells is the *fatty pigmentary*. Nearly all large cells of the cortex after middle life normally contain small deposits of golden-yellow granules, with a number of darker ones scattered among them. This substance, usually designated as fatty pigment—with which, however, it has really nothing in common, since it belongs rather to a metaplastic change in the protoplasmic structures of the cell—is unaffected by ether, by caustics or acids, but reacts to osmic acid, which stains darkly not only fatty constituents of cells, but also certain albuminoid products. Hence one cannot say with any certainty that the granules are of fatty nature. Hæmatoxylin and aniline do not tinge the substance at all, nor is it acted upon by any other dye.

In many mental diseases, inclusive of paresis, senile dementia, and, to a less extent, chronic alcoholism, the pigment granules increase greatly in numbers, and from occupying but a small portion of the cell protoplasm, extend over considerable areas, pushing the nucleus before them—a condition which may be assumed from the further disposition of the cell to be pathological. The outline of the protoplasm is now not so sharply defined, and there is some enlargement and alteration of the shape, while tinctural changes have taken place in the cytoplasm. The nucleus is at this stage not affected so far as regards outline or staining qualities; but a little later the basic stains are rejected, the acid stains are taken up, and

soon the corpuscle is forced to seek nutriment near the periphery of the protoplasm. Occasionally the nucleus takes up the pigment (Lewis), but in the final stages of the degeneration it always loses its vesicular outline, becomes more or less angular, and stains too deeply, while the nucleolus shows in its centre a bright refractile spot of some size. Should the degeneration proceed to a greater degree, the granules of pigment take on a brownish hue, the nucleus shrinks perceptibly, and finally disintegration of the protoplasm occurs, resorptive processes begin, the pigment granules are seen strewn irregularly and loosely within the pericellular space, and disintegration is complete. A somewhat rarer transformation is for the cell to lose completely the yellow pigment; it becomes translucent, and almost invisible in the microscopic field. A considerable degree of pigmentary metamorphosis of the nerve cell implies vascular lesion, either a dilatation of the blood-vessels with choked extravascular spaces, or inflammatory processes in the sheaths of the blood-vessels.

Simple atrophy of the cell is exceptionally found after vascular closure, embolism, or thrombosis. The body of the cell shrinks in all its diameters, the extensions assume spiral forms, the nucleus is indistinct, and eventually, after becoming roughened and excentric, disappears.

Coarse granular degeneration of the protoplasm is now and then seen after acute inflammatory processes. The cell body is tumefied and loses its sharp angles, while the cytoplasm shows, with hæmatoxylin or carmine, the presence of coarse angular particles distributed through the mass, but more especially heaped up around the nucleus. The nucleus now becomes excentric, and is even partly or wholly extruded beyond the outline of the cell body.

Vacuole formation in the protoplasm of the nerve cell may be either the result of post-mortem disintegration or of changes which have occurred in the cell from disease. In very fresh material the finding is a rare one, while in that from autopsies performed many hours after death it is frequent. In encephalomyelitis the formation of vacuoles is too distinct to be an artefact, but in general the round or oval holes in the protoplasm must be regarded as of trivial importance, and ordinarily of artificial production. After intense stimulation of the nerve cell by the electric current, vacuolar openings in the cytoplasm are also found. Vacuolarization of the nucleus has been found in cases of epilepsy, but the change is not a constant one.

Colloid degeneration of the cell is most common in the neighbourhood of foci of inflammation or near the retracting borders of a hæmorrhagic site. The colloid masses within the cell have a globular form, and stain deeply with carmine or hæmatoxylin.

Depigmentation of the cell is found in a number of chronic insanities where there is evidence of a sclerotic process. The characteristic finely granular character of the cell, seen with carmine or eosin staining, is lost, and the body now appears homogeneous, less dye is absorbed, and the cell structure is hardly to be differentiated from the surrounding matrix. Depigmentation and hyaline degeneration are closely allied to each other, and are supposed to mark the presence of sclerotic alterations in the cellular structures. In the final stages the cells atrophy.

A *finely granular disintegration* of the cell is noticeable after very numerous forms of toxæmic infection. The cells appear swollen, the protoplasm is cloudy, there is formation of fine and coarse granules within the protoplasm, aniline and carmine are feebly absorbed, even the nucleus resisting the staining by these reagents. This nucleus is often displaced, and finally becomes shrunken and irregular in shape. In the perivascular spaces may be seen large quantities of *débris* faintly stained by eosin, together with a material that blackens when osmic acid is used to treat the section. Broken-down leucocytes are also found in the vascular spaces, sometimes in such quantities as to completely pack the channel and seriously interfere with the return lymph flow.

Calcareous degeneration of the cortical cell is now and then found, after hæmorrhagic exudations, obliterating endarteritis, trauma, and other irritative disturbances. The calcareous cells are readily distinguished by their peculiar refraction, and the distinct broken appearances of their processes. On the addition of an acid to the section, bubbles of carbonic-acid gas are evolved, and characteristic crystals of lime salts are deposited on the surface of the section.

Alterations of the *nerve fibres* in the degenerative insanities are of frequent occurrence, and are particularly noticeable among the tangential bands. The change most frequently consists in an extreme varicosity of the medullary sheath of the fibre, and sequent ill-defined retrograde alterations, the fibre as an entirety being removed. Acute swelling of the axis cylinder with extreme varicosity of the protecting sheath is found in any variety of acute encephalitis, in focal softenings following thrombosis from the plugging of the vessels by micro-organisms, and in abscess of the brain,

from the destructive action of bacilli (for the most part the pneumococcus or colon bacillus) upon the tissue.

Lesions of the *neuroglia structures* seen with carmine and aniline staining are fairly numerous. One of the most striking alterations consists in a peculiar change in the power of these structures for absorbing the dye, so that they become more visible and distinct than under normal circumstances. Apparent multiplication of the nuclei of the stellate cells is found in the majority of diseases characterized by a tendency toward atrophy and diffuse sclerosis of the brain substance, and many local processes also show an immense increase in the numbers of nuclei in the surrounding irritated tissue.

The vascular neuroglia becomes an object of importance in the microscopic field in diseases in which there is a progressive destruction of the cellular elements, as, for example, in progressive paralysis or senile dementias. Even in carmine specimens these elements stand out prominently in the field, show immensely swollen bodies and tentacles, and ofttimes, within the body and arms, is to be found a finely grained detritus, in all respects identical with that in the adjacent perivascular spaces. When overladen with the products of the catabolic metamorphosis, and particularly when the nutrient arteries are markedly diseased, these neuroglia cells share the fate of the nerve elements and break down into molecular fragments. Their power of resistance to the toxic processes is manifestly greater than that of the nerve elements, but less than that of the long-rayed spider cells which maintain themselves, and form felt-works of filaments under the most adverse conditions. One of the most striking pictures of alteration in any tissue is seen in the early stages of paretic dementia when the myriads of podasteroid cells along the margin of the vessels become visible under low powers, with the swollen-footed processes attached to the margin of the vessel sheath.

PATHOLOGY OF THE CEREBRAL ARTERIES AND VEINS

Of the many morbid processes that weaken and injure the sheaths of the arteries, the condition known as arteriosclerosis, or arteriofibrosis, is by far the most wide-reaching in its effects, as well as the most frequent. It is found at all periods of life from adolescence to old age, and assumes several forms, which lead

eventually to fatty and calcareous changes in the innermost layer of the vessel wall.

The causes of arteriosclerosis are very numerous, but the mode in which they induce the vascular disease is not known. As a rule, it may be stated that any irritant poison circulating in the blood—alcohol, uric acid, syphilis, the gonorrhœal poison, the toxalbumins, etc.—are followed in a certain number of instances by chronic arterial disease, and it may be assumed that at least a certain number of these toxines act directly upon the inner coats of the vessels, and induce tissue degradations. Experimentally, we know that the poisons engendered in lyssa and other infections, as well as alcohol, directly occasion degeneration of the middle and inner coats; from which it may be inferred, for the human being, that in similar affections, after the subsidence of the disease stress, there is not recovery, but a progressive degeneration of the elements of the several sheaths.

Other factors besides those of toxæmic source may enter into the causation of the disease. In a large number of individuals of mediocre mental ability the arteriosclerosis begins at a very early age, and without any apparent immediate exciting factor (beyond the usual diseases of childhood). In such cases it is evident that the quality of the arterial tissue which the individual has inherited must be bad; indeed, entire families have been known to show this early tendency to the fibrosis, which cannot be explained on any other theory than that of direct inheritance.

Furthermore, any element that has the tendency to lower the vitality of the tissues may be a factor in producing the arterial degeneration, whether it be unhygienic surroundings, insufficient or bad food, or continued overwork, especially that of the muscular system, which causes an increase of the peripheral vascular resistance, thereby elevating the blood pressure. Over-feeding, though mentioned among the causes of arteriosclerosis, cannot be a very frequent factor, although over-distention of the blood-vessels, when unusual quantities of food are taken and a too large supply of fatty material is admitted into the blood, might be considered as an inciting cause. In the arteriosclerosis accompanying renal disease, in some cases the alterations in the arteries have come on first and have induced the lesion of the excretory glands, but that in other instances the renal disease has been primary and has brought about the arteriosclerosis, can be readily understood when we consider that in certain forms of nephritis the changes in the kidney, with the subsequent imperfect elimination of effete matters from the

blood, must necessarily exert a morbid influence similar to that of an irritant poison upon the vessels, causing degeneration of their component tissues.

The division of the forms of arteriosclerosis into three classes by Councilman is more comprehensive than that of Thoma, though the several varieties occasionally overlap one another, showing that the same etiological agents are common to the different types. Councilman distinguishes a senile, a nodular, and a diffuse arteriosclerosis.

In the *senile* form there is marked thinning of all the coats of the artery, but the media is more particularly involved. The muscular fibres have become hyaline, and finally, by the deposit of calcareous matter in the degenerated tissue, the whole artery is converted into a thin rigid tube, having a diameter slightly greater than that of the former healthy vessel. The endothelial tissue also undergoes degradation, and breaks down in focal areas with formation of the so-called atheromatous abscesses, the contents consisting of tissue *débris* and cholesterine crystals. The outer portions of these foci are covered by a thin pellucid deposit of lime salts inclosed in a layer of fibres derived from the sub-endothelium. These atheromatous foci may be thickly scattered over the interior of a vessel, or may be sparsely disseminated. They give the internal aspect of the artery a roughened appearance, and frequent fissures may be noticed in the calcareous plaques, which may form lodgment points for the beginning of thrombotic deposits. The atheromatous foci, or abscesses, as they are called, may rupture into the lumen, and the thinned wall of the vessel affords a favourable site for the beginning of an aneurism.

In extreme instances the greater portion of the intima may be covered by the rough calcareous plates. The adventitia is involved in the lesion only to a limited extent, there being slight atrophy, with changes in the nuclei. In the capillaries the degenerative change is less distinct than in the larger vessels. The latter are dilated, tortuous, their sharp outline is lost, and the nuclei become less numerous than in health, and indistinct. Calcareous deposits form in the walls, and in advanced instances there is calcification of the entire tube.

The *diffuse* form of arteriosclerosis is the most important one, and extends without delimitation from the aorta to the finest capillary of the brain. Foci of atheromatosis are not necessarily present, but are usually seen, when the disease is chronic, in the wall of the principal branches of the brain arteries, and may be traced from

them into vessels that are just visible to the naked eye. Great variation is found, under the microscope, in the appearance of the smaller vessels, some being greatly affected by endarterial changes with narrowing of the lumen, while others show only disease of the media and little implication of the intima. It is probable that Thoma is correct in his division of arteriosclerosis into two forms: (1) that in which there are local changes in the large arteries leading to dilatation, and a compensatory increase in the structures of the intima, and (2) arteriosclerosis secondary to resistance to the blood flow in the terminal vessels. This last condition is not infrequently found in the basal vessels, when there is disease of the end arteries of the cortex and ganglia, the increased resistance to the blood current leading to thickening of the intima of a compensatory order in the larger vessels. The arteriofibrosis is found at any age after adolescence, the youngest of Councilman's cases being twenty-three, and the oldest a man of sixty. Associated with it is a varying degree of heart hypertrophy. In a few imbeciles I have noted it at the age of ten and twelve years.

Microscopically, the lesions consist of a hyaline degeneration of the media, which now has a uniform homogeneons or light striated appearance, the muscular and connective-tissue elements having undergone complete necrosis and metamorphosis into the neoplasm. Associated with the changes of the middle layer there is usually an increase of the sub-endothelial connective tissue of the intima with nuclear proliferation; the better marked the lesion of the media, the greater the increase in the thickening of the intima. Exceptions to this rule are occasionally met with where there is great hypertrophy of the faintly striated hyaline material without decided changes in the intima. The membrana fenestrata suffers in varying degree in this affection of the artery. It may be unaffected, or may totally disappear; it has been known even to reduplicate itself, two elastic layers being present. In some not far advanced instances traces of the muscle fibres are seen in the hyaline neoplasm of the media, their nuclei being distorted, as well as showing in other ways the presence of a destructive process.

The adventitia plays but a small part in the disease process. There is ordinarily some slight multiplication of the fixed nuclei of the lamina, though but little encroachment upon the perivascular space.

When the intimal changes are advanced, particularly in the smaller arteries and arterioles, there is narrowing of the lumen

from the endothelial proliferation, which may progress to complete closure of the channel of the vessel—endarteritis obliterans—with great disturbance of the function of the part of the brain supplied by the artery (Fig. 13, obliteration of the posterior communicating artery).

Macroscopically, the arteries are tortuous, do not collapse when divided, while the intima may be smooth, showing very slight changes to the naked eye; or, more frequently, there are elevations of a pearly white colour and of a cartilaginous consistency; or these may be of an opaque whitish-yellow colour, with the centre soft, and filled with a mortar-like mass of cellular *débris* and cholesterine. In extreme instances of arteriosclerosis there may be a high degree of calcareous degeneration of the media, the whole layer now being converted into a cylindrical tube of chalky matter, through which the intima is not visible. In sections of the tissue these calcified arterioles stand out from the substance as fine white needles, which have a gritty feel under the microtome knife. The addition of a concentrated acid to the specimen, placed on a slide under a cover slip, evokes numerous bubbles of carbonic-acid gas. In high degrees of calcareous degeneration the adventitia may become involved, chalky offshoots from the media extending into the lamina.

The last form of arteriosclerosis commonly recognised, the so-called *nodular* form, has its main interest in the circumstance that it is closely related to the preceding variety, and is sometimes co-existent with it. In the early stages the internal sheath of the main arteries contains numerous flat projections of a yellowish-gray colour, rounded in outline, and more frequently situated near the bifurcation of the branches than elsewhere. In advanced stages these patches undergo fatty atheromatous alteration, a calcareous crust is formed on the surface, and the tissue beneath undergoes softening and breaks up into granular material. Embolism of an artery can take place as a result of the detachment of one of the atheromatous plates from its deeper attachments, but the formation of emboli from this source is infrequent.

The microscopic appearances of the patches indicate the primary occurrence of a mesarteritis and a periarteritis, there being a local infiltration of these layers, usually about the orifices of the vasa vasorum, with later changes in the intima. The formation of the atheromatous plaques is shown by Thoma to be of the nature of a compensatory process, the calcareous nodular plaque filling up and strengthening what would otherwise be a weak point in the dis-

eased intima. Aneurismal formation sometimes follows the rupture of the nodular abscess into the lumen, the blood pressure then dissecting and bulging outward the weakened wall.

FIG. 13.—ENDARTERITIS OBLITERANS. Occlusion of the right posterior communicating artery of the circle of Willis. The vessel has dwindled to a fibrous cord. Foci of atheromatosis are noticeable on the basilar artery. K., aged forty-one years; case of pseudo-dementia paralytica uræmica. Reproduced from a photograph.

Various other affections of the arteries are found in the brains of the insane, either alone or in combination with arteriosclerosis.

A *pathological dilatation* of the smaller arteries of the cerebrum is often found in chronic manias or in general paralysis where

there have been repeated congestions. The calibre of the vessel is now irregular (rosary dilatation), a succession of short enlargements and apparent constrictions being noted. Miliary aneurisms are frequently found in the smallest vessels that have been subject to this morbid expansion, but their frequency and importance as a cause of cerebral hæmorrhage has been overestimated. They are found also in any vascular disease which engenders a local weakening of the wall of the arteriole. The rosary dilatation is caused by loss of tone in the muscularis.

Fatty degeneration of the muscular fibres of an artery is a lesion of importance. In the earliest stage of the process refractile fat particles are seen between the single muscular strands, which at a later period become cloudy; the nucleus assumes an irregular outline, loses its staining qualities, and soon disappears, leaving the middle lamina a mass of yellow fat granules. The adventitia and intima are not implicated. The lesion is found occasionally in the arteries, both in youth and extreme age; its pathological importance is uncertain, beyond that it causes weakening of the vessel and tendency to hæmorrhage.

Except as a result of infectious processes primary degenerations of the *endothelial layers* are infrequent. The secondary forms are numerous, and sequential to arteriosclerotic or specific disease.

After ephemeral fevers, or other intoxications, degeneration and necrosis of the nuclei and connective-tissue elements of the intima are of extreme frequency. The affection usually ends in recovery, but there is occasionally an overgrowth of the fibrillary tissues and some narrowing of the lumen of the artery. Endarteritis of syphilitic origin is of great frequency, but will be treated of more in detail in the section on syphilitic lesions of the vessels.

The *adventitia* is usually affected when there is disease of the inner coats. Saccular dilatations of the sheath are seen when from any local cause there is interference with the lymph currents of the intravascular space. This dilatation is found more frequently in the white than in the gray substances, and, when extensive, gives to the tissue a cribriform appearance, the open holes representing the position of the dilated vessels. The condition is, however, rare.

Infiltration of the adventitial connective tissues with round nuclei and proliferation of the fixed elements is one of the most frequent lesions of arteries seen in the brain, both of the sane and the insane. It is more commonly found at the divisions of vessels that have been subjected to strain from fibrosis or repeated

congestions. Periarteritis accompanies any irritative lesion going on in the vascular sheaths, but in some instances it appears to be independent of any other morbid process. Periarteritis is a most important lesion when the neoplastic formation interferes with the nutrition of the nerve elements by choking up the lymph spaces, which in many instances is apparently the direct cause of the epileptiform seizures and serous apoplexies of so frequent occurrence in the organic-degenerative forms of insanity.

The meshes of the adventitia may contain a variety of products of pathological import. Extensive collections of fatty granules are found in it in the neighbourhood of apoplectic foci (small quantities of the fatty granules are normally found in the layer), or the pigment known as melanin may be massed in the meshes in large quantities, after previous attacks of severe malarial fever, as well as in some of the affections of the ductless glands. The pigment is located in the sheath of the vessel in the form of black or brownish fine irregularly scattered grains.

Lesions of the *capillary walls* are generally similar to those of the smaller arteries, though, owing to their size and the diminution in thickness of the sheaths, changes in them are less pronounced and distinct. Dilatation and wavy contours are the most frequent gross finding after congestions, while the fibrous degeneration accompanying arteriosclerosis is quite common (Lepinsky *et al.*).

The *veins* of the brain may participate in a number of the changes above described as appertaining to the arteries. Lesions of the intima are found after various toxæmias, or the media may undergo (in the largest veins) hyaline degeneration. Hypertrophy of the outer lamina is occasionally present, and most frequently of all we encounter a tendency toward nuclear proliferation in the outer sheath.

The contents of the perivascular spaces deserve mention before concluding this section. Lymphoid corpuscles, fatty particles, and sometimes pigment grains, are found in the normal space, but after the infectious processes the members of the leucocyte family, particularly the polynuclear variety, are occasionally found in countless numbers completely filling the space, sometimes to such an extent as not only to dam back the lymph current, but also, by pressure upon the walls of small vessels, to impede the free flow of the blood. Red corpuscles are occasionally found with them, their presence indicating either the rupture of a vessel, or a pressure upon the weakened arterial walls sufficient to occasion diapedesis of these

elements. In the extravascular space, under similar conditions, may be found the *débris* of degenerating leucocytes, besides that thrown into the channel by the podasteroid glia cells, and a peculiar homogeneous large body, probably formed by agglomerations of broken-down white-blood elements. Pus corpuscles may also be found in the lymph spaces adjacent to the cerebral surface after a purulent meningitis. In tumour growths of the meninges or brain substance various neoplastic elements may be found in the lymph spaces, the new formation following the line of these channels. Colloid-like masses staining faintly blue with hæmatoxylin, or red with carmine, are seen in the meshes of the adventitia or surrounding its layers. They are derived from the blood but are of unknown significance, beyond that they are more frequently found in irritative than in purely degenerative lesions.

Hæmatoidin crystals and *débris* are frequently seen both in the inner and outer lymph spaces after repeated congestions of the cerebrum. Except when the quantity is very considerable, and they help, together with the round-nuclear proliferation of a periarteritis or dense extravasations of leucocytes, to block the channel, their presence seems to be of little importance.

The *contents* of the arteries and veins are sometimes of considerable importance, though ordinarily, in an examination, the blood corpuscles are either normally diffused through the plasma, or located alongside of a network of coagulated serum that has expressed the corpuscular elements.

The vessels may be devoid of cellular contents, as is usually the case when the arteries are sound, or the blood corpuscles may be densely packed within the lumen (congestions, epileptiform crises). Under leucæmic or other physical conditions the leucocytes may form plugs solidly packed in the vessel's lumen. Again, there may be thrombosis of the vessel from dense aggregations of parasites (malarial organisms, colon bacillus, etc.), or the vessel may be plugged by a detached fragment from a diseased heart valve or bit of an atheromatous plaque, the last conditions affecting only the larger arteries.

In the several affections of the vessels coming under the head of arteriosclerosis, endarteritis, periarteritis, etc., the vascular disease is not always uniformly distributed over all the arteries of the cortex or ganglia. On the contrary, this uniform condition is rare, the majority of vascular lesions being irregularly distributed, some arteries showing an intense degree of alteration, while others may be

almost, if not quite, normal. Almost always the intensity of the vascular disease stress in the ordinary forms of arterial lesion falls within the territory of distribution of the middle cerebral artery, the probable reason being that the vessels are here larger and receive directly the full force of the cardiac supply.

SYPHILITIC VASCULAR LESIONS

Luetic lesions of the brain tissues, chiefly in the form of inflammatory processes in the walls of the nutrient arteries, occur so frequently and have in recent years attained such a pre-eminence that it is necessary to treat of them in some detail. Nowadays, whenever a case of tabes, general paresis, or one of the numerous other disorders that impinge upon both psychiatry and neurology presents itself, one naturally at once asks one's-self whether the patient is syphilitic or not—a question that is usually answered in the affirmative by the physician, with the result that the patient is treated accordingly until antisyphilitic therapy has at least been given a fair trial. Seldom in these luetic affections are there any positive indications of a focal character in the brain disease, though here and there disturbances of areas of cortex subservient to local sensori-motor functions are noticed to-day ; but to-morrow arrives and they disappear, to be followed by symptoms of a more general character.

Practically all the ordinary symptoms of general paralysis may be accounted for by the fact that there is going on in the brain tissues a progressive alteration of the vascular walls that reduces the supply of nutrient fluid to a minimum, and at the same time narrows the channels for the return lymph flow, inducing at times (when there is a more rapid extension of the disease) œdema of the brain substance, and the peculiar seizures known as epileptiform attacks.

Primary syphilitic disease of the large vessels of the brain basis presents some peculiar characteristics which serve to distinguish it, even to the naked eye, from diffuse arteriosclerosis and other degenerations, though in fact many of these are indirectly caused by the luetic poison. At an early stage the blood-vessels lose their semi-transparent character ; they become opaque, and acquire a peculiar whitish cast, which later assumes a gray tint. On cross section a vessel no longer collapses, but remains triangular, or at least irregular, in outline. To the touch the walls feel harder, and show a tendency to break on slight tension. On a closer examination of

the lumen it is found to be narrowed to perhaps one-half of its former calibre by what is apparently a zone of newly formed substance of gray or whitish appearance, which has a dry and cartilaginous consistency. Finally the lumen of the vessel may be entirely obliterated by the advancing growth of the new formation, or thrombi may form in the narrowed channel.

Other forms of syphilitic degeneration or neoplastic formation may now and then be found. Miliary gummata may be strewn along the periphery of the larger vessels, or the elements of the adventitia, nuclear or fibrous, may proliferate, inclosing the vessel in a thickened sheath which gradually involves the inner coats, weakening the walls, and, by extension of the proliferating elements, narrowing the lumen.

Microscopically, at least three different processes are to be found in individuals afflicted with syphilis of the brain.

The first extensive study of specific lesions of the brain arteries was made by Heubner in 1874 upon fifty cases of the affection. According to this writer's acceptation, the origin of the syphilitic new formation is to be found in the innermost layer (endarteritis luetica), where it develops between the membrana fenestrata and the endothelium. It begins in a proliferation of the endothelial cells, which continuously augment in numbers, and form a strong-felted lamina of spindle and star cells, into which round cells from the neighbourhood of the mouths of the nutrient vessels (vasa vasorum) wander, so that eventually there is formed a granulation tissue similar to that of a syphiloma. This new tissue grows in two directions, into the interior and along the length of the arteries, and narrows their calibre as it progresses to a complete involvement of the vessels. In the further course there now begins an organization of the new formation, which assumes a structure similar to that of the original vessel wall. The process stops after permanent narrowing, or is carried forward to complete obliteration of the lumen, with degeneration of the artery into a fibrous cord, so that the vessel becomes incapable of performing its vital functions.

The lesions described by Heubner as belonging to vascular syphilis are not the only ones that affect the intima in this disease. Morbid changes in the endothelial elements may in numerous cases be the fountain source of an obliterating process, equivalent to the usual type of obliterating endarteritis, entirely independent of any round-cell outgrowths from the vasa vasorum (Koster, Friedländer). Again, in cases of florid syphilis there may be outgrowths from the

intima equivalent to a local tumour formation, with complete plugging of the arteries owing to the masses formed by the multiplying elements.

In one case investigated by Alelekoff, death occurring about six months after the infection, there was found, on examination of the Sylvian and other arteries, a large neoplastic formation almost obliterating the arterial lumen. The tumour formation in this case had begun at single points along the intima, raising and separating it almost completely from the elastica, and by rapid proliferation closing the lumen of the artery. The neoplasms were adherent at points to the fenestrata, but at others were unconnected with it, and the inner membrane was separated in folds from the media, the space between being filled with red-blood cells. The new formation was composed of spindle-shaped elements, with between them fine connective-tissue strands. In places where the process was just beginning the intima was raised away from the elastica, and showed florid proliferation of the endothelial elements. The adventitia of these obliterated vessels was infiltrated with newly formed cells, whose presence in the neighbourhood of the vasa vasorum was particularly striking. The media, although to a less degree, was also infiltrated with foreign cells. In the smaller branches of the Sylvian artery an intense but simple endarteritis was discovered, which in many places had advanced to complete obliteration of the artery.

Baumgarten, in 1878, after a careful investigation of several cases of luetic arterial disease, found a condition of affairs in the vascular laminæ other than that described by Heubner. There was more intense disease of the adventitia than of the intima, and he therefore came to the conclusion that it is not in the innermost lamina that the inflammatory process starts, but in the connective tissue of the adventitia with its conjoined nutrient arteries, as well as in the muscular layer, and that secondary to these follow the proliferation and thickening of the intima. Baumgarten writes only of the larger arteries, but in the straight arteries of the cortex no form of specific arteritis is more frequent or more characteristic of the syphilitic poison than a profuse periarteritis, particularly when it assumes, as it very frequently does, the aspect of a periarteritis nodosa. Here, in but slightly advanced instances, there is rapid multiplication of round cells among the proper fibrillar elements of the adventitia until not only are the meshes of the layer covered, but also the whole extravascular space has become filled

with them, and nothing can be seen of the inner coats of the vessel owing to the dense overcrowding of round nuclei. In the first stages the adventitia alone is involved, but soon the media becomes infiltrated with the new elements, undergoes necrosis of the muscular cells with disappearance of the nuclei, and eventual transformation into a fibrillated hyaline material, not very readily noticed in the round-cell mass, which itself may later take on caseous degeneration, or more frequently partly disappears by an absorption process, leaving hæmatoidin crystals and *débris* to mark the former turgescence and nuclear overgrowth. Finally, the intima may take on the cellular proliferation by simple extension of the inflammation; both fibres and nuclei increase and multiply, the lumen of the vessel is reduced in calibre, and, if the degeneration advances, is eventually closed, though to the last there is retention of the innermost endothelial lining.

From a clinical standpoint this inflammatory process may be equally important, more rapid in its effects, and more lethal than the Heubner endarterial disease. In nine recent autopsies upon cases of dementia paralytica of specific origin the adventitial alteration was found in all in varying degree, from complete filling up of the perivascular space to a much less pronounced form, in which only a cortical area here and there showed a decided degree of adventitial disease. Greco also, in twenty-one examples of the same mental trouble, found in all periarteritis, which in some had advanced to an obliterating endarteritis. Retrograde changes in the proliferated adventitia are always found if the case has been of long standing, and the muscular and endothelial alterations assume greater prominence.

The intimal thickening of Heubner must therefore be regarded not, as he supposed, as the characteristic lesion of arterial syphilis, but only as one expression of the implication of the intima in common with that of the outer layers of the artery.

In the very earliest stages of the periarterial process the point of departure of the inflammatory trouble is unmistakable. At some varying place along the outermost sheath of the arteriole a local increase of small round cells with a comparatively large nucleus and scant protoplasm imbedded in a fibrous matrix is seen (Plate IV, Fig. 1). From this point proliferation extends, and the adventitia and surrounding lymph space become filled with the cellular and fibrous elements, which overflow and permeate not only into the media, but also into the surrounding nerve tissues, inducing

degeneration of the cellular structures of various kinds, the podasteroid gliacytes particularly suffering. The media and intima are nearly always involved subsequently to the nodular periarteritis.

As above remarked, this form is more highly characteristic of syphilitic infection than any other, arising primarily in the smaller arterioles, and not being secondary to any ascertainable disease of the adjacent tissue.

It has been found that the obliterating endarteritis so frequent in specific troubles of the brain may be secondary to any interstitial degeneration, as in disease of the pyramidal tracts or tabes dorsalis; or it may accompany any chronic inflammation, and is then not to be differentiated from the luetic affection. Likewise any pressure upon the sheath of the artery—acute, as in Baumgarten's ligature experiments, or chronic, from the blocking of the perivascular channels by nuclei, crystals, and *débris*—may also induce an endarteritis which would appear to be of a compensatory nature.

In the terminal stages of these several syphilitic degenerations of the arterioles, if the patient be so unfortunate as to live to reach them, there is resorption of the small round-celled infiltration, with shrinking of the fibroid elements of the adventitia, and hyaline-fibrous degeneration of the media; in the larger arteries occasional duplication of the elastica, with more or less advanced narrowing of the lumen, owing to the fibro-cellular proliferation, and occasional formation of two or more lumina, or total obliteration of the vessel.

Another rather rare affection of the arterial system in long-standing cases of syphilis is a fibrous-hyaline degeneration and hypertrophy of the muscular layer without any considerable involvement of either the adventitia or intima.

This primary alteration of the main support sheath of the artery may proceed to such a degree that the lumen is reduced in size to a capillary opening, or even entirely closed by a mass of granular material sometimes containing the *débris* of blood corpuscles, as if the blood within the vessel had undergone coagulation and afterward partial organization (Fig. 13, Plate IV). This condition is found not only in the larger meningeal vessels, but also in the medullary tissue, and is of importance inasmuch as it necessarily deprives the underlying and surrounding tissues of their immediate blood supply. The morbid process is not uniform in the affected vessels, some being only considerably thickened with the lumen remaining open, while in others, although a very minor number, it is completely obliterated.

The intrinsic condition of the media in the advanced fibrosis is most interesting. No trace of muscular substance is anywhere to be found in the greatly thickened layer, which now is composed of fibrillæ waving and twisting in a manner strongly suggestive of the

Fig. 14.—Congenital Capillary Fineness of both Posterior Communicating Arteries of the Circle of Willis. In the fresh specimen only a fine pin could be introduced into the lumen of these vessels, but pressure against the board on which they were photographed has flattened them, making them appear larger than natural. There are numerous foci of atheromatosis upon the basilar artery, which is dilated. R., aged sixty-eight years; senile insanity.

involutions of the membrana fenestrata, so that until close examination is made it might be mistaken for a multiplied elastica. The fibrillæ are not always arranged in such definite form as in Fig. 14, Plate IV, but twist and turn in a labyrinthine confusion; occasionally, however, a definite retained fenestrata may be observed entirely

distinct and separated from them. The transverse diameter of an artery of very moderate calibre is often so greatly increased in size that it can be distinctly seen in the gray matter with the naked eye.

In the earlier stages of the process, on staining with fuchsin or safranin-picric acid, the muscular cells are seen to be undergoing a

Fig. 15.—Congenital Absence of the Right Posterior Communicating Artery of the Circle of Willis. B., aged fifty-three years; presenile insanity. The arteries showed fibrosis with many atheromatous foci. Reproduced from a photograph.

definite hyaline degeneration, with discolourization and disappearance of their large nuclei. Then there begins an hypertrophy by proliferation of the fibrous elements, which, as the increase takes

place, progressively narrows the lumen of the artery until it is too small to admit of an equalized blood current, or becomes filled with a granular half-organized mass. In not a few instances (Fig. 13,

Fig. 16.—Congenital Absence of the Right Posterior Communicating Artery of the Circle of Willis. The arteries showed a diffuse sclerosis. W., aged sixty-five years; senile melancholia. Reproduced from a photograph.

Plate IV) the fenestrata and intima have become separated from the fibrinous mass by a fairly broad space containing hæmatoidin grains. Owing to the necessary shrinkage due to hardening reagents this space is probably wider in the preparation than it was in reality during life. In only exceptional places was the intima

thickened at all, and in these to an inconsiderable degree. The outer layer is never implicated in the change to any considerable extent.

The very frequent abnormalities in the construction of the basilar arteries deserve a passing notice at the end of this chapter, as they are significant of the defective formation of the entire body in the insane—the vital clay is not moulded rightly, but allows defects in the formation of the vessel to be noted here and there.

Among the more prominent of these abnormalities, absence or unusual calibre of the large basal arteries may be mentioned. The right or left posterior communicating artery may be absent or defective, being reduced to capillary fineness; or the entire system of basal vessels may be too small to admit a sufficient blood supply to the encephalon. The cerebellar arteries arising from the basilar artery are not infrequently too small. The Sylvian artery less frequently than the others shows deviation from the normal in its distribution (Figs. 14, 15, 16).

There are no statistics, to my knowledge, of the frequency of arterial abnormalities in the insane in comparison with the sane. In sixteen consecutive autopsies in which careful search was made in the basal vessels for their presence, deviations from the normal were found in four, a proportion of twenty-five per cent, which would be far higher than in normal man, but the number of cases examined is too few upon which to base statistics.

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PLATE IV

DESCRIPTION OF THE DRAWINGS

Series A. Perivascular

FIG. 1. *Perivascular Space of Artery.*—Transverse section of a small artery from the cerebral cortex, showing the degenerating pulp of round nuclei enclosed in a delicate fibrillated sheath. *A*, round nuclei. The remaining portions of the artery are normal. *N. S.*, narrow part of the perivascular space. Resinmethyl violet stain, alcohol hard ring. Zeiss, D. D. Ocular II. Enlarged.

FIG. 2. *Perivascular Space.*—Transverse section of a small artery of the cortical gray matter. The extravascular lymph space is completely filled with the new-formed elements, except that at *S. S.* a lymph passage is left open. At several points, particularly at the one marked (', the new formation spreads beyond the margin of the perivascular space into the surrounding tissues. The muscularis shows a beginning invasion with round nuclei; the intima is normal. The staining and mounting reaction are the same as in the preceding figure.

FIG. 3. *Perivascular Syphilitic.*—Transverse section of a very small artery of the gray substance. No trace is to be seen of the original adventitia, and the entire extravascular space is filled by foreign cells which overlie the margin of the channel and penetrate among the surrounding nerve elements. The muscular nuclei are indistinct. The intravascular space is seen to be dilated with round nuclei. Alcohol hardening, hematoxylin-eosin staining. Zeiss, D. D. Ocular II. Enlarged.

FIG. 4. *Perivascular Vacuoles Treated with Hydrazine Reaction of the Muscularis.* Transverse section of a medium-sized straight artery of the cortex. The perivascular space is seen to be dilated. *N. S.*, margin of the space. *M. M.* a heaping up of round nuclei embedded in a filmy stroma is noted. *M. M.* the muscularis has disappeared, and in its place lies a tissue showing faint fibrillation and containing a small number of round and oval nuclei. The nuclear elements are somewhat in number toward the periphery, but even there are sparse. *A* has the usual fibre-bands radiating from the latter toward the external margin of the vessel. *M. E.*, a split in the fibrous tissue lined with a thin [illegible] *E. E.* [illegible] Alcohol hardening, hydrazine-reaction [illegible] Zeiss, D. D. Ocular IV. Enlarged fourfold.

Series B. Perivascular Fibrous Lesions

FIG. 5. Transverse section of a small cortical nutrient artery. The perivascular space is opened by the line *N. S.*, is seen to be much dilated, and in one quadrant of the circle lies the greatly changed vessel. The lamina vitrea and muscularis by a slightly thickened stroma. Outwardly from this every trace of the muscularis has disappeared, and in its place lies a tissue showing faint fibrillation and containing a small number of round and oval nuclei. The nuclear elements are somewhat in number toward the periphery, but even there are sparse. *A* has the usual fibre-bands radiating from the latter toward the external margin of the vessel. *M. E.*, a split in the fibrous tissue lined with a thin [illegible] *E. E.* [illegible] Alcohol hardening, hydrazine-reaction [illegible] Zeiss, D. D. Ocular IV. Enlarged fourfold.

FIG. 6. [illegible] section of a very small artery, showing the same form of perivascular alteration. The dilated perivascular space is filled with the exception of a portion of one quadrant, [illegible] by a mass of new [illegible] which shows numerous round and oval nuclei and a few fibres. *M. E.* the more well [illegible] of the vessel, surrounded by a faint hyaline zone. No trace of the muscularis is anywhere to be found. Alcohol hardening same as in preceding figure.

FIG. 7. The same form of perivascular is seen although a much larger artery. The lumen is irregular, the intima slightly thickened. Within the area of hydrazine reaction are several irregular spaces filled with round nuclei. *N. S.*, lymph spaces. The perivascular space contains oval and round nuclei not belonging to the [illegible] of the blood. The perivascular margin [illegible] fibres, and shows an unusual number of nuclei. *M. E.* margin of perivascular space. Alcohol hardening; eosin staining. Zeiss, D. D. Ocular IV. Enlarged fourfold.

FIG. 8. The same form of perivascular [illegible] artery of the cortex. Alcohol hardening, eosin-[illegible] Zeiss, D. D. Ocular IV. Enlarged fourfold.

PLATE IV

Description of the Drawings

Series I. Periarteritis

Fig. 1. *Periarteritis Nodosa Syphilitica.*—Transverse section of a small artery from the cortical gray matter, showing the beginning heaping up of round nuclei embedded in a faintly fibrillated stroma. *N.*, round nuclei. The remaining portions of the artery are normal. *P. V. S.*, margin of the perivascular space. Eosin-hæmatoxylin staining, alcohol hardening. Zeiss, D. D. Ocular II. Enlarged.

Fig. 2. *Periarteritis Syphilitica.*—Transverse section of a small artery of the cortical gray matter. The extravascular lymph space is completely filled with the new-formed elements, except that at *L. S.* a lymph passage is retained. At several points, particularly at the one marked *C*, the new formation spreads beyond the margin of the perivascular space into the surrounding tissues. The muscularis shows a beginning invasion with round nuclei; the intima is normal. The staining and magnification are the same as in the preceding figure.

Fig. 3. *Periarteritis Syphilitica.*—Transverse section of a very small artery of the gray substance. No trace is to be seen of the original adventitia, and the entire extravascular space is filled by foreign cells which overflow the margin of the channel and penetrate among the surrounding nerve elements. The muscular nuclei are indistinct. The intravascular space is seen to be distended with round nuclei. Alcohol hardening, hæmatoxylin-eosin staining. Zeiss, D. D. Ocular II. Enlarged.

Fig. 4. *Periarteritis Nodosa Uræmica* with hyaline degeneration of the muscularis. Transverse section of a medium-sized straight artery of the cortex. The perivascular space is seen to be dilated. *P. V. S.*, margin of the space. At *N.* a heaping up of round nuclei embedded in a fibrillary stroma is noticed. At *H.* the muscularis is seen to be distinctly hyaline, and the nuclei have disappeared from that portion of the lamina. Alcohol hardening, picric-acid-fuchsin stain. Zeiss, D. D. Ocular IV. Enlarged fourfold.

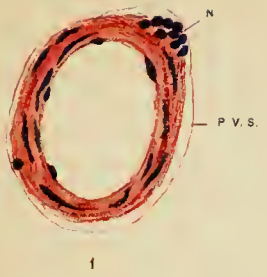
Series II. Periarteritis Fibrosa Luetica

Fig. 5. Transverse section of a small cortical nutrient artery. The perivascular space indicated by the line *P. V. S.* is seen to be much dilated, and in one quadrant of the circle lies the greatly changed vessel. The lumen is narrowed and surrounded by a slightly thickened intima. Outwardly from this every trace of the muscularis has disappeared, and in its place lies a tissue showing faint fibrillation, and containing but a small number of round and oval nuclei. The nuclear elements increase somewhat in numbers toward the periphery, but even there are sparse. A few thickened fibre-bands radiate from the intima toward the external margin of the vessel. At *L.* a split is seen in the fibrous tissue, lined with a thin membrane containing a number of oval nuclei. Alcohol hardening, fuchsin-picric-acid staining. Zeiss, D. D. Ocular IV. Enlarged fourfold.

Fig. 6. Transverse section of a very small artery, showing the same form of periarterial alteration. The dilated perivascular space is, with the exception of a portion of one quadrant, completely filled by a new growth, which shows more numerous round and oblong nuclei than in the last figure. At *L. A.* the narrowed lumen of the vessel is seen, surrounded by a but slightly changed intima. No trace of the muscularis is anywhere to be found. Magnification same as in preceding figure.

Fig. 7. The same form of periarteritis is seen affecting a much larger artery. The lumen is irregular, the intima slightly thickened. Within the area of fibro-nuclear proliferation are several irregular spaces devoid of contents. *L.*, *L.*, lymph splits. The perivascular space contains oval and round nuclei not belonging to the white elements of the blood. The perivascular margin is distinctly fibrous, and shows an unusual number of nuclei. *P. V. S.*, margin of extravascular space. Alcohol hardening, safranin staining. Zeiss, D. D. Ocular IV. Enlarged sixfold.

Fig. 8. The same form of periarteritis is seen involving a moderate-sized nutrient artery of the cortex. Alcohol hardening, eosin-hæmatoxylin staining. Zeiss. D. D. Ocular IV. Enlarged fourfold.



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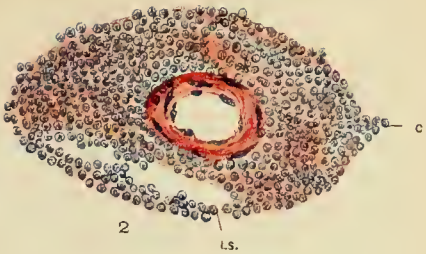

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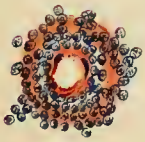

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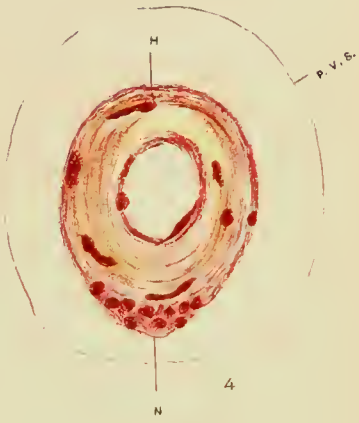

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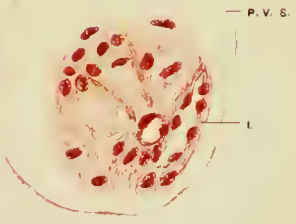

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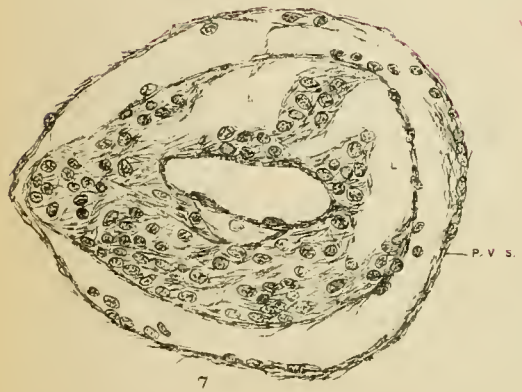

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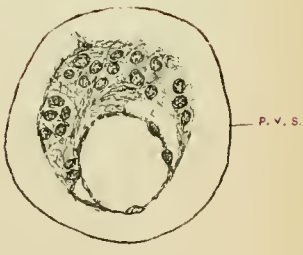

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PLATE IV[a]

Series III. Mesarteritis (Hyaline Degeneration)

Fig. 9. Common form of fibrous-hyaline degeneration of the media. Transverse section of a medium-sized cortical artery. *A.*, adventitia, slightly thickened in places, but without nuclear increase. *He.*, *He.*, hæmatoidin deposits in the external lamina. *L.*, dilated intravascular lymph space. *M.*, fibrous-hyaline muscular layer devoid of nuclei. *I.*, unaltered intima. Staining and enlargement the same as the preceding figure.

Fig. 10. Longitudinal view of a small cortical artery affected by hyaline degeneration. *H.*, *H.*, *H.*, points at which the muscular nuclei have entirely disappeared, and the wall of the vessel takes only the picric-acid stain. At numerous places atrophy and degeneration of both the muscular and intimal nuclei are seen. Alcohol fixation, safranin staining. Zeiss, D. D. Ocular IV. Enlarged twofold.

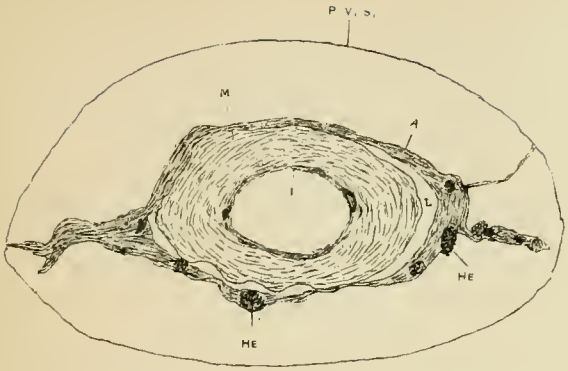
Fig. 11. Medium-sized artery from the gray matter, showing thickening and hyaline degeneration of the muscularis. A single retained nucleus of a muscular fibre is seen on the right-hand side of the field. The intima is unaltered, the adventitia comparatively unchanged. *A.*, adventitia. *M.*, muscularis. *P. V. S.*, margin of perivascular space. Müller's fluid hardening, eosin-hæmatoxylin staining. Enlargement the same as the preceding figure.

Series III. Fibrous Mesarteritis

Fig. 12. Thickening and distortion of the muscularis. Medium-sized artery from the gray substance. *P. V. S.*, margin of the perivascular space. *E. L. S.*, irregular perivascular lymph space. The adventitia is to be determined with some difficulty. *M.*, fibrous muscularis. The lumen is irregular, the intima unchanged. Alcohol fixation, fuchsin staining. Zeiss, D. D. Ocular IV. Enlarged fourfold.

Fig. 13. Unusual form of fibrous mesarteritis affecting a large meningeal artery. The adventitia is seen to be but slightly thickened, while the media is converted into a mass of coarse waving fibrillæ. Externally to the middle layer the intraadventitial lymph space is seen to be enlarged, and holds a few brown pigment grains derived from the hæmatin of the blood. The membrana fenestrata and intima are very closely united, and no nuclei in the latter are stained. The entire lumen is filled with an organized, slightly fibrillated mass, with a slightly tinged central region. Alcohol hardening, Van Gieson stain. Enlargement as in last figure.

Fig. 14. The drawing shows the same form of fibrous thickening of the middle lamina without involvement of the adventitia or intima. Transverse section of a small meningeal vessel. The lumen is oblong in form and greatly narrowed. Alcohol, picric-acid-safranin staining. Enlargement as before.



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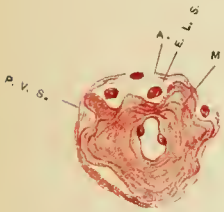

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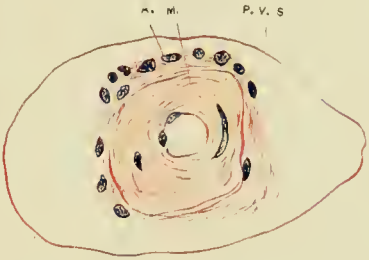

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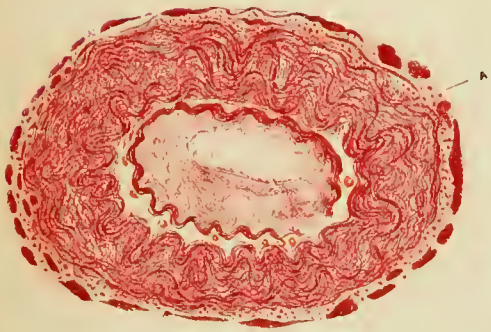

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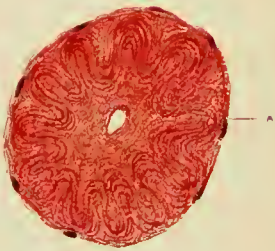

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PLATE V

COMMON FORMS OF ATROPHIC DEGENERATION OF THE NERVE ELEMENTS OF THE BRAIN

FIG. 1. Types of pigmentary-atrophic degeneration of the nerve cells of the [illegible] in a case of progressive paralysis of long standing. Alcohol, [illegible]-right ×. FIG. 1 figure (1) shows the whole cell body filled with the [illegible] granules, and the dendrites reduced to stumps. The nucleus is [illegible] eccentric position, but reacts to the stains and accepts acid ones. Its outline is normal, the contents homogeneous. The nucleolus is considerably enlarged and [illegible] homogeneous.

FIG. 2. The protoplasmic bodies are densely filled with the brown granules, while the cell processes have disappeared. The nucleus is dislocated to the periphery of the body, and seems larger than normal. Its contents are homogeneous, but the nucleolus is not distended or enlarged.

FIG. 3. A process of cell disintegration is now visible in the cell body, the granules [illegible] and the nucleus is driven to the extreme border of the cell. The processes do not appear to be so much altered, though it has become strongly acid-stable.

FIG. 4. An advanced form of degeneration of the pigmentary-atrophic form is reproduced. The protoplasm is shown as an homogeneous faintly reticulated [illegible] containing scattered pigmentary granules. The nucleus has been already [illegible]. The nucleus is enlarged, distorted and its contents small and [illegible]. Both are strongly acidophile. All figures, Zeiss, 1. D. Ocular IV. Alcohol, [illegible] tion, hematoxylin-eosin staining.

PLATE VI

SIMPLE ATROPHY OF NERVE CELLS (FROM THE FRONTAL CONVOLUTION OF A CASE OF PROGRESSIVE PARALYSIS OF LONG DURATION)

FIG. 5. A pyramidal nerve cell with diminishing processes and atrophic protoplasm filled with coarse irregular granules that absorb the aniline stain more deeply than the surrounding substance. The protoplasmic body contains but a small proportion of the pericellular space. The nucleus is large in proportion to the total amount of protoplasm, and is a little tumefied in outline. The nucleolus is very irregular, resembling a star, and has absorbed a large amount of the stain.

FIG. 6. Pyramidal cell showing the same general changes as the last, protoplasm except that a portion of the basal region is free from granules. The nucleus is irregular in outline. The nucleolus shows several extensions.

FIG. 7. Pyramidal cell very much atrophied, lying free within the pericellular space. The nucleus is indented, and at the [illegible] the nucleolus is lost.

FIG. 8. Pyramidal nerve cell in an advanced stage of simple atrophy. The entire cell lies within the sheath, and only by means of a modern [illegible] can it be observed to be present. V. C. S. drawn [illegible] Alcohol, hematoxylin-eosin staining. Zeiss, 1. D. Ocular IV.

PLATE V

Common Forms of Atrophic Degeneration of the Nerve Elements of the Brain

Fig. 1. Types of pigmentary-atrophic degeneration of the nerve cells of the corpus striatum from a case of progressive paralysis of long standing. Man, aged thirty-eight years. The figure (1) shows the whole cell body filled with the metaplastic granules, and the dendrites reduced to stumps. The nucleus occupies a central position, but rejects basic stains and accepts acid ones. Its outlines are normal, the contents homogeneous. The nucleus is considerably enlarged, the membrane roughened.

Fig. 2. The protoplasmic bodies are densely filled with the brown granules, while the cell extensions have disappeared. The nucleus is dislocated to the extreme periphery of the body, and seems larger than normal. Its contents are homogeneous, but the nucleolus is not disturbed or enlarged.

Fig. 3. A process of active disintegration is now visible in the cell body; the granules are falling apart, and the nucleus is driven to the extreme basal region of the cell. The nucleus does not appear to be seriously altered, though it has become strongly acidophile.

Fig. 4. An advanced form of degeneration of the pigmentary-atrophic form is reproduced. The protoplasm is shown as an homogeneous, faintly rose-stained substance, containing scattered metaplastic granules. The branches have been absorbed. The nucleus is enlarged, distorted, the nucleolus small and roughened. Both are strongly acidophile. All figures, Zeiss, D. D. Ocular IV. Alcohol fixation, hæmatoxylin-eosin staining.

Simple Atrophy of Nerve Cells (from Third Cellular Layer of the Cortex) after Obstruction of the Extravascular Spaces

Fig. 5. A pyramidal nerve cell with dwindling processes and atrophic protoplasm filled with coarse irregular granules that absorb the aniline stain to a greater degree than the surrounding substance. The protoplasmic body occupies but a small portion of the pericellular space. The nucleus is large in proportion to the total amount of protoplasm, and is a little roughened in outline. The nucleolus is very irregular, resembling a star, and has absorbed a large amount of the stain.

Fig. 6. Pyramidal cell showing the same general characteristics of the protoplasm, except that a portion of the basal region is free from granules. The nucleus is irregular in outline; the nucleolus shows several extensions.

Fig. 7. Pyramidal cell very much atrophied lying free within the pericellular sac. The nucleus is indistinct, and all trace of the nucleolus is lost.

Fig. 8. Pyramidal nerve cell in an advanced stage of simple atrophy. The entire cell lies within the space, and only the outline of a nucleus, devoid of nucleolus, is to be seen. *P. C. S.*, margin of pericellular space. Alcohol fixation, safranin staining. Zeiss, D. D. Ocular IV.

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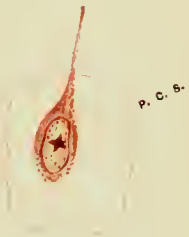

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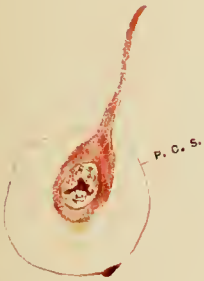

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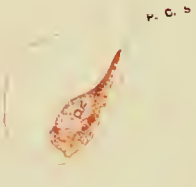

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PART III

CLINICAL SECTION

SPECIAL SYMPTOMATOLOGY, PATHOLOGY, AND THERAPY OF THE FORMS OF MENTAL DISEASE

The Classification of Mental Diseases

Writing many years ago, Lavater divided men into three classes: "the retrograde, the stationary, and the progressive." In the following pages we have to deal not with the progressive, rarely with the stationary man, but almost entirely with the retrograde class.

With our present knowledge of the etiology and pathology of mental diseases an accurate classification of the multitudinous forms of insanity is an impossibility, though year by year, as with the somatic diseases, the so-called functional mental disorders, one by one, are being taken out of that category, and are finding a more appropriate place in the list of the maladies consecutive to inherited disability, or injury from the effects of poisonous substances upon the encephalic substance. For example, the delirious forms of mania (*delirium acutum*) and a distinctive form of insanity of the post-partum period have been shown, almost certainly, to be due to an infectious process, or to the storage of nerve poisons engendered within the organism from defective tissue metabolism.

Three bases for the classification of mental diseases presenting themselves, it has unfortunately happened that each writer upon psychiatry has chosen the one that appealed most to his own views, the result being untold confusion. With respect to these three groupings, it will readily be seen that a classification based upon *clinical symptomatology* is necessarily unsatisfactory because the indications of one form of disease frequently overlap those of another; while an *etiological* basis is equally defective, inasmuch as the fundamental causation is frequently unknown and unascertainable. Far preferable to either of the two foregoing is a classification dependent upon the *morbid anatomy*, for when the pathology of a disease

has been once recognised, the course can be predicted with some certainty, and the treatment instituted rests upon a solid foundation.

In order to avoid the production of any further confusion in nomenclature, I have followed in this work the main lines of the classification of Krafft-Ebing, only departing from its principal features when there was opportunity to place a disease that has been more fully studied in recent years under the insanities following an ascertainable lesion of the cerebral substance.

With other progress of recent times the discovery has been made, and the fact has been clearly shown, that many of the forms of so-called functional mental disease, the simple manias and melancholias, do not belong to this category at all, but must be included among the insanities dependent upon an inherited constitutional predisposition. I refer to the various forms of periodic insanity, which outnumber twentyfold the idiopathic ones. The closer study of clinical symptoms in the last decennary, together with the better organization of society, has enabled the psychiatrist to more thoroughly observe and follow individual cases, with the result that the functional psychoses are ever receding into the background, while the degenerative types are becoming more prominent. Perhaps the easier access to and more frequent abuse of alcoholic liquors may be held to be largely responsible for the relatively increasing prominence of insanities of degeneracy in private practice and in asylums. Perhaps, also, the admixture of race strains has been a considerable factor, just as we see the tendency to tuberculosis accentuated in the offspring of mixed negro and Caucasian races. The insanity of the degenerate is growing yearly in importance, since we now recognise more readily the brand-marks of mental deterioration.

The several forms of mental disease may, most conveniently for the purposes of the clinician and student of mental pathology, be arranged under four main groups. Some of these, it is true, merge into each other, and subdivisions are sometimes placed in a principal group for the reason that certain phenomena of the malady have greater value and importance than others of less distinctive character. Thus, for example, with the puerperal insanities, cases are met with that belong sometimes to the toxic group of psychoses, sometimes to the degenerative forms of insanity, yet both present two features in common: they have their inception at the time of parturition, and number among their clinical manifestations a maniacal exaltation. The distinctive puerperal insanity, however, belongs to the first order, but for the sake of convenience both must be placed under

the general heading, puerperal psychoses. This plan, we are well aware, is most objectionable, but until an entirely new classification is made and generally accepted it cannot well be avoided.

Group I. *Mental diseases without ascertainable pathological alteration of the brain substance.*—The idiopathic insanities (the psychoneuroses of Krafft-Ebing) may be defined as acquired forms of mental disease arising in individuals without an inherited or acquired predisposition to insanity, and who accordingly have a sound mental constitution. They may follow such factors as acute physical diseases, trauma, brain shock, or any sudden oversetting of the mental equilibrium from the effects of toxines or other brain-disturbing factors. They are the cases most benefited by therapeutic measures, and from which a large percentage of permanent recoveries may be expected. The degree of mental reduction in the milder forms is usually much less striking than in the degenerative disorders, the faculty of logical thought being often unaffected. It is customary to separate the psychoneuroses into two chief classes, states of mental depression (melancholia) and states of mental exaltation (mania), but it should always be remembered that these two terms, mania and melancholia, are used very loosely in psychiatry, and may be applied to diseases entirely different from the true primary insanities. Thus, for example, we speak of epileptic mania, or of alcoholic melancholia, solely because the most prominent feature of the symptom-complex is a condition of excitement or depression. A simple but at the same time more accurate segregation of the phenomena of mental disease is most desirable, but long custom makes innovations almost impossible.

Group II. *Mental diseases sequential to ascertainable alteration of the cerebral substance.*—From a pathological standpoint this group is the most sharply defined of any of the forms of alienation. In contradistinction, etiologically, to the true psychoses, the mental symptoms are not dependent upon perverted psychical processes, but are consecutive to direct or indirect lesion of the neural tissues. They are chiefly secondary to organic-degenerative or inflammatory processes beginning in the blood-vessels of the cerebral pulp, which cause denutrition of the cortical cells and consequent sensori-motor symptoms. In the febrile insanities the presence of an irritating virus circulating through the blood-channels may induce not only lesion of the vascular walls, but also direct injury to the nerve cell, and the same factors are almost equally prominent in chemical intoxications, or in insanity from auto-infection.

Group III. *Insanities due to inherited or acquired mental instability.*—These frequently show a one-sided or warped evolution of the mental faculties, and are usually to be traced to anatomical abnormalities, such as a defective development or malformation of the cranial bones, with imperfections in the brain structures, especially in the convolutions, and anomalies in the vascular construction. In many examples the stigmata are only faintly marked, or are impossible to recognise during life. This class is very large, and probably includes more cases than any of the other groups. They are frequently confounded with the idiopathic psychoses, from which they should be rigidly distinguished, since both the onset and prognosis are essentially dissimilar.

Group IV. *States of complete or incomplete retardation of the psychical (and physical) development.*—These depend upon congenital malformations or gross deficiencies in the development of the brain, its envelopes, or in the arterial supply. Other causes are to be found in the lack of an adequate amount of some essential glandular secretion, cerebral hæmorrhage, trauma or infectious processes occurring in the earliest years of life, which have prevented perfect evolution of the faculties by retarding or stopping the brain growth.

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GENERAL ETIOLOGY OF INSANITY

Rindfleisch has stated that any given disease falls under one or other of five etiological categories—overexertion, injury, parasitism, defective growth, and premature involution. In studying insanity it will be necessary to place in this list several additional causes.

The factors that contribute to mental disorders are both direct and indirect. Insanity from gross disease immediately affecting the brain cortex is not of great frequency, but is found after apoplexies involving the cortex, after purulent meningitis, after syphilomata arising from the cerebral arteries, and in quickly growing tumours. In all these cases the symptoms usually approach the maniacal or stuporous types. Again, after *commotio cerebri*, or after extensive injuries to the brain whence there has resulted intense pressure upon the soft tissues, we occasionally find mental symptoms of a maniacal order. The explanation of the psychical condition under these circumstances is fairly simple—increase of the intracranial pressure. Grashey's investigation on the circulation of the blood within the skull has taught that any extraordinary increase of the intracranial pressure leads to compression of the cerebral veins in their peripheral portions, with consequent slowing of the circulation, followed by congestion and œdema. If this process of disturbance of the lymph and blood flow be very severe, there is soon absolute loss of consciousness, followed by death; if less intense and of slower evolution, there is incapacity for thought, weakness of memory, somnolence, and eventually a condition of dementia with complete apathy.

Direct implication of the brain or its intrinsic vascular tissues is also met with in the insanities following infectious processes, typhoid fever, inflammatory rheumatism, pneumonia, cerebrospinal fever, gonorrhœal infection, the absorption of putrid matter from the intestine, influenza, paludal poisoning, tuberculosis, and the exanthemata generally. Here the vascular lesions and a toxine acting directly upon the nerve cell are the exciting causes. Syphilis may occasionally be a factor, the virus exerting a specific effect in the

same general way as other toxines. Poisons acting directly upon the brain cell without vascular lesion may be included under the same general category; among them may be mentioned the narcotics, alcohol, opium, cocaine, also illuminating gas and carbon disulphide.

The indirect causes of mental disease are inseparable from those leading to disorders of the general nervous system, and the pathology is largely the same.

Civilization and Education.—During man's original savage state he was little subject to mental disease; nor is this to be wondered at, for his habits were simple and the opportunities for constant excitement minimal; the open-air life must naturally have tended to diminish the risk of mental disturbance; above all, there was lacking the close contact with his fellow-man in the strife for existence that is ever present in the life of to-day. Nor is the savage often burdened with the tendency to religious exaltation that has been, and is still, an influential factor in oversetting already weakened intellects.

To counterbalance to a certain extent the free and careless existence of the savage, with civilization comes better food, better and warmer clothing, and in the house better hygienic surroundings.

Education is to some extent a factor in the production of insanity, but only in the way of weeding out the weak brains from those that are more capable. At the same time it is undeniable that mental overexertion in healthy individuals may be carried to such a degree as to inflict upon the nerve tissues an injury so serious that it is impossible afterward for the subject to fully recover his former mental capacity.

It is a somewhat curious fact that some of the lower races as a mass do not admit of any advanced degree of education. I refer more particularly to the negro. The average negro child, at the age of four or five years, is in many ways quicker and brighter than the white; but soon there begins a change. Brain-cell growth continues in the white boy, the receptive capacity increases little by little, until by the time he has advanced to the age of seven or eight years he has outstripped his dark-skinned competitor, who is now nearly stationary, and, as time goes on, retrogrades, at least by comparison. Centuries of civilization and education have told upon the development of the Caucasian race, and while the brain-cell evolution may be at first slower, less animal-like, if I may use the comparison (for we see in young dogs and other animals the same early activity), it is nevertheless surer, and advances by a gradual

progression, continued through many years, to a higher and higher plane.

In a race still in process of mental development, as in the cited instance of the negro, we find more frequent types of the degenerative forms of insanity than among the Caucasian races. Nor is this surprising. The negro has been thrown upon his own physical and mental resources and has entered the strife for existence as an inferior; he is syphilized, alcoholized, his food is ofttimes unsuitable—the prevalence of rickets among negro children being an attestation of this fact—his surroundings are usually unhygienic, and tuberculosis finds in him an easy prey. No wonder is it that under these circumstances we have in our asylums an ever-increasing number of idiots, of imbeciles, and of all types of the dementias from the coloured race.

Brain-cell degeneration from overstrain has been recently brought into prominence by the publications of Bevan Lewis and of Batty Tuke. The effect of worry, of long-continued excitement, especially under the influence of some artificial stimulus, of overstudy with insufficient sleep, all lead in the end toward a species of mental deterioration that may be permanent, especially if the individual has inherited nervous and arterial tissues not of the strongest type. Clinically, these mild forms of mental aberration manifest themselves under various guises of depression and mild dementias. The breakdown of the student after continued mental overexertion belongs to this type, as well as the rapid dementias that follow acute maniacal excitement. Nature is most beneficent, and repairs the effects of overactivity whenever possible, but limits may quite readily be reached beyond which it is not safe to pass, especially for those that bear the burden of an hereditary taint; beyond this point it is impossible for the natural reparative forces to overcome the strain; constructive metabolism is unequal to the drain upon it, or is defective, and there results either temporary or permanent mental disability. From the standpoint of the experiments of Hodge, and the later ones of Van Gehuchten and Marinesco, overstimulation of the nerve cell can only be recovered from when it has not proceeded beyond a very fixed and definite limit. In this connection I recall particularly the case of a son of an alcoholic, a bright, energetic boy, who stood well in his classes at school, and as a consequence was stimulated by his teachers to his utmost working capacity. All went well for a time; he stood at the head of his class, with apparently the prospect of a brilliant future; but soon

a change began, mental effort to keep up became great, and on being urged to further effort he suddenly and completely broke down, the collapse being final, for he retrograded to the mental level of a six-year-old child, without future, and without hope of any permanent intellectual repair, even his physical development remaining stunted. Such an example is of course extreme, but the effect of overpressure upon the youthful developing mind is frequently seen, and is one of the immediate factors in the evolution of certain types of adolescent insanity. Hereditary taint and high education do not go well together, and although such a practice is impossible in our present social state, it would be advisable that a selection be made by capable physicians as to the capacity of children for advanced education.

Nationality is of somewhat uncertain importance. It is true, however, that under equal conditions the excitable Celt is more prone to insanity than the phlegmatic Teuton, and that members of the former race do not recover so readily from attacks of mental aberration.

Gender.—It has been stated that women are more prone than men to insanity, on account of the liability to infectious troubles in the puerperium, and the more frequent nerve-storms incidental to childbearing, the menstrual periods, and the grand climacteric. Statistics are largely drawn from asylums, where the women almost always outnumber the men, but the probable explanation is to be sought for in the fact that women survive longer, not being subject so commonly to organic-degenerative mental troubles as the other sex.

Insanity is more frequent in the unmarried than in the married, mainly because the latter are more regular in the sexual relation, enjoy a more steady daily life, and usually better hygienic surroundings. On the other hand, it might be supposed that the increased duties and liabilities in providing for the support of a family would necessitate increased mental wear.

Age.—The changes that take place in the nervous system at certain definite periods of life make these epochs of sufficient importance to be mentioned among the indirect causes of insanity. As a rule, the simple acute mental troubles occur in the young, the degenerative disorders in middle and advanced life.

The epochs of puberty and adolescence are the first definite periods in which much strain is placed upon the nervous systems of the hereditarily burdened, and as a consequence it is then that large

numbers of those with an inferior nerve tissue succumb. Mental disturbances during childhood are comparatively rare. From one standpoint we must look upon dementia paralytica, occurring as it does in the best years of a man's life, as nothing more than the precocious mental and motor symptoms of a beginning involution taking place in persons who have inherited nervous stability sufficient to carry them through the ordeals of early life, but insufficient to enable them to withstand the beginning changes that inevitably accompany the period of retrogression of the functional activities plus an acquired somatic disease.

A somewhat analogous alteration is very frequently seen about the time of the grand climacterie, though with women, inasmuch as they are less prone than men to degenerative troubles, the disease assumes a type more closely resembling the varieties of idiopathic psychical alteration than of the mixed motor-psychical changes in man.

Of all the varied inciting causes of mental infirmities, *heredity* and *alcohol* are the most important.

The statistics of heredity differ greatly according to the race or locality from which they are derived. They vary all the way from 30 up to 90 per cent, a fair average being perhaps between 60 and 70 per cent for all forms of mental disease. In communities in which there have been many intermarriages, perhaps, for generations between blood relations, there is naturally a more frequent inheritance of the psychopathic disposition than in others where the population is of a more mixed origin. This tendency is seen even in this country among the Hebrews, and in certain sections, where the numbers of their co-religionists are few, among the Catholics. Nor is this condition of affairs remarkable, for the reason that alliances of blood relations have a tendency to aggravate all the peculiar physical and psychical defects of a family, while the opposite is true of marriages between persons having different ancestors, unless the type of defect be of a similar character in the two parents. Where the deficiencies are of a different order, there is a tendency in the children to return to the better type, the defects of each parent being nullified to a certain extent by the differences in the ancestry.

As in tuberculosis, so in insanity, it is not the actual disorder that is carried over to the progeny, but the tendency thereto. The disease itself only develops under the influence of exciting causes. Among the few well-known exceptions to this rule must be men-

tioned the carrying over of syphilitic disease to the second and third generation.

An interesting form of heredity is known under the name of *atavismus*, or the return to an ancestral type. The physical and mental disposition of a parent may not be shown in the son, but may recur in the third generation. Only exceptionally, however, is the type of insanity developed in the descendant identical with that present in the forefather; transmutations usually take place, so that among the children of neurotic parents we are apt to find various forms of mental alienation. Occasionally the same forms of insanity crop up from generation to generation, the types then being of a degenerative character.

In this connection a passing word may be said of the tendency to suicide at a given age in certain families. In a neighbouring city there has been a family living since colonial times who on the male side developed a tendency to self-indulgence and licentious living. Four generations ago the great-grandfather committed suicide at the age of thirty-eight by drowning himself, after the most elaborate and careful preparations. The son at the same age put an end to his life in the same manner, and his son drowned himself under precisely similar circumstances at a very recent date.

As a rule, it may be stated that in cases of hereditary insanity the tendency for mental disorders, occurring in succeeding generations, is always to appear at an earlier age until the family becomes extinct.

Alcohol and heredity are so closely connected that it is almost impossible to separate them. Pronounced alcoholism in the parents always means examples of mental disease and weakmindedness in the children, provided the alcoholic tendency is not acquired somewhat late in life. Illustrations of these facts are most striking, and the sequence is often as follows: The first children in a family are, as a rule, mentally sound unless accidents occur at birth; as the parents advance in age and continue to beget offspring, and at the same time one or other parent continues the alcohol habit, the succeeding children are more and more mentally inapt, and if there is a large family, the progeny that come last are not uncommonly imbeciles or idiots. Children of pronounced alcoholics are most frequently of dull and feeble mental development. Many die at an early age. As a striking instance of these facts, Marcé has detailed the history of a drunkard who had sixteen children, fifteen of them dying at an early age, while the one that grew up was an epileptic. Darwin states that the families of drunkards do not descend beyond

the fourth generation. According to Morel, the plan of decadence is the following: In the first generation there are moral depravity and alcoholic excesses; in the second, drunkenness and maniacal outbursts; in the third, melancholia, hypochondria, and impulsive ideas, particularly those of murder; in the fourth generation the imbeciles and idiots appear, and the family becomes extinct.

The action of alcohol directly upon the nervous system can be definitely traced as the cause of a large number of the total admissions to any general asylum, variously estimated as from one tenth to one third of the whole. The lower the social class the more frequent the insanity from alcohol. This does not mean that the better classes are more free from the vice of drunkenness, but that the beverages drunk by the poor are more often adulterated by the admixture of cheaper alcohols or ethers and thus rendered even more deleterious than the better variety of liquors. *Amyl alcohol* is perhaps the most frequent and pernicious of these articles, being far more destructive to the nerve cell than ethyl alcohol. An apt illustration showing the different effects of the two alcohols is seen in the action of their nitrites. The ethyl nitrite is a mild fluid, hardly at all stimulating; the amyl nitrite, on the contrary, is a violent congestant, producing its constitutional effects rapidly and with great intensity.

The deleterious results of the ingestion of alcoholic stimulants may be more readily understood if we watch its effects in those who have already an unstable nervous system, the imbeciles. I have on several occasions known a single glass of beer to completely upset the mental equilibrium of such an individual, and have been acquainted with other instances in which the drinking of a most moderate amount of spirituous liquor has produced violent excitement with vivid hallucinations, a condition much resembling delirium tremens. But what is most noteworthy in these persons was the observation that although there was a return to the normal condition for a time, the transient disturbance of the nervous system set up a tendency to a periodical recurrence of insanity, which persisted until they finally demented and became totally depraved.

Insufficient or bad food is sometimes a cause of insanity. Low diet induces various anæmic conditions, and as a consequence of insufficient brain nutrition we may have maniacal or hallucinatory confusional disturbances of the mental equilibrium. An example of the effect of bad food is seen in the cases of pellagrous insanity of great frequency in Italy in the regions of Lombardy. The maize

is affected by parasitic growths of the *secale cornutum*, which, when constantly eaten by the peasants, inevitably induces this peculiar form of insanity. Overfeeding is only rarely an indirect cause of alienation, though it may bring about certain arterial changes that conduce to the presenile and senile forms of insanity.

I have been able in this chapter only to sketch the most important of the predisposing and acquired causes of insanity. The subject is most complicated, and is deserving of much more comprehensive treatment. In concluding, I would again emphasize the fact that alcohol and heredity are the principal factors we have to look to in searching for the etiology of mental disorders.

GENERAL SYMPTOMATOLOGY

The extreme frequency of mental disturbance among all classes of society in this country makes it desirable that the student of medicine and the general practitioner should have at least some practical knowledge of the different aspects under which it may show itself. While many of the forms, either by reason of excitement, violence, or suicidal tendencies, need the care and attention only to be found in an institution for the insane, there are many others of the mentally disordered in whom the disease is mild or transient in character, and who can be better treated in their homes than in asylums, and therefore come rather under the care of the general practitioner of medicine than of the specialist. There are types of insanity that are just as curable as the majority of somatic maladies, and it behooves the physician to recognise and treat them not as if they belonged to a category distinct from and having nothing in common with physical ills, but rather as forming a part of these and being subject to the same hygienic and other laws.

In England the insane are counted as one in every three hundred of the total population, and in some States of the Union the proportion is hardly less. Even here in Maryland there is one individual in every four hundred who is of unsound mind, and this calculation does not include numerous members of the congenitally defective class who do not need constant medical attention.

I shall not here attempt to give an exact definition of what constitutes insanity, but would rather outline the various and complex departures from normal mentalization that justify the employment of the term. A definition of insanity, indeed, does not admit of verbal accuracy, for what constitutes sanity in one individual may be insanity in another who has had different surroundings, education and moral training. You would not, for instance, necessarily think of a departure from ordinary mental health in the case of an uneducated negro who spoke to you of strange religious superstitions, fetich worship, witchcraft, or other absurd beliefs, and showed by his earnest manner and actions that he thoroughly be-

lieved in them. On the other hand, should a highly educated Caucasian converse with you in a similarly serious strain, and show plainly that he believed that a bit of skin or cloth was the dwelling place of an omnipotent spirit who had power to harm the person's enemies or benefit his friends; or should he convince you of his belief in the capability of an imaginary diabolical machine, worked by unseen enemies at a distance of miles, to influence his thoughts and actions, converting and perverting them to the uses of the hidden transgressors, you would immediately suspect that the individual had a mental twist. Belief in superstitions and unseen agencies is, therefore, by no means of the same importance among the uneducated classes as it is among those of a higher intellectual status, nor should delusions of suspicion be sufficient grounds for adjudging an ignorant man insane unless it can be proved that he has recently acquired them, and that they have caused a change in his conduct either toward others or himself.

The boundary line between insanity and sanity is rarely very sharply drawn, as may be seen from the following illustrations. A mother loses her only son. She is naturally depressed, takes hardly any interest in her surroundings, the conscious mental pain is great, and energy is lost. She does not, however, go so far as to become inattentive to the needs of her person; she remains capable of performing her most pressing duties, and when called upon in an emergency, will cast aside her own woes and look after the welfare of others, finding relief from her own depression in the work of cheering the sufferers and alleviating their misery. This woman has not been insane; the depression has remained within physiological limits. Another mother may, after a similar experience, not only become depressed and lose all interest in her surroundings, but may even neglect her dress and the imperative duties of her daily life. It may be impossible to convince her that the death of the child was not owing to some fault on her part, and she may sit day after day brooding upon her misfortune. Even when called upon in an emergency to rouse herself and assist others in the direst distress, her sympathies cannot be awakened, but she will remain inactive, enwrapped in her own loss and overcome by the impellent delusions resulting therefrom. In fact, she is wholly incapable of mental or physical exertion. In this case the physiological limit has been overstepped; the woman is insane, and the risk of suicide may be extreme.

Quite frequently we are called to determine whether a person of defective mental organization be sane or insane. Ordinarily this

presents no extreme difficulty except in the more intelligent imbeciles, in whom the warp exists only in one direction, affecting more particularly the ethical instincts. Without a previous history of the case a decision may be most difficult, as the defects in intellectual development are not striking, and from the patient one can derive no assistance. In these cases we must obtain a history of the life of the person from the cradle upward, carefully study the records of his school days, his moral training, his home life and surroundings, and check off in our minds the probable effects of vicious companionship and improper training against the theory of moral perversion. The arithmetical test may sometimes help us, as few even of the higher class of imbeciles are at all proficient in the abstract sciences.

Not only with the imbecile, but with all examples of supposed aberration, besides obtaining a fairly accurate knowledge of the person's mental state at a time at which he was considered to be of sound mind, we must find out in what respect he is now supposed to be different; whether he has recently undergone alteration of character, the quiet man becoming readily excited to violent language or actions, the cheerful man depressed without adequate cause; whether he is suffering from suspicions, delusions, hallucinations, or homicidal tendencies; whether he now shows perversion of the moral instincts or is given to senseless debauchery; whether his night's rest is disturbed; whether the reasoning power, the logical co-ordination of thought, has suffered—in a word, whether the judgment has become disjointed; whether the memory and powers of imagination have deteriorated, as shown by the loss or diminution in sharpness of these several faculties.

When there is loss or perversion of the mental attainments we should inquire most fully into the functions of the organic part of the nervous system, whether there is palpable disease of the brain, evidenced by alterations in the pupillary reflexes, neuritis of the optic nerve, speech anomalies, disturbance in the innervation of the facial or other muscles; whether there are anæsthesias and paræsthesias, not only of the surface of the body but also of the internal organs; whether the reflexes are changed, and whether the functions of the bladder and bowels are disordered from lack of nerve tone. In fine, the physical examination should be as thorough as if one had to deal with a case of purely nervous and not combined neuro-mental disease. Only rarely, in the organic forms of insanity, will the indications of coarse disease of the nervous system be lacking.

Examination of all the arteries of the body that can be reached should never be neglected, and the student will be surprised to find how often advanced arteriosclerosis can be detected even in persons who have not yet attained to middle life. The tibial and arteria dorsalis pedis will sometimes give information that may not be ascertainable from the radials or temporals. Arteriosclerosis is a far-reaching malady, not confined to any particular period of life, and in its train comes a host of symptoms, sometimes vague, at other times quite definite, that may simulate those of almost any form of mental or nervous disease. The arteries convey the life of the body, and with any severe disturbance of nutrition comes a train of abnormal mental phenomena.

No inquiry into the mental condition of a patient can possibly be complete without a full examination of the urine, especially for casts, albumin, sugar, acetone, and the ethereal sulphates. Stuporous and confused mental conditions are not infrequently directly due to renal lesions, and other psychical phenomena in Bright's disease and in glycosuria are extremely common. The presence of indican and skatol indicates, at least, the absorption of the products of fermentative changes in the intestine, and though cleansing and rendering the canal more aseptic does not immediately cure the insanity (which is usually of a confusional type), it at least tends to accelerate the recovery, sometimes to a remarkable extent.

Never neglect the alimentary canal in your examination. A foul tongue and pronounced constipation are important indications for a definite line of treatment, and the conditions for which they stand, if neglected and allowed to persist, will always prolong the severity of all the symptoms, and may even be responsible for some that would never have developed had it not been for inattention to the needs of the digestive system.

Finally, when a presumably insane patient is seen for the first time, always consider the possibility of trauma or traumatic shock, of drugging from alcohol, opium, or chloral, or a combination of two or more of these drugs. Make sure from the history whether or not he is suffering from the present or after-effects of a continued infectious process, especially typhoid or pneumonia. Take note of his temperature and respiration, but remember that in cases of acute lung trouble the mental symptoms may completely mask those of the respiratory organs, and that the absence of fever does not positively negative the presence of an extensive consolidation of the lung. Remember also that there are a number of post-febrile

insanities in which the ordinary evidences of physical disease have entirely receded into the background.

Again, in order to estimate accurately the present state of a patient, the physician should decide in his own mind what the past mental endowments are likely to have been. In this connection the race, environment, station in life, and the previous doings of the individual must be taken into consideration. But in order to qualify himself for forming a correct judgment on these points, the medical man must previously have a thorough acquaintance with the beliefs and superstitions of the several social classes, their peculiarities of education, their manner of ideation, their religious beliefs, and their actual daily life, remembering that we have no actual standard of sanity and insanity, and that each individual must be judged separately according to the average mental acquirements of his compeers.

Do not forget that in committing a patient to an asylum you are taking a step that seriously affects his social standing and his legal responsibilities. Make sure that your decision is never arrived at without a due consideration of all that is involved therein, and that his confinement is solely for the benefit of the patient himself, or for the safety of his relations and the public at large.

I. ELEMENTARY INDICATIONS OF DISTURBED MENTALIZATION

The deviation from normal mentalization that is called insanity presents but a small number of manifestations sufficiently striking to be obvious to the observer, though these may be present in an infinite number of variations. This paucity in the psychic phenomena of insanity, the prominent mental symptoms of very different diseases being often quite similar, renders the task of accurately separating the different groups into divisions and subdivisions a most difficult one. Thus, for example, a patient who is both psychically and physically in a state of great excitement may have sensorial deceptions (ocular or aural) of an intense character, while another who presents to the eye a very opposite picture, sitting by himself apathetic and listless, imbued with his own misery, may be equally subject to them. At the same time it should be recognised that the sense deceptions in the two foregoing examples are of an entirely opposite nature; in the patient with the motor-mental agitation they are agreeable and pleasing, while in the other they represent sense deceptions of a terrifying or persecutory import. A

second and very powerful factor may at times show itself, controlling and influencing the attitude—mental inhibition amounting to deep confusion. When the mind is overwhelmed by a growing cloudiness, such as occurs in toxæmias, this element plays the most prominent part in the malady, the obtundity not allowing the patient to form a correct judgment of transpiring events, so that, owing to the impossibility of correction, hallucinations arising at this time acquire a tenfold intensity.

The cardinal psychical deviations from the normal, showing themselves in the insane, particularly in the subjects of the acute forms, are three in number: hallucinations, delusions, and confusion. Any of these may be present alone, or combined with the others. Delusions, accordingly, may be found without the presence of attendant hallucinations, or hallucinations may begin years before anything of a delusional tendency becomes manifest. Mental confusion, as we have seen, may lead to hallucinations, while in turn the hallucinations, being in themselves but perversions of antecedent psychic impressions, may call forth delusions.

In another though somewhat rare form of psychic disturbance the depth of the prostration is so profound, that though at one stage confusion, hallucination, and even delusion, may exist, they are so transient as to pass unnoticed, the patient rapidly becoming lost in the depths of a mental coma in which every faculty is in complete abeyance, and from which the most severe stimuli cannot arouse him.

Many other minor mental phenomena are to be noted in insanity; with them comes a train of symptoms of a more purely nervous nature, such as increased or diminished excitability of the peripheral nerves of common and special sensation.

In cases no longer acute, and which are not proceeding toward a favourable termination but are becoming chronic, other evidences of imperfect mentalization make their appearance; the finer details of memory, especially its ethical side, become blunted; the patient loses his former attainments, the creative faculty is lost—he becomes demented.

Though the cardinal symptoms are customarily noticeable, there are cases in which they do not make themselves manifest at all, or are so ill defined that one can hardly feel sure that they are present. Patients suffering from a mild pathological excitement may be without delusions, hallucinations, or confusion. There may be simply garrulity, some lack of logical criticism and incessant motor activity, but no more profound implication of the faculties; indeed,

a purely motor agitation is sometimes the only expression of the mental perturbation. Similarly, a change in the general character of the individual, the development of cruel propensities, a tendency to flagrant transgression of the rules of convention and custom, or to acts of reckless violence with insufficient motive in a previously well-balanced man, may betoken that he is becoming alienated, although he may not necessarily have exhibited any of the more characteristic symptoms of insanity.

Delusions.—From a legal point of view in mental troubles other than mania and dementia, delusions are accepted as an affirmative test of insanity. This in itself is a false conception, for there are quite a number of insane individuals who never manifest any false beliefs either about themselves or the world in general. People of sound mind may at times have delusions, but the essential difference between the erroneous conceptions of the insane and that of the sane man lies in the fact that the former is not able to correct his sense errors, while the sane one does so. Clouston's definition of a delusion, which he describes as "a belief in something that would be incredible to sane people of the same class, education, and race as the person who expresses it, this resulting from the diseased workings of the brain convolutions," is perhaps the best that can be given. A delusion, therefore, is conceived centrally, and is not, like the hallucination, the direct result of perverted peripheral stimulation, although it may arise after a process of elaboration within the diseased mind as the result of a sensorial impression. Thus a paræsthesia of the skin may induce the false belief that the limb is filled with worms, or the visual deception of flames may convince the individual that he is in hell-fire.

Delusions may be either fixed or evanescent. In the chronic insanities their constant presence augurs ill for the recovery of the patient. In the acute manias and melancholias they are fleeting, and the prognosis is fairly good, but in organic disease, as paresis, although they are likewise inconstant, changing from day to day, the eventual outlook is most unfavourable.

False beliefs may be either unpleasant or agreeable. The expansive conceptions of the maniac are usually happy, and the superabundant energy displayed in the constant activity—singing or dancing—is in consonance with the ideas of superabundant physical vigour and unusual mental accomplishments. Those belonging to the states of depression, on the other hand, arising from false ideas of destitution or ruin, of wickedness, of crime, as well as of

imaginary murders of children or relatives, are naturally painful, and may be aggravated and intensified by voices urging instant self-destruction. Many delusions originate in dreams, or are conceived in half sleep, and afterward, by reason of constant brooding, become fixed and enduring; or they may be developed as a result of external impressions, as when a paragraph in a book or newspaper is misconstrued, and by a process of false reasoning twisted to suit the insane purpose of the individual. Hallucinations supply the most frequent material out of which delusions are elaborated. Thus in paranoia, the constant imprecatory voices following the individual everywhere finally impress him with the idea that he is the object of persecution by hostile individuals, or is acted upon by magnetic machines worked by the members of some secret society that wish to rob him of his life, his virility, his money, or his intellect. The determination of the existence of delusions in any case of insanity is of the utmost importance, not only from the standpoint of diagnosis and prognosis, but in medico-legal investigations, for by the laity a man who is proved to be suffering from delusions is always accounted of unsound mind, since their presence shows that the intellectual co-ordination has been overturned. Insane conceptions are frequently to be traced, in part, at least, to insufficient brain nutrition, local or general, particularly when they begin after a febrile delirium, or after organic disturbance of the digestive apparatus, anæmia, and toxic conditions.

The sensory deceptions known by the appellations of *hallucination* and *illusion* are of equal importance with the delusion, and similarly may be of a pleasant or an unpleasant character. The essential difference between the two forms is that the hallucination needs no external excitation to evoke it, while with the illusion a peripheral sensation on its way to the central organ of perception is falsified, either in the terminal apparatus of the sensory organ (sight, hearing, gustation, and smell), or after arriving there has an incorrect interpretation put upon it owing to imperfect mentalization.

In view, therefore, of the difficulty, and at times the impossibility, of strictly separating illusion from hallucination, there has been a growing tendency in recent years to regard the two as having practically the same basis, and to retain the distinction solely as a matter of convenience (Parish, Kraepelin). Esquirol's definition of an illusion as "a false interpretation of a sensation actually perceived" is true, but an hallucination may also have had primarily an external cause at some either recent or distant period, which at a

given moment is called forth from the cortical cell in the form of a perverted sense deception. An hallucination, therefore, would be a sense deception perceived through the medium of one of the several senses, which at the moment of evolution had no palpable external cause sufficient to evoke it. To believe that one sees an object and to actually see it are ideas so closely united in the average mind that a distinction cannot be drawn between them. All hallucinations and illusions may be reckoned as fallacious perceptions whether observed in the sane or insane, whether arising spontaneously or experimentally induced (Parish). Even the most clearly defined central hallucinations—for example, those of the acute alcoholic—are nothing more than remembrance pictures of pathological intensity. Before the mental vision of the delirious man pass the forms of animals or men; events long past, saloon revels in which he participated in other days, are re-enacted; all these are now called forth by an over-excited state of his sensori-cortical sphere. They appear to him as a reality, and are composed of a mixture of actual perceptions with hallucinatory additions, the forms evoked assuming fantastic appearances.

The simplest forms of hallucinations are mental reproductions of scenes enacted, or words read aloud, which, passing the sensory portals, are again called up by memory with strange additions. Simple forms of illusions, for example a band upon the wall paper of a room, by intent fixation of the eyes upon it, may assume a wavy, dancing outline, which by a process of perverted cerebration is transformed into the likeness of a huge snake, from which the person shrinks in terror. The falsified retinal impression is here converted by the diseased working of the brain cell into a sensory deception which is now on the order of an hallucination. More complicated fallacies of sensorial perceptions are present when a patient feels upon the tongue or skin words spoken by some one near him, and these sensations are perverted into strange feelings of lack of tone in the entire body, or equally peculiar muscular cramps.

The clinical forms of sensory deceptions are manifold, and involve all the special senses, including those of muscular sensation and equilibrium.

Those of *hearing* are the most frequent. Imaginary voices are the most common, though sounds of hammering, of the noises of machinery, the whistling of locomotives and the like, are not rarely met. The explanation given by Kraepelin of the frequency of the

voices is most probably correct. The majority of mankind, consciously or unconsciously, think in words, and the voices which are heard are nothing more than the audible expression of the person's own thoughts, and accordingly have a greater influence upon his actions and relations to surroundings than other varieties of hallucinations. At first the voices may be indistinct, but upon constant repetition and evolution from subconscious thought they acquire intensity, eventually dominating the life of the individual. They may at first be considered as the result of noises in the ears and be corrected by the patient; but after a time the iteration, together with brooding upon their derisive tone, conduce to a full belief in their reality.

The frequency of middle-ear troubles in instances of auditory hallucination is worthy of note. Thus Redlich and Kaufmann, in twelve examples of acute hallucinatory confusion, found only one with a normal auditory apparatus. Out of eight subjects of acute hallucinatory insanity, in only one was the ear normal. Similarly in six cases of melancholia and mania with hallucinations, only two of the patients possessed normal audition. Out of fifty paranoiacs, five had no auditory hallucinations, and of these, three had perfect hearing, while among the forty-three with hallucinations there were only fourteen with a normal auditory apparatus.

Visual hallucinations are next in order of frequency. They consist in the appearance of phantoms, of angels, of the dead, of landscapes, or, as in the case of the alcoholic, of visions of wild animals, devils, the flames of hell, and a thousand other deceptions. They are of less grave import than auditory fallacies, and are of importance mainly because they confirm mental delusions. They are more characteristic of the acute than of the chronic forms of insanity, but may be present in both.

Hallucinations of *taste* and *smell* occur more rarely, and are usually of a disagreeable character. The patient detects the taste of poison in his food, or of urine in his drinking-water; he smells the chloroform with which his persecutors are attempting to overpower him. These deceptions of the special senses are much more frequent in the chronic forms of insanity, particularly those influenced by alcohol, than in the acute types.

Perversions of the *common sensibility* of the cutaneous surfaces or of the viscera are also more frequent in the chronic than in the acute insanities. The constant irritation from disturbance of sensation originating from a diseased alimentary tract may influence

the whole life of the individual, when a mild or more pronounced mental reduction has once induced him to ascribe them to the influence of supernatural causes. The same deductions may apply equally well to the rarer deceptions from perversions of the muscular sense and of the sense of equilibrium.

The loss or diminution of the power of *serial thought** is often one of the first indications of an approaching mental storm. Especially is this the case in the majority of examples of severe mania or melancholia, and more particularly in paresis. The patient is no longer able to assemble coherently finer ideas into a connected chain; there are gaps in the sequence of things remembered that, however slight, in a well-educated and trained mind are pathognomonic of serious brain disease. Such a defect always indicates a lesion of the association tracts or centres that is not readily recovered from, but usually progresses to the annihilation of coherent thought. The results are especially noticeable in the earlier stages of chronic alcoholism, where the lapses in the history of yesterday and to-day stand out in strong contrast with the retained memory of the remote past. This condition is to be classed as a minor form of the amnesic states noticed so frequently when the alcoholic disease has advanced still further, and which are usually followed by a permanent dulling of the acuteness of all memory, until the person becomes demented.

Mental reduction implies more than the loss of the power of serial thought; it includes rather a dulling of all the faculties, and is of great importance in determining the prognosis in any case of insanity. When, for example, after the acute symptoms of an attack of mania have passed, the patient is still suffering from evident weakness of memory, with falsification and confusion of his ideas both as to his personality and surroundings; if we find also that his perceptive faculties have diminished, and that he is apathetic and listless, we infer that he is reduced mentally from a higher standard, or, in other words, is demented.

Among the minor though frequent indications of actual or approaching insanity may be noted excessive irritability. Impulsiveness, with tendencies to destroy property or injure persons, are common in the manias and epileptic insanities. Closely allied to these is the loss of self-control noticeable in the chronic insanities, paranoia, etc., and in the acute melancholias.

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* The term *serial* thought is used throughout these pages in the sense of connected logical thought.

Defect in the *faculty of attention* is an early indication of the beginning breakdown in all forms of organic dementia, as is likewise diminution of *purposeful will power*, which is also seen in states of depression. Apathy to surroundings, with neglect of the personal appearance, implies either that the individual is entirely self-centred, as in melancholia, and is too much occupied with the insistent delusions that overpower his ordinary energy to take notice of what is going on around him; or else that there is present a considerable degree of reduction, the absence of mental activity rendering the individual listless and indifferent.

Change in *sexual desire* is noticeable in many forms of acute insanity. An increase of the erotic element, sometimes leading to shameless indecencies, is often prominent at first, while later there ensues temporary or permanent loss of the instinct.

The *æsthetic* and *religious* elements in the character of the individual often undergo alteration. They become perverted or diminished, according to the nature of the mental trouble, and afterward may form the basis of delusions which then become the most prominent feature of the insanity.

Unwarranted fear, a psychical hyperalgesia, is occasionally a prominent feature in acute insanities, especially those due to the effects of toxines upon the nervous system. Here the painful hallucinations are the direct cause. In melancholic states the equally distressing delusions of being damned for all eternity, or of having committed murder, lead the patients to expect harsh treatment at the hands of their attendants, and they shrink at their approach.

Disturbances of *speech* in the insane, while ordinarily belonging to the motor symptoms, may be induced by inhibition of the faculty of thought, resulting in a slow, hesitating, at times entirely broken articulation. There is here none of the scanning speech, syllable elision, or ataxic articulation noticed in organic mental defects.

Imperative Ideas (*Obsessions*) *and Impulses.*—An imperative idea is a thought which intrudes itself upon the mind with such persistence and force that it interrupts for the time all other coordinated intellectual processes and cannot be inhibited. The will is therefore annihilated, or so weakened by the obsession that it is unable to control and regulate the actions of life. Mental manifestations of this kind tend to show themselves in forced actions. But even when the impulse has been yielded to, and the actions have been accomplished, although the imperative idea passes away for the time, it returns later with its former insistence.

Imperative ideas and impulses, while frequent among the alienated, do not necessarily belong to the phenomena of insanity. In milder forms they are met with in normal man, and are encountered more commonly among neurasthenics than in members of the insane class. In such event they may be regarded as one of the stigmata of mental degeneracy.

II. DISTURBANCES IN THE REALM OF SENSORY INNERVATION

These have their importance in psychiatrical medicine from the fact that they are frequently the underlying cause of hallucinations and delusions, and in the intoxication psychoses evoke paroxysmal attacks of irritation and excitement. Hyperæsthesias are naturally of more moment to the insane than anæsthesias, which for the most part are unnoticed by them.

Hyperæsthesias in the domain of the nerves of special sense are noticed in manias, the hysterical and alcoholic insanities, more particularly in their earlier stages. Abnormal quickness of vision and of hearing lead to perception fallacies. Those of taste and smell, appearing in perversions of the respective senses, are rather rare.

Hyperæsthesias of the ordinary forms of *cutaneous* and *visceral* sensation are found in a variety of psychoses, and are mainly evidenced as formications, a feeling as of worms creeping through the skin, and other equally unpleasant impressions. Irritability of the sexual organs frequently leads to masturbatory and other sexual excesses. Hyperæsthesias of the vaso-motor nerves are prevalent in the melancholic and neurasthenic, who show an unnatural pulsation of the great vessels and palpitation of the heart, accompanied by the well-known præcordial anxiety. All these various abnormal sensations may be perverted by a clouded intelligence into various persecutions by individuals or inimical agencies. The irritation, which was peripheral in origin, has now become a central hyperæsthesia, and the subjects are a menace to society, since the pursued is apt to turn upon his supposed pursuer. The original peripheral irritation soon becomes a central hyperæsthesia.

The frequent *peripheral neuralgias* of the insane are closely allied to the more ordinary hyperæsthesias, and, like them, may form the basis of delusions. They are particularly frequent with the melancholiac, and their influence goes some way toward intensifying the painful character of the mental fallacies.

The *anæsthesias* play a very secondary part in the symptomatology of insanity. Not infrequently in the demented there is a dulling of all the peripheral organs of sensation, as shown by the unimpressibility to cold, the absence of desire for food, inattention to the calls of the bladder and rectum, or by self-mutilation.

True localized anæsthesias for pain, tactile and temperature sensibility, are found among the hysterical and hystero-neurasthenic class, but are more common where there is organic lesion of the central nervous system, as in dementia paralytica, senility, and alcoholism. Anæsthesia of the retina is noticed in the anæmic forms of insanity. A marked degree of anæsthesia of the muscular sense is probably present in patients that assume forced position over hours and days without any appearance of physical exhaustion, as well as in forms of acute mania, where, after the most prolonged exertion, there ensues no noticeable muscular fatigue.

III. DISTURBANCES OF THE MOTOR FUNCTIONS OF CRANIAL AND SPINAL NERVES

These are of frequent occurrence in many forms of mental disease, but are obscured owing to the preponderance of the psychical phenomena. Disturbances of the deep reflexes are found in melancholias, anæmic insanities of all kinds, and in the organic forms of mental disease, as progressive paralysis and senile dementias.

The *knee-jerk* is frequently sluggish or lowered in activity in the depressive forms of insanity, especially the anæmic melancholias. On the other hand, in the anæmic manias, lactational insanities, or post-febrile affections, an exaltation can often be demonstrated.

The alterations in these several diseases are transient, but they are sufficiently frequent to show that it is not safe to make a diagnosis of organic disease solely from the absence or exaltation of the deep reflexes. In epileptics, as well as with many imbeciles, there occur perversions of the deep reflexes, a diminution or exaggeration being noted on one side, while the other may be normal; or on both sides they may be too active.

Absence of the *eye reflexes*, especially non-reaction to light (spastic myosis), is ninety-nine times out of a hundred indicative of organic brain disease, provided that it has not been present for many years as a symptom of locomotor ataxia, and even then the spinal disease and cerebral implication are not uncommonly combined. This sign is exceedingly rare in mental diseases other than paretic

dementia and syphilitic insanity, but is occasionally noticed in senile dementias.

Partial defect in the *proper innervation* of the muscles, particularly in the domain of the facialis, is seen in irregular movements of the small muscles of the angles of the mouth and the orbits, as well as in irregular wrinkling of the forehead. Muscular cramps are also noted in the same regions, but are not so frequent. A lack of full innervation is frequent in alcoholism, paresis, and in advanced secondary dementias of all kinds. *Tremor* is a symptom of alcoholism, of general paralysis, of sclerotic brain affections, of the anæmic psychoses, and may also be an expression of psychical anxiety. The tremor of the paralytic is fine, fibrillary; that of the alcoholic is a *tremor en masse.*

Convulsive attacks, paralysis of single muscles, or of those of an entire limb, are always significant of advancing organic brain disease, when they have come on in middle life, and are not the result of some old disorder dating from childhood.

Disturbances in *articulation* occur in alcoholism, progressive paresis, syphilis, and insular sclerosis, but may also be among the prominent symptoms in uræmic states with cerebral complications.

Disturbances of *muscular co-ordination* are found in paresis, alcoholism, after apoplexies followed by mental symptoms, and in some dementias following traumatism; also in tumour of the brain with disorder of the functions of the mind.

IV. DISTURBANCES IN INNERVATION OF VASOMOTOR AND TROPHIC NERVES

Two affections show these indications most clearly: melancholia and paresis. In severe melancholias the condition of the pulse is almost pathognomonic of the disease. It is slow and of small volume, the artery being contracted, and as a result the skin is dry, cold, and sometimes shows cyanotic patches, clear indications of a vascular cramp. The pulse of the paralytic is at first slow, monocrotic, while at a later stage the tension is abnormally diminished, an evidence of a progressive paralysis of the arterial coats.

In the later stages of all dementias, terminal or original, the same condition of vascular paralysis is found, the slow contraction of the heart, the loss of tone in the artery, with eventual cyanosis of the extremities, sometimes also of the ears.

Many of the disorders of the *secretory* functions are intimately connected with the morbid condition of the vessels, while the dry, roughened skin and fragile nails and hair are evidences of trophic disturbance, which in itself is directly induced by the loss of vascular tone. Likewise disturbances affecting the sweat glands, or the other excretory glands, especially the lachrymal and renal bodies, may be brought about by the defects in the cardiac innervation. *Trophic lesions* of the bones, joints, etc., except those complicating locomotor ataxia, are not commonly found in insanity.

V. DISTURBANCES IN THE VITAL FUNCTIONS

Insomnia is nearly always an important symptom of the earlier stages of any form of insanity, and may persist throughout the entire course of the malady. Nocturnal excitability with diurnal somnolence is characteristic of the chronic manias, also of some of the acute forms of psychoses. When the patient is about to be restored to mental health, or, on the other hand, is beginning to sink into a demented state, sleep is abnormally prolonged and deep.

Bodily Weight.—In the acute stages of any form of insanity, even in the transient periodic forms, there is progressive loss of weight, with other indications, chiefly on the side of the alimentary tract, of disturbance of the nutritive functions. The return to a normal avoirdupois without diminution or cessation of the mental symptoms is always a bad indication, suggesting the beginning of a dementia.

Bodily Warmth.—Except in the toxic and infectious forms, there is seldom any rise of temperature in the insanities unless there are coexistent lesions of the connective-tissue (vascular) elements of the brain (paresis, apoplectiform lesions with psychic disturbance). In the mild manias the temperature remains normal, while in the graver types there may be a rise of less than two degrees Fahrenheit. In the severe forms of intoxication, notably the *delirium acutum*, the temperature may rise to six or seven degrees above normal.

Digestion and assimilation are always disordered in the primary forms of insanity. They complicate the disease, and at times add greatly to the severity of the symptoms. This is particularly the case in the severe melancholias.

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GENERAL TREATMENT

The first requisite in the treatment of any case of ordinary insanity is a good nurse; the second, a good cook; and the third, good air with pleasant surroundings.

Without the first we cannot hope to control, or to have a regular course of treatment carried into effect; without the second, all our efforts to increase the bodily nutrition will be in vain; while the last adds greatly to the patient's chance of complete recovery.

General hygienic treatment is of vastly greater importance than the administration of drugs. A large proportion of patients, especially those afflicted with a curable form of insanity, come under the care of the physician in a lowered physical condition, often intensely anæmic, and needing just as much food as can possibly be assimilated. It is sometimes indeed remarkable how much nourishment a patient can take without disturbance of digestion; ten or a dozen eggs, with several quarts of milk during the day, are nothing unusual, and the benefit of the increased diet is from the first apparent.

Of all the different kinds of food at command, eggs and milk are the most important. It is usually better to give them in combination than alone, in the form of eggs beaten up in milk with sugar added, or in liquid custards. Milk with egg albumen is retained by delicate stomachs when all other articles of food are rejected. In insanities in anæmic individuals it is sometimes wise to add wine, brandy, or whisky to the milk diet, and these in considerable amounts; but in other forms of mental disturbance, especially those caused by organic disease of the brain, alcohol is to be shunned as a cerebral poison.

Vegetables and fruits should be freely allowed, with the possible exception of those containing much starch, from their liability to disagree with many persons. Spinach seems to have some actual tonic properties, possibly from the relatively large amount of iron salts contained therein. Meats in the form of broths, soups, pep-

tonized beef, and jellies are of great service, but an oversupply of animal nourishment is to be avoided in maniacal states, owing to its exciting qualities and its tendency to increase the amount of uric acid in the system. Soups and stews made of sweetbreads are extremely delicate, and at the same time very nourishing.

Many melancholiacs and some maniacs have to be fed forcibly through the stomach tube, which is inserted through one of the nasal orifices or through an opening between the teeth. Force is in all cases to be avoided. Eggs and milk, with brandy, soups, and broths, may be given in this way. One should always make sure that the tube has passed into the œsophagus, and is not curled up in the pharynx, before the food is poured into the funnel, or the results will be disagreeable, not to say dangerous to the life of the patient.

Rectal feeding, although, as a rule, not very serviceable, is occasionally indispensable. In addition to the ordinary egg and milk enemata, predigested or not, as the occasion may require, the sweetbread clysters may be mentioned as an useful addition. The sweetbread is boiled with a few drops of dilute hydrochloric acid, and afterward mashed to an impalpable pulp; it is then run through a sieve to remove the coarser particles and connective tissue, and the liquor in which it has been boiled is added. It is necessary to use three or four sweetbreads to obtain a sufficient quantity for an injection.

So far as drugs are concerned, we should always endeavour to build up our patients by the administration of tonics. Of these, iron, manganese, quinine, arsenic, and phosphorus, with cod-liver oil, occupy the first place. The ordinary sirups of the phosphates, or elixir of the phosphates of iron, quinine, and strychnine, are in every-day use. I prefer the albuminate compound known as the pepto-manganate of iron and manganese, from a reputable pharmacist, with the addition of strychnine in suitable cases, to any other iron-containing preparation. Cod-liver oil with free phosphorus is particularly beneficial when the skin is dry and harsh and has an icteric hue. The glycerophosphates of lime and iron are also helpful. Gentian, nux vomica, cinchona, and belladonna, alone or in combination, are useful when iron is not tolerated. Belladonna sometimes acts as an abortive in certain forms of periodic insanity, as will be detailed more especially under that heading. The thyroid extracts should rarely be employed except for conditions arising from defective action of the thyroid gland (myxœdematous insanity, cretinism).

The majority of insane persons have a tendeney to torpidity of the intestinal tract, and a moderate degree of jaundice is not infrequent. It is therefore advisable, before the beginning of any set course of treatment, to order some form of cathartic, preferably calomel, blue mass, or one of the salines.

As a supplement to an appropriate diet, the various baths—needle, tub, half, or full baths, according to special indications supplied by the physical condition of the patient—may be employed. These may be at a moderate temperature or hot, according as a tonic or sedative effect is desired. The calmative effect of the hot bath at a temperature of 100° to 110° F. is often remarkable, the violently maniaeal patient becoming quiet and falling into a much-needed sleep. Hot baths should not be too prolonged, for fear of their depressing influence. Massage is not generally indicated, although a thorough rubbing with coarse towels can do no harm. I have seen no benefit from the use of the so-called electrical baths, beyond impressing the friends of the patient.

Striet eonfinement to bed is not expedient, except in the cases of patients who are weak physically, and in certain forms of melancholia; but even in these instances it should be continued no longer than is absolutely necessary. It is far better, in dealing even with the violent maniacs, to send them with suitable attendants to the country, where they can enjoy the open air and be diverted and amused in a quiet way. By these means opportunity is afforded them of working off their superfluous energy by sufficient exercise; whereas if confined in a strong room they will rage until they are exhausted, tear their clothing, and be noisy day and night. The benefieial effect of exercise in the fresh air for every case of mania is undoubted, the duration of the aeute mental malady is shortened, the patients themselves are never so violent as when in confinement, sleep is much more readily induced, and resort to hypnotics not so frequently needed.

While under certain conditions it may be advisable or even necessary to administer sedatives to unruly or restless patients, their routine use is to be discountenanced, as it will soon degenerate into abuse. Narcotics are seldom beneficial to the future course of the disease, but rather retard recovery. Try the simpler measures first—exercise and the warm baths; when these fail, a stiff dose of brandy will often succeed in inducing rest, if it be given in a quantity of hot water and about the time of the customary hour for going to bed; but never give large doses of any alcoholic liquor when there

is organic disease of the brain. Among the hypnotics chloral hydrate has, in my experience, been the best sleep inducer. It should rarely be given alone, but acts better in combination with bromide of potassium, and perhaps also with hyoscyamus and cannabis indica. A dose of fifteen to twenty grains, with the addition of these adjuvants, will produce a more tranquil and prolonged sleep than double the amount given alone. Given by the rectum, it is equally as efficacious as by the mouth, but for rectal use a somewhat larger dose is necessary.* Morphia should be very rarely used. It locks up the secretions, and, although advocated by many writers, is positively injurious in the melancholias.

Paraldehyde is a pure hypnotic, and is comparatively harmless. It does very well in conditions of mild excitement and restlessness, but where the disturbance is severe and is prolonged for a considerable time it is better to substitute some other stronger medicament for it. Methylal is safe and efficient as a sedative, and has the advantage that it may be given hypodermically.

Trional and sulfonal are somewhat similar in their effects, but trional is more prompt in its action, while sulfonal is more lasting. The dose is usually considerably larger than that required as an hypnotic for the sane individual. Forty, fifty, or sixty grains may be needed in the violent manias to produce an effect. If one large dose does not act, the drug should not be pushed, but should at once be abandoned for a more efficient substitute.

The bromides are ofttimes useful, and, as a rule, not deleterious unless long continued. They markedly diminish reflex irritability, induce a quieting effect upon the nervous system, and do not affect nutrition by any active destruction of the red-blood cells. They may be combined with hyoscyamus, cannabis indica, and sulphate of codeia. The potassium bromide appears to have more sedative powers than any of the other combinations of bromine with the metallic bases.

In the active restlessness of mania, where there is much shouting and violence, hyoscine hydrobromate, as a pure motor depressant, is perhaps the most serviceable drug we possess. Hyoscine requires careful watching, and at first very small doses, not more than the $\frac{1}{150}$ of a grain, should be used, and only rarely should this amount be increased beyond $\frac{1}{100}$ or $\frac{1}{90}$ of a grain. Never give

* Chloral hydrate will, with some patients, induce hallucinations. These ordinarily subside when the drug is withdrawn.

hyoscine to a patient with a weak heart. It is a moderate depressant of voluntary motion, and acts without producing much mental confusion. The ease with which it may be given by hypodermic injection often causes it to be chosen, but with many patients it is not a safe drug.

The hypnotics are not only admissible, but frequently prove most serviceable in attempting to abort an incipient attack of melancholia or mania. When employed with judgment they may induce a patient to resume the broken habit of sleep, and temporarily quiet violent cases so that they are saved from the severe effects of prolonged frenzy, and, if necessary, are rendered torpid for a certain length of time, during which it is possible to remove them from their homes to a proper place for treatment. Never use hypnotics longer than is absolutely necessary; the after-effects are not readily controlled.

We are not infrequently confronted by the question, Will the patient stand a better chance of recovery at home, or in an asylum for the insane? Cases from the lower walks of life are always better off in an institution where they can be properly cared for, but the same rule does not generally apply to the wealthier classes. If from previous experience we expect the duration of the attack to be short, and the individual can have proper nursing and food at home, it is better for him to stay there, in order to avoid the stigma of the mad-house which might remain attached to him or her forever afterward. Extremely violent cases have to be removed at once to a suitable institution. Mild manias, melancholias, or the confusional forms of insanity, do equally well or better at home than in an institution. Often one of the chief considerations is whether the patient be suicidal or not. If he has shown any such tendency, and there is any question about the reliability and watchfulness of the attendants, it is wise to have him removed. If he is homicidal the same holds good. As a general rule, it may be said that only the milder cases of the acute and chronic forms of insanity should be treated at their own homes.

GROUP I

IDIOPATHIC INSANITIES; INSANITIES WITHOUT ASCERTAINABLE ALTERATION OF THE BRAIN SUBSTANCE

I. MELANCHOLIA

General Considerations.—Depression is a symptom common to a great variety of mental diseases, but by *melancholia* proper is meant a simple affective insanity, in persons not necessarily burdened by neuropathic heredity, characterized by mental pain which is excessive, out of all adequate proportion to its cause, and accompanied by a more or less well-defined inhibition of the mental activities. The victim becomes introspective, centred entirely upon self to such an extent that he does not react to stimuli received from contact with the outer world.

In the more acute forms, almost without exception, the individual who becomes the subject of melancholic symptoms has previously arrived at a state of profound physical debility, as a result of some recent illness, of long-continued defective digestion, insufficient or improper food, bad hygienic surroundings, or some of the varied anæmic conditions.

Women are more often the subjects of attacks of melancholia than men. Especially is this true of early and advanced life. The cases are more equally divided between the two sexes between the twentieth and thirtieth years. A preponderating majority of all forms affect women about the time of the climacteric, when the sexual and nutritional changes incidental to this period of life have spent their full force upon the nervous system. In Zichen's statistics of 238 cases of melancholia, 19.33 per cent occurred between the fortieth and fiftieth years, and of these 12.60 per cent were in women and 6.73 per cent in men. In the two decades from forty to sixty years, 37 per cent of the entire number of cases are found, 24 per cent being women and 13 per cent men; while in the twenty years from fifteen to thirty-five, 30.67 per cent of the cases occurred,

10.92 per cent being men and 19.75 per cent being women. Uncomplicated cases are seen after middle life in men as well as in women, but are rare.

Etiology.—In the immediate causation of a melancholic condition, worry, sorrow, or failure to succeed in life has a great influence, but this does not exclude as an underlying factor depletion of the strength from anæmia, dyspepsia, or denutritive causes in many forms, or hereditary tendencies in the individual. In nearly one half of all cases of melancholia, emotional disturbances from the death of wife, husband, or child are mentioned in the clinical histories of patients. Vivid emotions of any kind, the shock of business reverses, the loss of property, actual want, and similar accidents of modern civilization, are liable to evoke pathological depression in those predisposed. Mental overexertion combined with digestive disturbances may also be noted as a cause.

Heredity as a factor is also of considerable importance, though less than in almost any other form of mental trouble, and melancholia occurring in members of families having the uric-acid diathesis has been not infrequently observed.

Disease entailing gross brain lesions, whether in childhood or adult life, rarely predispose to melancholia, and the same may be said of intoxications, alcohol and morphia being of minor causal importance, although there is a distinct though infrequent form of alcoholic melancholia.

The influence of childbirth and lactation, especially the latter, is considerable in the evolution of melancholia. Melancholia during the puerperium is fairly rare, that of pregnancy is more frequent. In nursing mothers cases are frequent, the patients being often intensely anæmic, the skin dry and putty-like in colour. Exhaustion from loss of blood in puerperal or surgical cases occasionally directly induces melancholia.

The frequency of melancholia about the time of the climacteric suggests a direct cause in the frequent nerve storms of that period of life, in combination with the usual run-down condition of these patients. Influenza and other exhausting acute diseases are occasionally responsible for melancholic symptoms.

General Symptomatology.—Nutritive disturbances of the cerebrum being the principal causative factor, psychical distress, and a sense of woe and of uneasiness are the ways by which the brain expresses its sense of lack of proper nourishment. In the great majority of cases the condition comes on insidiously. For weeks,

or perhaps months, there has been a sense of bodily ill-being, with digestive disturbances, sometimes with jaundice of the conjunctivæ. The patient complains of a feeling of increasing physical and mental disability and loss of appetite; there is an increasing dislike for exercise, a tendency to sit inertly brooding for hours, and an inclination to avoid the other members of the family or friends. Later, as this apathy grows, the patient becomes untidy in her habits, she loses all care for her personal appearance, the world presents to her jaundiced mind an appearance that is dark and dismal, and no compensation is afforded by attempts at work or in the pursuit of pleasure; everything has become irksome. With the physical inertia there is a corresponding amount of mental pain, although no delusions of any kind are apparent. The majority of cases probably do not go beyond this point, as the larger number of these simple forms are amenable to treatment and soon recover under appropriate measures.

Let the disease proceed a little further and the defects in the nutrition of the entire body become of an order such as can hardly escape attention. The skin presents an earthy, muddy tint, and feels dry and harsh to the hand. The mouth and lips are dry, and herpes is not infrequent. The bowels are constipated, the urine contains an excess of phosphates, the pulse is slow, the arteries are contracted, the body temperature is lowered. If the disturbance be very marked, there may be anomalies of the deep reflexes which usually under these circumstances are exaggerated, being more rarely subnormal. Loss of weight is very considerable. Sleep in the acute cases is profoundly disturbed, while in the lighter forms there is always nocturnal restlessness, and even under the influence of hypnotics there are frightful dreams and frequent terrors which prevent sound repose. Headache or nuchial pain is a frequent symptom, particularly among the anæmic, and neuralgias and paræsthesias are the rule. With women the menstrual flow is either decreased or ceases for the time.

The patient is anxious, fearful of everybody around her, resists attention passively rather than actively; she shows a noticeable degree of mental confusion, or, at any rate, a slowness in thought and association of ideas; indeed, the fundamental characteristics of melancholia are passivity and inertia. This mental inhibition is an important factor in the psychalgia of the afflicted individuals on account of the incapacity to reach beyond one line of thought, the patients recognising only too clearly their altered state. Inability

to reason clearly is one of the most frequent sources of complaint.

Delusions are present only in the more severe forms of melancholia, and, while manifold, are essentially of a painful nature in all their aspects. They are not infrequently induced by the bodily defects, the gastric or sensory disturbances; even the pain in the neck so common in melancholiacs may be a source of sense deceptions. Intellectual inhibition frequently plays an important part in their genesis through the incomplete logical operations of the mind, together with inability to associate and connect ideas, owing to the concentration of every sense upon the *ego*. Hallucinations are frequent in the melancholiac, and of these the auditory form is by far the most important. Their presence is, indeed, of grave prognostic moment.

The delusions are so multifold that any attempted list must of necessity be incomplete. They are always of a painful nature. The patient imagines she is being poisoned, that her soul is lost, that some awful calamity is impending, that she is dead or in hell-fire, that she has committed murder, moral suicide, the unpardonable sin, or is under the spell of any of a hundred other delusions. In any case the prevalent motive is self-depreciation and thoughts of annihilation.

In the graver forms the feeling of mental pain is accurately represented in the attitude, the mask-like expression of the face, and the slow verbal utterance. There is frequent weeping, wringing of the hands, with occasional ejaculatory utterances, as "O God!" "I am in hell!" "I am lost!" over and over again; or the enunciation of some of the vivid delusions. Tendencies to suicide are present in fully two thirds of all melancholias of any severity, and all cases, no matter how apparently trivial the depression, should be watched with the greatest and most constant care to guard the victim against self-destruction. Many of those afflicted with the milder forms of melancholia will tell one that they have constant impulses to suicide, but that their self-control is sufficient to enable them to overcome them; but even with these there should be no relaxation of watchfulness. More accidents occur in melancholia than in any other form of alienation, usually from lack of care on the part of the physician to warn the attendants in seemingly mild cases, or from disregard of his commands.

Relapses in this form of mental disease are very common, perhaps one half of those affected falling back at some period from a

few weeks to years. These cases are to be classed among the periodic melancholias, which belong to the degenerative forms of insanity rather than to the psychoneuroses, but are indistinguishable from them except by a past history of relapses.

Prognosis.—Under appropriate treatment, from sixty to eighty per cent of the less grave types of melancholia should recover from a first attack, and over one half from a second. Indeed, melancholia is usually regarded as the mildest form of intellectual disturbance, and as being accompanied by a less degree of mental reduction than is found in any other form of insanity.

Recovery is sometimes very rapid, taking place even in one night during sleep, so that in the morning the patient will recognise and acknowledge to the physician the absurdity of her delusions, and be fully aware that she has been insane. These rapid recoveries show an infinitely greater number of relapses than the more gradual form, and accordingly it is preferable to see a patient recover her faculties only slowly and little by little.

Melancholia is not infrequently the pre-stage of a deeper intellectual disturbance—mania; indeed, it is seldom safe to make a diagnosis of melancholia until one has had the patient under observation for several days. The transition from one to the other is usually complete within a few hours. Melancholia may rapidly terminate in death, usually from malnutrition, owing to the refusal of food, or from inability to assimilate it when forcibly given. Accidents, as has been stated above, are quite frequent.

The third form of termination is for the individual to pass gradually into a chronic condition of depression, in which she may remain for months or years, after which she reaches a state of more or less permanent mental reduction, the *secondary dementia*.

Forms of Melancholia

Some thirty varieties of melancholia have been recognised by various authors, who classify them according to the individual symptomatology of the patients. Such a detailed differentiation is unnecessary and confusing, and for every purpose a division into five classes will be sufficient:

Simple melancholia without delusions.
Delusional melancholia.
Hypochondriacal melancholia.
Agitated melancholia.
Stuporous melancholia.

Simple Melancholia

Simple melancholia is the best example in the long list of mental diseases of an insanity affecting solely the intellectual faculties, and in which there is less reduction than in any other form. It embraces those states of morbid depression in which the painful element preponderates to the exclusion of defect in the reasoning faculty, the patient being aware of his altered mentalization. Definite delusions are absent, there is no enfeeblement of memory, and the will power, while it may be in abeyance, is so solely from the psychomotor torpor, as is made apparent when the patient is roused from the condition of passivity into which he has fallen.

The psychical inhibition is essentially functional in origin; it is not induced by any pathological lesion of the conducting tracts as in dementia, but is compelled by the overpowering feeling of hopelessness and of despair. Owing to this profound sensation of mental pain, and to the essential concentration of all the faculties upon a single painful idea, thought is slow, and motion is devoid of energy, the subject remaining sitting all day long in one position, without will and without action.

The most diversified forms of melancholia simplex are met with in practice. Every gradation is found, from those individuals to whom life has lost its freshness, and in whom ideas of personal unworth prevail, to those who, overpowered by the mental pain, are sunk in an abyss of despair, and to whom the entire outer world is as nothing. This simple type of melancholia is the most frequent, and fewer of the patients find their way into asylums than in any other form, from the fact that the loss of mental and motor energy compels them to remain in bed, where they can be cared for by their family. Diagnoses of anæmia, neurasthenia, nervous prostration, anything but actual insanity, are frequently given in order to spare the feelings of relatives and friends.

Suicidal thoughts are very frequent in these cases, but the reasoning power still asserting itself, the patients recognise their moral obligations, and the promptings are counterbalanced by the preserved self-control. Still it is advisable to warn their friends of the possible danger, and to guard from mishaps by the constant presence of a faithful attendant.

If a patient with simple melancholia does not recover within a limited time, but, on the contrary, becomes more and more depressed, one finds a gradual change in the mental condition. The

attempts at treatment and administration of food are interpreted wrongly, the patient becomes more and more suspicious, the self-introspection is productive of delusions, the volitional restriction is more profound, and the patient passes into the second form.

Delusional Melancholia

The presence of delusions, always of a painful nature, argues a deeper reduction than that belonging to melancholia simplex. Apprehension and fear have now passed into dread certainty, and ideas that could before be corrected by the intellect are now no longer under its sway, since the reasoning power is in abeyance. Hardly two patients present the same series of delusions, and the only classification available is into physical delusions, those appertaining to disordered bodily functions, and psychical delusions, from perversions of the intellect. Of the latter class, delusions of a quasi-religious type are the most prominent. The patient, imagining that she has sinned against God and man, regards herself as a fit subject for the torments of hell, and to be lost through all eternity. Ideas of persecution are equally frequent. Voices are heard uttering words of imprecation, telling the victim that she is unworthy to live; the people on the street seem to mock at her and cast offal at her. Visual hallucinations are less frequent than those of aural origin, but combined forms may be present. Hallucinations of taste and smell are more particularly met with in alcoholics than in pure melancholiacs.

In the subform of the delusional variety, known as *hypochondriacal melancholia*, the symptoms of intellectual inhibition are more decided than those of psychical pain, and the attention of the person is called solely to the functions of the body, to the stomach or bowels, to the respiratory, circulatory, or genital organs. Syphilophobia is one of the most frequent characteristics of this variety of the disease, the patients imagining that their bodies are filled with the loathsome disease, that their hair, skin, or limbs are decaying and foul, or that they have infected their families. All these ailments are recounted in endless variety, and brought to the attention of the physician again and again, like the revolving links of an endless chain. The victims of hypochondriacal melancholia will tell one that they have no stomach, will present for examination an arm, which, despite its obviously well-nourished condition, is cited as an evidence that the body is drying up or is mortifying; or again, they will asseverate that they have not slept for months and cannot

last long, that they are undergoing starvation, that their bowels are obstructed, and that no stool has been passed for months, and so on in an endless variety.

Patients of this class are abject pictures of misery, wholly absorbed in their own fancied complaints. In hospitals they will follow the physicians or the attendants about the wards, importuning them for relief and comfort.

Many of these cases do actually have some organic trouble as the basis of their delusions, a chronic catarrhal condition of the bowel, a contraction of the œsophagus, a dilated stomach, or even an old bronchitis; occasionally some simple eczematous or acneiform eruption becomes a source of terror.

The apparent degree of mental pain in these cases is great, the actual amount is small. It is more the morbid craving for sympathy than real distress that induces such individuals to exhibit their manifold disorders. Suicidal attempts are frequent, not from any desire to destroy life, but from a wish to elicit sympathy or to become attractive through notoriety.

Cases of alcoholic hypochondriacal melancholia are fairly frequent, and are to be distinguished from the ordinary forms by the ever-occurring symptoms of analgesias and hyperæsthesias of the peripheral nerves, especially those of common sensation, pricklings, formications, or electric-like twitchings of the skin of the abdomen or extremities.

Agitated Melancholia

The two preceding forms of melancholia are passive and show no motor agitation, but there is another type characterized by the presence of incessant movement, together with the appearance of an agonized frame of mind. This is a graver form than either of the two which have just been considered, and argues a more complete derangement of the intellect. The patient is quiet only when under the influence of some hypnotic; motion is incessant, and is accompanied by tearing the hair, disarrangement of the clothing, striking the head with the hands, sobbing, and the repeated ejaculation of some fixed phrase as, "I am in hell-fire!" "I am damned!" "I am lost!" The duration of this agitation may be short, ending in a more or less complete recovery; or the case may become chronic, running over years. To show that in the latter event the mental pain is superficial, I may cite the case of a young woman of twenty-six, who for three years suffered in this way. She was in

the habit of incessantly walking the floors of the asylum exclaiming "I am in hell-fire! I am in hell-fire!" yet if one would stop her and distract her attention from herself, she would smile, and converse with every appearance of interest and pleasure; but when left for a moment, she would walk away and recommence wringing her hands and repeating the set phrases. After three years she became somewhat demented, and the mental distress subsided. The idea of punishment for all eternity seems to fascinate these individuals, and there is constant self-analysis as well as self-pity. As long as the agitation keeps up the patients remain thin and anæmic; as soon as they recover or become demented they fatten. In chronic cases the acquisition of adipose tissue is of evil augury, as invariably the subjects soon begin to dement.

Stuporous Melancholia

In this form of melancholia, the one accompanied by the gravest degree of mental reduction and psychical disturbance (*melancholia attonita*), the patients are entirely sunk in their own calamities, mute, passive, apparently entirely oblivious of what is transpiring around them, and absolutely without will power to rouse themselves out of their stuporous condition.

As a rule, these spellbound conditions arise in the course of some of the more common forms of melancholia, and in this region are of comparative infrequence. They can also begin after a sudden fright, or after a severe illness, but in the majority of the patients there is a distinct history of hereditary nervous instability.

That the stuporous condition is only apparent, not real, is shown by the anxious expression, the occasional wrinkling of the forehead, and by the occasional wild starts and frantic attempts at self-destruction.

Patients who recover will tell one that they were overpowered by frightful delusions and hallucinations; they felt they had committed murders and were to be hung, or that the world had come to an end and the day of judgment was at hand. Usually the remembrance is vague, nebulous, the mental ablation for the time being nearly complete.

The muscular condition in these forms is noteworthy. The entire muscular system is in a state of semi-tonic contracture; the limbs are flexed, and on an attempt being made to extend them an intense resistance is encountered. Place one of these patients in a forced position, she remains in it indefinitely, and this catatonic

condition is noticeable even in the less frequent instances in which there is absolute passivity of the muscular system.

Cases of stuporous melancholia seldom show signs of true anæsthesia, though the mental anergy may, to the casual observer, strongly stimulate it, as the patients may allow themselves to be pricked or pinched without exhibiting the least show of feeling.

The heart's action is increased, the pulse small in volume, the vessels are contracted even to a degree of vasomotor spasm. The skin is dry, foul, the bowels are obstinately constipated, the tongue is coated, the temperature of the body sub-normal; nutrition has sunk to a low ebb; forced feeding is absolutely necessary.

When recovery ensues it is gradual, the rigidity of the muscles slowly diminishes, assimilation of nourishment is increased, the bowels are less difficult to regulate, the vascular spasm decreases, the overpowering delusions become less vivid, and the patient returns little by little to a normal state of health.

If, on the other hand, the case results unfavourably, the general muscular rigidity is replaced by relaxation or partial contractures of the limbs, especially those of the upper extremities. The patient loses her faculties, but the nutrition becomes better, the pulse stronger, though coldness and cyanosis of the extremities persist. Occasionally a patient loses the mutism so characteristic of the disease, and at this stage becomes voluble, and may show the indications of chronic mania in declamatory speeches and vibergeration.

The majority of cases of the so-called *catatonia* of Kaulbaum belong to this class of stuporous melancholic dements, and are not to be considered as belonging to a distinct form of insanity.

The *melancholia attonita* presents many points of resemblance to the acute curable dementias, but is to be distinguished from them by the history of antecedent depression, the anxious expression of the countenance, the frantic attempts at suicide, and after recovery by the retention by the patient of a fairly accurate memory of the events of the time of apparent stupor.

The *treatment* of acute melancholia is mainly dietetic, combined with rest.

The majority of the patients when first seen are anæmic, exhausted, and should be put to bed immediately, fed with milk and eggs, especially in the form of custards or egg-nogs, with strong beef and mutton broths, predigested meats and nitrogenous foods of all descriptions, besides wines, ales, and malt liquors. In a large

percentage of cases opposition to the administration of food will be encountered, either from the idea that the individual is unworthy to live, from religious motives, from the delusion that it is sinful to take food, or from suspicion that it is poisoned. In these instances enforced feeding is necessary with the spoon or a feeding-cup with a spout. Sometimes persevering insistence in milder cases is sufficient to make such patients take their food. In severer instances the stomach-tube, passed through one of the nares, may have to be brought into requisition. Even when there is evident gastric and intestinal disturbance, over-feeding is indicated, but the nourishment should be easily digestible. Where there is constipation, an active purgative—calomel, salts, even a drop of croton oil placed upon the tongue, if it is difficult to make the patient take the medicine—will do more to restore digestion and thus promote recovery than any other means. After the patient has rested in bed a few days to a week or two, it is better to insist upon some exercise in the open air than to prolong the rest cure. Change of scene, the open air of the country, the relief of constipation, with the administration of quinine, iron, and strychnine, are quite as efficient as more energetic medicinal treatment. Above everything, feed young patients with as much as their digestive apparatus will stand; eight or ten eggs, a proportionate quantity of milk, with port or sherry wine and malt liquors, will not be at all too great a supply of nourishment in the first days; afterward the diet may be more varied. Hot baths at night are better than hypnotics, and except in agitated cases there is little danger of the patients uncovering themselves and becoming chilled. Prolonged hot baths, lasting from half to three quarters of an hour, or even a whole hour, may be tried when the shorter ones fail. Hypnotics are to be avoided when possible. When, however, they are indispensable, chloral hydrate is the best, especially in combination with the bromides; sulfonal and trional are fairly efficient substitutes. Hyoscine should only be used in agitated cases, and then sparingly. A good dose of brandy at bedtime in the food, especially when there is anæmia of the brain, is often more efficacious in producing sound sleep than the pure hypnotics. On the general principle that food induces slumber, the heaviest meal of the day should be given at the hour of retiring. There is a wide diversity of opinion as to the efficacy of opium in these cases, but at best it locks up the secretions, and should not be given unless other means fail to produce sleep. Opium itself in watery solution acts better than the morphine salts.

Make the surroundings of your patients as pleasant as possible. Have everything done to divert and distract them from themselves. Provide a pleasing nurse, a cheerful room, and have constant watchfulness exercised over them, as the danger of self-destruction in melancholia is far greater than in any other of the varied forms of mental troubles. To the uttermost fulfil every principle of hygiene. The minutiæ count for more than the great things; relief of constipation will often bring sleep when other means fail; the removal of some trivial source of visceral trouble may cure your cases. In the occasional instances in which there is intense contraction of the blood-vessels, with slow and feeble pulse, alcohol will do more to relieve than the administration of the dangerous nitrite of amyl and nitroglycerine, and the effects of belladonna are ofttimes magical.

The *urine* in melancholia shows some departures from the normal. In acute cases the total excretion of phosphoric acid is diminished, the alkaline phosphates are lessened, while the earthy phosphates may be either decreased or considerably augmented. The urea invariably sinks, usually to about one half the normal. Formic acid has been found constantly in the urine by Marro. The chlorides are occasionally augmented. Excess of indican and skatol is usual, sometimes to a marked degree. Albuminuria is not frequent in the milder forms of the disease, though in nineteen cases Vassale found hyaline cylinders, and in three of the nineteen granular casts. I have also obtained much the same result in the examination of a number of cases.

Despite the fact that there are more frequent deaths in melancholia than in any other form of acute mental trouble, actually nothing is known of its *pathology*. Clinically it appears to be a disease of inanition, but it is difficult to explain how it can happen that even graver anæmias are found without psychical disturbance, not to mention the fact that, of course, every anæmic person does not become insane. The only possible explanation lies in a constitutional instability of the nervous system, which may be inherited, or of which the seeds may have been acquired in early childhood. Melancholia is usually accepted as the least hereditary of the psychoses, yet Clouston found a neuropathic history in 30 per cent of the cases admitted to the Edinburgh Asylum, and Ziehen in 10 per cent of males and 11.3 per cent of females admitted to the Jena clinic. In chronic cases coming to the autopsy table there are evidences of old anæmias, venous congestions of a passive form, œdema of the pia and of the brain substance, and even general

atrophy of the convolutions. Gross lesions of the cephalic substance are unusual causes of melancholia, though such an occurrence is not entirely unknown, as in the instance recorded by Vorster, where a small tumour of the right frontal lobe apparently induced a melancholic attack. A similar instance has also recently been found at the City Asylum.

II. MANIA

Shakespeare's statement that "melancholy is the nurse of frenzy" may have been founded upon the observation that there are but few cases of mental exaltation without a prodromal stage of depression. Under the name *mania*, originally the equivalent of *madness* or *lunacy*, are included a host of states of mental exaltation or excitement of very dissimilar natures. Thus we still speak loosely of the mania of acute alcoholism, of that of the puerperium, or of post-epileptic mania; and indeed at one time all cases of insanity not of the melancholic type were classed under this general term. It is obvious, however, that some more precise terminology is necessary in describing the various forms of mental excitement, if we would separate the cases that are functional in character from those that are due to organic or degenerative brain disease. But even this distinction is difficult, from the fact that a vast proportion of cases of what, for the sake of convenience, may be termed simple mania, occur in persons who have an hereditary history of brain defect. Again, the complication becomes still greater when, upon examination of these individuals, we find many of them with degenerative stigmata so slight in degree as to readily escape the notice even of the trained medical man. For clinical purposes, therefore, a diagnosis of mania is used to designate a symptom-complex rather than an actual disease entity. The difficulty in discrimination is so great that a recent writer in this field (Kraepelin) has proposed to set aside the name entirely, and would arrange the cases of mental excitement under entirely new classifications.*

* Kraepelin, in his Text-Book of Mental Diseases, says that among 1,000 cases of acute mania he has observed only one in which the symptoms did not recur. This statement has elicited considerable comment, and has called forth a number of statistical investigations. Thus Kips, in Dordrecht, found in 41 examples of simple mania that 36 were periodic cases, and that 4 only had had a single attack with no subsequent relapses.

Hinrichsen, of Zürich, found in 125 cases of mania 74 with periodical attacks, while among the remaining 51 discharged as cured there were 7 individuals

Despite, however, all the objections which have been raised, there is no doubt that cases of functional mania are now and then found—cases in which there is neither acquired nor inherited weak-mindedness, and in which there is no evidence of brain degeneration.

Following somewhat closely Mendel's description, *mania* may be defined as a functional disease of the brain, characterized by a morbid increase in the activity of the imagination, accompanied by a more or less extensive loss of the power of correlation of the ideas, and by a hyperexcitability of the motor centres of the brain, shown by the muscular agitation.

The beginning of a case of primary mania is never sudden. On careful questioning one will always find a previous history of gastric disturbance, loss of appetite, diminution in weight, constipation, a foul tongue and a dirty skin, with headache, mental inaptitude, a feeling of fulness in the head, a gradual increasing inability to sleep, incapability for active work, melancholic brooding, or hypochondriasis. Some or all of these symptoms may have existed from a few days to a month. After this stage the bodily ailments lose their intensity, the physical appearance changes, the patient feels stronger, pleasurable emotions and facility of thought take the place of the mental lassitude, there is a welling-up of a sense of well-being and an overflowing of the spirits. The individual feels compelled to spend his newly acquired energies in active employment or in restless walking. He unburdens his mind even to chance acquaintances; he is egotistical, self-confident; the gloom of the past is replaced by cheerfulness, the stinted speech by rapid flow of language, disconnected, it is true, and showing defective ideation, but nevertheless overflowing, while a certain recklessness of conduct

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that had not developed any further attacks after periods of from fourteen to twenty-one years. According to these figures, then, only 4.7 per cent of the total number of cases had remained entirely free from a relapse for a considerable length of time. Mayser (Hildburghausen), in a material of 2,400 cases, found only 59 of simple mania discharged cured, 32 of which did not relapse. Of these 32, 15 were under observation from one to ten years, and 17 from eleven to thirty-one years. Binswanger narrates the case of a young lady who had a maniacal attack at the age of nineteen, from which she recovered. At the date of his publication she was still mentally sound—thirteen years after the attack. I have now under observation a man who thirteen years ago had an attack of acute mania, and has never relapsed. Simple mania, in accordance with these statistics, is an exceedingly rare form of mental disease, and one therefore should be cautious in making a prognosis of final recovery. Relapses after a number of years, when stability is apparently assured, are frequent, as every one interested in mental medicine knows only too well.

affords additional evidence of a lack of mental balance. It was to such individuals, perhaps, that Dryden referred when he wrote,

> "There is a pleasure in being mad,
> Which none but madmen know."

Many cases after reaching this stage do not pass beyond it, but return to their normal state, with but slight mental reduction.

In a stage still further advanced, the boisterous conduct of the patients increases; they sing, dance, and are difficult to control; their ideation is of a lower order, there is a greater degree of mental clouding, the flow of words, while facile, amounts to mere repetition of the same idea, or of a single train of thought repeated over and over again. Hallucinations and delusions become prominent, and the capacity for serial thought is reduced to a low ebb. The patients are now in the stage of active maniacal excitement; they are incoherent, and have to be restrained to prevent them from hurting themselves or others; they have to be fed and attended to like children; indeed, in their illogical and irrational conduct they present many of the aspects of the undeveloped mind of a child.

The majority of the cases of idiopathic mania may be divided, according to the intensity of the symptoms, into two classes: A mild form, the *simple mania* of the authors, the *hypomania* of Mendel, and the *typical form*, with intense excitement and marked mental reduction.

The *mild form* is ofttimes characterized only by unwonted garrulity, restlessness, the motiveless journeying from one place to another, an increase in the desire for sexual and alcoholic excitement, unruly conduct, and a slight degree of incoherence, with an incapacity for the performance of any continued fine mental labour. After a period of several weeks these symptoms may gradually pass away, and the person returns to his normal mental condition, although frequently the finer edge of his mental faculties has been blunted by the brain-storm, and he has become less acute, less intrinsically ethical, and less receptive for external impressions.

On the other hand, the excitement may increase and the patient may pass from the simple into the *typical form*. In this four stages are recognised: the initial stage, that of exaltation, that of frenzy or furor, followed by the stage of decline.

Like the milder variety, the typical form of the disease begins as a rule with gradually progressive digestive disturbances, headaches, a general feeling of exhaustion, despondency, unrestful and

insufficient sleep. Business affairs are attended to irregularly, and the power to fix the attention upon a problem is somewhat enfeebled. After a period of several weeks of this physical and psychical hebetude the stage of excitement comes on. The patient loses the bodily depression, the digestion becomes better, the skin and general appearance show an apparent return to health, the eye is bright and glistening, with perhaps a margin of the sclerotic showing above the iris, the mimetic expression varies from moment to moment, as fleeting ideas pass before the mind's eye. The person feels that life is reopening for him; the capacity for work is increased, thought flows freely, fantasies crowd before the mental vision, and at this stage patients often have temporarily a mental capacity before unknown. Long-forgotten poems or entire chapters of prose are repeated with astounding accuracy, when in health no remembrance of them could be called up even by strenuous effort. The patient rejoices in his new-found mental wealth, which opens to him new and happy prospects for the future. Accompanying the flow of ideas is a lively mimetic display, restless movements of the hands and fingers, and an unwonted activity that drives the affected person hither and thither without aim. The man at this stage resembles closely one who has taken a stimulating dose of an alcoholic liquor, and shows the same inclination to garrulity, to extravagances in conduct, and to sexual excesses.

As the mental confusion increases, delusions are now intermingled with the constant flow of words, these sense deceptions being usually of a pleasant nature. The individual has become possessed of great mental ability, or of extraordinary physical power. Projects that exist only in his imagination appear to him as already fulfilled; he has become a rich man, has attained posts of high honour, has succeeded in achieving some wonderful mechanical invention, and so on. Delusions of an erotic character and those of a religious nature are equally frequent; indeed, the two are often commingled. The entire character of the delusion of the maniac is of a fleeting nature, changing from day to day. The occurrence of more permanent delusions is of evil augury in the prognosis of these cases.

Hallucinations of a visual nature are also extremely frequent. They see God, the angel Gabriel, the faces of men and women, objects changing into the generative apparatus, and the like. Many of these visions are mingled with aural hallucinations, and the patient is kept busy answering imaginary voices and listening for their replies. The hallucinations and delusions are by no means always

of a pleasant nature. Sometimes frightful scenes float before the eye, and wild ecstasy alternates with abject terror caused by awesome apparitions.

"Ten thousand shapes of fury
Are whirling there, and reason is no more."

An inquiry into the degree of mental reduction at this stage presents great difficulties. The majority of patients, right in the midst of the most vivid hallucinations and delusions, can return momentarily to reason and talk coherently, and although they show amid all the logorrhœa a derangement of the correlation of ideas and considerable mental obscuration, yet the judgment is frequently unperverted. The so-called *stadium furiosum* is but the height of the period of excitement. The flow of language has become a torrent, ofttimes, of meaningless words; the incoherence is profound; the subject is no longer capable of being roused for the moment into approximate normal mentality; the motor agitation is excessive and uncontrolled; the clothing is torn away, either on account of peripheral hyperæsthesias, or more frequently in obedience to some delusion; frenzy possesses the brain, the patient wanders around gesticulating, striking the head with the hands, sometimes rushing wildly to and fro, or, if confined, covering himself with ordure, or listening to and answering imaginary voices. This frenzied state may last for days, weeks, or months, with alternations of quieter intervals, but without complete return to a normal condition. During all this time the patient has been losing weight, despite, perhaps, an enormous appetite.

After a variable length of time the violent excitement perceptibly decreases, the intervals of quietude become longer and longer, and the case enters the period of decline of the maniacal symptoms. Sleep, before in abeyance, now returns; the hallucinations and delusions, lessening in intensity and paling before returning reason, are finally acknowledged to be mere deceptions. The individual becomes mildly melancholic, and gradually passes on to a more or less complete recovery. Death in the stage of delirium of functional mania is exceedingly rare, and, though it may be caused by the exhaustion of the long-continued motor and mental agitation, is usually the result of some intercurrent affection or accident.

In those cases that do not proceed to a complete recovery, the final result may come about in one of two ways: 1. The patient, after a long-continued period of excitement, shows a progressive exhaustion of the brain powers and becomes apathetic; he loses his

delusions, but with them his mental vitality also departs, and he is left in a condition known as *secondary dementia*, reduced to a level beneath that of the beasts of the field. All shades of this dementia are met with, from the simple dulling of the mental activities to the graver form just cited. 2. After a long procession of delusions and hallucinations of a more or less fixed nature, accompanied by stages of irritability, the patient may gradually develop a condition of mental weakness, broken now and then by spells of frenzy persisting over months and years. This is the so-called chronic mania, which eventually leads to a condition of complete abolition of the faculties—*the secondary or terminal dementia.*

More rarely the intelligence is fairly well retained, the various delusions acquired in the stage of excitement are reduced to a system, and become the daily life of the subject, who remains indefinitely in this condition, one often confused with paranoia, and to which the name *secondary paranoia* has been given. The intellectual defects, however, are more striking here than in true examples of chronic progressive paranoia, and even without a history of previous states of excitement chronic mania should not be confounded with the latter disease.

All forms of functional mania show a great tendency to recur. While some seventy to eighty per cent of the cases recover from a first attack, making it the most curable of all mental diseases, fully ninety per cent of those returning to a normal mental condition relapse, some within a few weeks or months, others only after an interval of years. In some cases the relapses recur with such frequency and regularity that the designation *periodic mania* has been applied to them. Frequent attacks of maniacal excitement always argue a profound instability of the neurones, nearly always the result of hereditary antecedents. The symptoms in the second and following attacks do not differ materially from those of the primary one, except that, as time goes on, there is an ever-increasing tendency to mental weakness, and the less the inherited equilibration the more marked the drift downward. The initial period gradually becomes less and less marked, slighter causes suffice to elicit the nerve-storm, until finally the individual becomes partly or fully demented and degraded. The majority of cases of mania found within the walls of institutions are of this relapsing type; they have been admitted and discharged a number of times, until the frequency of the recurring attacks places them among the chronic insane of an asylum.

It is difficult to determine whether men or women more often relapse. Certainly the frequency of the post-menstrual excitement in women would lead one to believe that the female sex is more prone to relapses, but as a matter of fact careful investigation will show an almost equal proportion of males. The forms of periodic mania will be dealt with more particularly in another chapter.

Cases of true mania always begin under thirty years of age. If a patient over this age comes before us with symptoms of mental exaltation and motor activity, some other form of insanity should be thought of, or an inquiry should be made into the past history of the individual to determine whether or no previous attacks have existed. It also should be remembered that true mania is a very rare form of disease, not more than two to three per cent of admissions to asylums representing this form of mental disturbance.

Special Symptomatology

Somatic Symptoms.—As has already been said, during the earlier period of an attack the bowels are torpid, the tongue is foul, the appetite indifferent or insatiable, and in either case there is steady loss of weight.

Even in the stages of greatest excitement the temperature does not rise above the normal, or has an elevation of perhaps a degree at most; indeed, in cases that show marked pyrexia, some organic disease of the body, or the *delirium acutum*, to be presently described, should be suspected. Sleeplessness throughout the course of the disease is the rule, and nocturnal exacerbations of the excitement or frenzy occur in the majority of cases. As a result, the tendency to diurnal sleep is noticeable after a night of exhausting activity.

Common sensibility is markedly obtunded during the course of a maniacal attack. Bruises, wounds, even the breaking of bones, are apparently not felt, and the bandages and dressings applied to injuries are torn away by the sufferer. This anæsthesia is, however, psychical, not real. Sensations of hunger and thirst are not felt with the same acuteness as by the sane individual, although the patient afflicted with mania often drinks copiously and eats ravenously without, seemingly, any feeling of satiety after an enormous meal. On the other hand, he may go without food or drink for long periods with apparent indifference. Refusal of all food is now and then found, usually when there are hypochondriacal delusions. Muscular exhaustion after the continued frenzied states is

not indicated by the appearance of the patient till late in the course of the disease. The pulse is small, quick, ninety to a hundred beats per minute; the heart sounds are normal, except in the presence of organic cardiac lesions, which are found in a certain proportion of these patients.

Headache is often complained of during convalescence, hardly ever in the maniacal stage. Anomalies of the deep reflexes are not frequent, although occasionally after a period of intense excitement they show a tendency to a transitory exaggeration, which is also sometimes noted in the manias occurring in intensely anæmic conditions.

The reflexes connected with the pupils show less disturbance than those having their origin in the lower levels of the spinal cord. According to Allbutt and Lauenbach, during a paroxysm of excitement the optic disk is anæmic, and at a later stage becomes suffused and obscure.

The bodily weight throughout the initial period and the stages of excitement shows a progressive diminution. With beginning quietude the weight increases rapidly. It is always a bad sign, from the standpoint of future recovery, to have the patient put on fat during a period of long-continued exaltation.

Anomalies of the Psychical Functions

Except in the mildest forms of mania, illusions and hallucinations are of constant occurrence. The majority of these are visual and of a very elementary nature. Figures on the wall-paper move about and assume various shapes; china figures on the mantel will make grimaces; a band upon the wall-paper will change to a serpent and perform various contortions; a pocket handkerchief or a stick may assume the form of the penis. With women a visual picture of the uterus or of the vulva is not uncommon. Graver reductions are represented by the appearance of angels, of the forms of dead friends, of horrible scenes of anguish, of fire and slaughter, or of rape and other atrocities. These painful hallucinations may alternate with those of picturesque landscapes, pastoral scenes, and a hundred pleasurable visions, even the opening of the heavens and the appearance of the celestial realms before the mind's eye. Songs and the repetition of passages from poems conjure up to the mind of the afflicted incidents described therein and lead to deceptions.

Hallucinations of *hearing* are on the whole less frequent than those of sight, and are usually evoked by the visions. The aria of

a song will induce a hallucination of the presence of the singer, and as a sequence a conversation is begun and continued indefinitely. Hallucinations of *taste* and *smell* seldom come into evidence, possibly because it is difficult for the physician to test for them; but that they do occur is evidenced by the fact that some patients speak of the delightful odours that surround them, or of unpleasant tastes that resemble those of urine and fæces.

Perversions of *general sensibility*, as well as of the special senses, are frequent, as shown by the constant and shameless onanism, the sensations of prickling, formication, and the feeling of swaying as if in an open boat upon the water, and by various anæsthetic phenomena.

Delusions are present in all cases of mania graver than those of the simple form, which is characterized only by motor excitement and an expansive flow of language. These are mainly of an optimistic nature. The individual has altered his personality, he has become a prince among men, a famous general, or a great inventor; he has acquired enormous wealth; his self-estimation is great, he is ambitious, and feels capable of great and generous deeds utterly inconsistent with his acts and surroundings. The delusions are manifold, of the expansive form, and changing frequently. Rarely is there any approach to a delirium of persecution in the mid-periods of mania, though the person may imagine that because of his exalted position he is being shut up in prison, or is to be poisoned because he possesses secrets of great importance that his persecutors wish to die with him. Later, as the excitement retrogrades, the persecutory ideas may prevail to the exclusion of those of the expansive form, and the patient becomes melancholic.

The finer *intellectual* faculties are ever brought to a lower plane in the maniacal condition. The true moral, æsthetic, or religious feelings are blunted; there is loss of foresight regarding the results of extravagant conduct, and an inappreciativeness of its effects upon others. Most strikingly is this shown in the elevation of the sexual impulses. The modest woman is driven to seek pleasure in obscene language, in erotic actions, even in acts of indecency and shameless onanism, while the formerly moral man lives in open adultery, frequents in a barefaced manner houses of prostitution, and indulges in indecent and foul language even in the presence of his family. From this prominence of the perverted sexual instincts we have in the woman the so-called *nymphomania*, in the man, *satyriasis*.

The inclination to alcoholic excesses is frequent in all forms of mania. Even should the individual have been previously of absolutely temperate habits, he now becomes a frequenter of saloons and drinking halls, there to consort with lewd company and indulge to excess in spirituous liquors. Many cases of the so-called dipsomania really belong to the periodic manias. When each era of excitement begins the subjects take to drink, and the spree ends only with their incarceration. In making a diagnosis or prognosis in a case of apparent acute alcoholic insanity, it is well, therefore, to remember that periodic inebriety is often only a symptom of maniacal attacks.

In a proportion of cases of mania there is a tendency to wander away from home (*mania errabunda*), to join caravans and travelling shows, to become tramps or itinerant preachers. And since the flow of language is often increased to a degree entirely unknown in these persons while sane, such individuals often meet with remarkable success as evangelists or orators, and pursue their new vocation as long as the maniacal condition persists. But after a while the period of melancholic depression comes on, and on awakening from this stage they return home, to renew at some future time their vagaries.

With any of the moderately severe forms of mania there is always some disturbance of memory, in so far that despite the apparent quickening of thought and action there are afterward gaps in the recollection of events that have transpired during the illness, a nebulous confusion of facts and fantasies, that is most marked in those graver cases which from the inception of the mania show an alternation of motor excitement with a degree of passive incoherence.

The faculty for writing, being of a later development than that for speech, shows more clearly this confusion of ideas. The handwriting is altered in character and is more or less illegible; omissions and constant repetitions of words are noted, as though the patient was trying to follow a train of thought with incomplete success. Exactly the reverse is seen with the simple forms. While the handwriting may be equally indistinct, it is no longer slow and laboured—indeed, the pen can no longer follow the train of thought with sufficient swiftness; words are underscored once, twice, thrice; special marks are made at the margins to indicate particular passages, and sheet after sheet of paper is used in the attempt to depict in writing the flow of ideas passing through the mind.

Etiology.—This is not different from that of other primary forms of insanity. Inheritance plays the same part as in other mental diseases, a defect being traceable in at least sixty to seventy per cent of all cases (Mendel). As a consequence, the disease is wont to make its first appearance at that time of life when the youth or maiden changes to manhood or womanhood, and the cortical interconnecting fibres are just attaining their full and complete development. In the possessors of an imperfect nervous equilibrium the occurrence of a traumatic injury, an insolation, overstudy, or any unusual stress laid upon the brain, is sufficient to evoke the disease.

The mild mania, ordinarily one of the numerous forms of periodic excitement, is by far the most common type, and can usually be treated successfully outside of an asylum. The severe form is rather infrequent, and necessitates detention in an institution. Cases of maniacal excitement follow pneumonia, typhoid, chorea, occasionally phthisis, and, much more rarely, variola, scarlatina, and acute rheumatism.* There is a genuine mania of starvation, and occasional outbreaks take place after copious or repeated losses of blood, in severe anæmias, or, in fact, any very depleted condition of the system. Gross lesions of the brain, tumour, purulent meningitis, apoplexies involving the cortex, may all be causes of maniacal symptoms, though, of course, these do not belong to the primary forms of the disease. Mendel and some of the French writers have noted the presence of cardiac lesions in a considerable proportion of cases of mania, but in my own experience valvular disease has not been more frequent than in other maladies. Mania as compared with melancholia is rare during the period of gestation, while, on the other hand, after childbed, mania is much more common than melancholia. Primary mania does not occur during or after the climacteric.

The cares of life, failures in business, mental overactivity, unhappy love affairs, fright, and traumatic shock, are oftentimes the immediate exciting causes of the disease, but underlying all is the hereditary predisposition.

The *duration* of an ordinary mania is usually protracted over weeks, and sometimes months, the average period being about six months. Patients who get well within a few days nearly always relapse within a short time, and cases showing a slow recovery with periods of remission and returning excitement are much to be pre-

* See chapters on Autogenic Intoxications and Febrile Insanities.

ferred, from the standpoint of a future prognosis, to those in which a rapid and uninterrupted restitution takes place.

So far as the question of *prognosis* in mania is concerned the following may be said: (1) For a first attack, complete recovery may be looked for in about seventy-five to eighty per cent of all cases, but many of these relapse within a short period. (2) We may have incomplete recovery with psychical defect, and perhaps the retention of delusions that assume a systematized form—the *chronic delusional insanity* or *secondary paranoia*. Often these patients may be returned to their homes, and despite the persistence of the delusions remain fairly useful members of society. (3) The excitement may subside for only a short time, and the patient at its termination show evidences of pronounced weakmindedness. Many develop delusions of personal importance and similar conceptions, and then, without clear intervals, from time to time, again become violently excited, and after passing through a series of these attacks are left with a form of dementia—the secondary dementia—which either succeeds immediately the primary psychoses or appears after a time in the chronic forms. The hallucinations and delusions are now lost little by little, the bodily health becomes better, the intellectual faculties are more or less abolished, the motor excitement subsides to a great extent, the patients become childish, mischievous, at times agitated, or sink into the deepest obliviousness of all their surroundings.

Death in mania, except from some affection as tuberculosis or pneumonia, is very rare, the average being less than two per cent for all cases of the disease.

Differential Diagnosis.—While the manias are characterized by a rapid flow of thought and constantly changing ideation, there are a number of other diseases for which these conditions are equally characteristic, and which must be remembered in an attempted differentiation.

In alcoholic intoxication, as well as intoxication from cocaine and other motor excitants, states of mental exaltation presenting all the clinical symptoms of mania are frequent. But in the former we have in addition, most commonly, tremor of the extremities, numerous visions of reptiles and animals, and oftentimes a temporary speech defect. Furthermore, there is the frequent presence of albumin in the urine in alcoholism.

In exceptional instances, in young persons, it is impossible at first to decide definitely between the two disorders, but even when

no previous history of alcoholism has been obtainable, a few days' waiting will determine the question, a *restitutio ad integrum* on the part of the patient with no tendency to relapse excluding mania.

Pre- and post-epileptic mania are of considerable frequency. These conditions are differentiated from the true form by the presence of hallucinations with intense confusion, while the language flow, if present at all, is lacking in the rapidity of ideation of the idiopathic maniac. Frenzied conditions after latent epilepsy (*epilepsie larvée*) are almost as frequent as after the genuine attacks, and are particularly notable for blind, unreasoning violence in conduct. Old scars upon the tongue, upon the scalp, and about the forehead should be carefully looked for in all cases of suspected epilepsy.

The occurrence of hallucinations with mental confusion is the essential factor in a differential diagnosis between cases of confusional and epileptiform mania, but these only become evident with the progress of the disease. The frenzied state in the epileptic lasts only from a few hours to a few days; in the confusional maniac, from weeks to months.

In dementia paralytica there are frequently attacks of frenzied excitement, especially at the opening of the second stage. For differentiation we have the age, the presence of spinal and pupillary symptoms, the optimistic delusions of vast wealth and personal importance, which are declaimed upon and maintained by the patient, combined with evidences of weakmindedness. This assurance of the paretic is in strong contrast with the tendency on the part of the maniac to make excuses for his extravagant conduct and fanciful ideas.

Cases of agitated melancholia are occasionally confounded with mania by reason of the motor agitation common to both. The difference is to be found in the poverty of associated ideas in the melancholiac, and the depressive character of the delusions.

The *urine* in mania contains nothing especially indicative of the disease. There is very often an excess in the total excretion of the phosphates, and where there is grave implication of the gastro-intestinal tract with confusional excitement considerable quantities of skatol and indican are demonstrable. A considerable number of cases have hyaline and occasionally granular tube-casts in the urine. Albumin is found in not more than ten per cent even of the severer

forms, and then only in very inconsiderable amount. Glucose is only exceptionally present.

The *pathology* of true mania has not been discovered, and it is useless to recount the details of the few unsatisfactory post-mortem examinations that have been made.

The *treatment* of acute mania offers a better opportunity to the physician for an exhibition of skill, and promises more satisfactory results than almost any other form of mental trouble. Very frequently one is called upon to treat these cases at their homes, and, provided there is a supply of efficient attendants, the task may be successfully accomplished.

A few years ago it was universally recommended to confine the patients to a room, to put them to bed, and compel them by forcible measures to remain there. In exceptional instances, where there is great exhaustion, these measures may be needful; but with patients who are fairly robust the plan has always seemed to me to be positively harmful, since the surplus energy of the patient is then expended in violent gesticulations, springing about, dancing, and similar active movements. All cases that are strong enough should be sent, with an attendant, to the open country, where they can be in the fresh air for several hours of the day, roaming about the fields, and in this way the excess of motor energy will be diverted into a more natural channel. Hallucinations and delusions will not be fostered by seclusion, and sleep will be induced without recourse to narcotics; night will not be turned into a pandemonium, and the course of the disease will be in a measure shortened—a matter of great importance, in order that, whenever possible, any permanent damage to the brain cells and vessels may be avoided. Maniacal patients should be fed to the utmost limit with easily digested and nutritious food, eggs, custards, milk in various forms, abundance of wheat foods, and vegetables. Meat should be used sparingly until toward the end of the attack, when it may be allowed in moderate quantities. A foul, coated tongue is no indication that food should be withheld, but rather the contrary. The patients should be carefully watched to prevent them injuring themselves or others, even though suicidal acts are not frequent in the disease. All breakable articles should be removed from the room or rooms in which they are to pass the night, and it should be seen to carefully that no deadly weapons are at hand to be used in moments of impulsive excitement.

Hot baths are of great value as a calmative and to induce sleep. Cold compresses to the head may be used separately or in conjunc-

tion with the bath. The temperature of the latter should be from 100° to 105° F. If the immersion is to be prolonged—and this is often needful—the lower temperature should be chosen and maintained throughout its duration. The bath may last from half an hour to several hours, but the patient should be watched throughout, and any threatening changes in the heart's action should be an indication to bring it to a conclusion.

Except for the purpose of aborting an incipient attack of mania, hypnotics are inadvisable. In private practice, however, one is sometimes compelled to resort to some temporary narcotic, to induce sleep or to afford members of the household a needed rest. As a routine measure the practice is bad, and much better results for the patient are obtained by open-air exercise and hot baths. In the exceptional emergencies referred to, my preference is for chloral and bromide of potassium in combination, the bromide prolonging the effect of the former drug and inducing a more natural rest. Sulfonal and trional sometimes act like a charm, and at other times fail utterly. The sulfonal is perhaps the better of the two drugs, its effects persisting to some extent over a full twenty-four hours. Both drugs should be given in somewhat larger doses than are necessary to induce an ordinary sleep. Hyoscine hydrobromate is very useful when there is motor agitation, but should be given with great caution, a dose of not more than one one-hundredth of a grain being employed for the first administration.

Tonics should never be omitted when the patient is passing from the excited to the melancholic stage. Strychnine, iron, and quinine are the best, in combination with the phosphates of lime, and with cod-liver oil, when it is well assimilated. Malt liquors and wines are preferable as stimulants in cases where there is much physical depression, but milk, egg-nogs, and milk punches offer the means *par excellence* of administering nourishment and a stimulant combined.

In cases of periodic mania, during the interval between the attacks the utmost care should be taken of the patient. Something can be done to lessen the tendency to brain irritation by removing the sufferers to congenial surroundings in the country, sending them on long voyages by sea, and putting them out of the reach of temptations to indulge in alcoholic drinks or tobacco, and of business cares. As Clouston suggests, such persons should cultivate quiet hobbies, to give them thought and rest from the excitement of civilized life. Their bodily condition should be closely watched, any

lowering or perversion of the system should be combated by appropriate therapeutic measures, and sufficient outdoor exercise should be rigorously insisted upon.

SUB-VARIETIES OF MANIA

In a proportion of cases of acute excitement bearing a certain resemblance to the group of functional manias we find a departure from the usual symptoms. In the first group a pronounced confusional element is noted in addition to the motor symptoms; in the second, an elevation of the bodily temperature, followed by death within a period of a few days. These forms of insanity really do not belong to the idiopathic manias, but from the predominance of certain symptoms are usually classed among them. The first is known under the general term *hallucinatory confusional mania*, the second as *acute delirium* or *delirium grave*. Both will be more particularly considered in separate chapters.

Acute Hallucinatory Confusional Insanity

Sometimes during or after febrile diseases, notably during convalescence from typhoid fever or acute articular rheumatism, in the puerperium, after auto-intoxications, as well as in long-continued cachexias, after operations which have been followed by considerable loss of blood, and in the case of individuals undergoing solitary confinement with low diet, there occasionally arises an acute insanity, having for its predominating symptom illusions and hallucinations of a vivid character. The disease is accordingly a true collapse delirium with motor excitement, and is to be differentiated from the primary manias. In this weakened state the sense deceptions readily induce a condition of mental confusion, and then, as the sensorium becomes more and more clouded, delusions are engendered. Many varieties of hallucinatory delirium are met with in practice, which will be considered in separate sections of this work, and it is sufficient at present to give a general outline of this form of mental disturbance.

The fact that numberless other individuals pass successfully through these various trials and strains upon their physical and mental endurance argues an easily exhausted brain in those who succumb—a brain incapable of standing any heavy strain laid upon it by disease or unusual conditions.

The incubation stage of *hallucinatory confusional insanity* is short, seldom more than a few days, and usually appears after the patient has apparently convalesced from the febrile or other disorder.* During this time there are the usual indications of nervous exhaustion, irritability, sleeplessness, anxious dreams, frights without adequate cause, headache, vertigo, with beginning mental confusion, and incapacity for long-continued thought. These indications of mental collapse precede the commencement of the hallucinations. The full development of the disease now rapidly follows. First come multifold visual deceptions, which are soon associated with those of hearing, smell, taste, and feeling, and as a logical sequence of the numerous hallucinations there follows confusion but no constant motor agitation. The loquaciousness and high spirits with retention of memory of the typical maniac are entirely wanting, the capacity for recognising the surroundings is also in abeyance. Alternating with the periods of deep mental confusion come outbreaks of excitement with considerable motor agitation, but the language flow is confined to single words or broken sentences without meaning.

Hallucinations of a persecutory type are most frequent, such as being shadowed by detectives for a crime, or of being poisoned; those of a hypochondriacal nature are almost equally common. In other cases hallucinations of a religious type predominate—visions of the saints, of the bodily presence of the Virgin, of beatific forms —while in still others the hallucinations are of an erotic character. In one moment the deliriant may be possessed of a devil, be a god, may take an attendant or the physician for the Saviour or for a demon, may communicate with the Deity; while at another time he may show the utmost degree of terror and anxiety, and make every effort to escape as though from some overpowering presence.

Through the whole picture stands out prominently the mental cloudiness of the patient, who recognises neither his friends nor his surroundings. This state of mental confusion is primarily owing to the exhaustion of the brain centres from the effects of the antecedent fever, intoxication, or low diet, and, secondly, to the impellent hallucinations whose manifold character renders the individual for the time completely blind and deaf to all that is going on around him. To some degree we have now a repetition of the mental condition in states of acute stupor, or in some of the severer

* See chapter on the Febrile Deliria.

forms of melancholia, but consciousness and action are never sunken to the low plane present in these troubles, for on recovery there is some remembrance of the events of the delirium.

When the exhaustion of the higher brain centres has not proceeded to such a grave extent, in the less severe examples, which are more frequent than the preceding form, the picture of the disease is by no means so striking. The hallucinations, while vivid and real to the sufferer, are not so multifold, and the mental obtundity is slight.

The illusions and hallucinations are now of a simple nature. Voices proceeding out of the wall or from neighbouring rooms, shrieks, pistol shots, the sudden clanging of bells are heard. Fearful shadows follow and persecute the sufferer; voices call him a good-for-nothing, a thief, accuse him of crimes, and tell him that he is to be hung or sent to prison for past misdeeds, and so on in an endless variety. The consciousness in this form is not disturbed beyond the incapacity to associate cause and effect, the patient remaining capable of giving a correct account of himself, biased, however, by the impression made by the hallucinations.

The mien of the affected individuals generally shows resignation. They are apathetic, quiet, occupy themselves in attending to their sense deceptions, and are little disturbed by what occurs around them, give monosyllabic answers to questions, and are tractable. At a later stage the development of delusions out of the hallucinations is evident.

Less frequently, and as a direct sequence to a persecutory deception, the hallucinatory insane show motor implication, ordinarily from the fact that they seek to escape some supposed impending danger to themselves. They will move restlessly for hours about the room, seeking to avoid becoming a mark for an assassin, or will provide weapons with which to defend themselves from their supposed enemies in case of need. The larger number belong to the apathetic class.

In the simpler form the hallucinations are confined to a few subjects, which repeat themselves over and over again, and the condition greatly resembles paranoia, yet is wanting in any attempt on the patient's part to systematize the deceptions, and also in any attempt to defend them logically, even though they be of a persecutory nature.

A large proportion of cases of this form of insanity continue to show the delusions and confusion over periods of weeks and

months, with alternations approaching lucidity and again exacerbations. Some run over years without change in the character of the hallucinations and sequent delusions, yet showing a gradual decrease in the amount of mental confusion, while the sense deceptions continue in fixed but unprogressive form, as in the paranoiac. The majority of patients, however, recover their reason to its full extent within a few months (seventy per cent, Krafft-Ebing), while a few die in the state of progressive exhaustion.

The *urine* contains traces of albumin and excess of the ethereal sulphates much more commonly than in primary mania.

A *differential diagnosis* from the forms of idiopathic mania is to be sought in the lack of the rapidity of thought-flow, the absence of great motor agitation, the evident state of exhaustion, and the manifold hallucinations which overpower and confuse the patient.

From the confused mental conditions after epileptic attacks it is distinguished by the longer continuance and slighter degree of confusion, and the prominence of impellent hallucinations in the latter. Scalp scars should be looked for in doubtful cases.

From melancholia it is discriminated by its sudden inception, by the presence of the manifold hallucinations, the probable etiology of the disease, the lack of dejection, the evident confusion of the patient, the absence of overpowering deprecatory delusions, and by the duration and course of the malady.

A differential diagnosis from paranoia, especially in those forms that have long-continued, fixed hallucinations, is ofttimes difficult without a previous knowledge of the history of the individual. Most prominent is the lack of method in the hallucinatory insane, as well as the absence of systematic evolution of an idea into a group of sense deceptions. The hallucinations remain stationary, not developing in systematic fashion as the months and years roll on. Paranoia, too, never develops suddenly; its incubation stage may last for years, and there are rarely any signs of mental confusion.

The *treatment* consists of absolute rest in bed for the exhausted cases, a liberal diet, perhaps nutrient enemata, wine, egg-nog; and for the sleeplessness, chloral with bromide, sulfonal, or morphine subcutaneously.

STATES OF MENTAL STUPOR

(*Acute Curable Dementia*)

There are a number of mental conditions resembling melancholia stuporosa, which, however, should be distinguished from this disease, inasmuch as they belong without exception to the degenerative types of insanity. They are rarely met with in practice. Sometimes, for example, after a transient attack of acute maniacal excitement the subject will fall into a condition of complete stupor, remaining entirely passive. Unlike the melancholiac, however, he does not resist the administration of food, nor does he show evidence of delusions or hallucinations. Gradually in the course of days or weeks he returns to a normal mental state. Again, an alcoholic, after prolonged indulgence or after the ingestion of enormous quantities of liquor, may become excited or depressed and later pass into a condition of passive stupor. In one case, which impressed me particularly, an individual who had taken an average of three pints of whisky a day for three weeks, at the end of this time became violently excited, exhibited symptoms of profound mental confusion, and then passed into a condition of complete psychical and physical torpor, deaf to all sounds, mute, only taking food when it was administered by the tube. At the end of six weeks he showed some slight return of the faculty of speech and recognised his surroundings; but although he was able within a few days to give a full history of himself up to the time of the stage of excitement, the events of the succeeding six weeks remained a complete blank to him, at least up to the date of his discharge, several weeks after recovery.

The condition known as *acute dementia*, while uncommon, is exceedingly interesting as an example of one of the mental affections resulting from brain depravity. The subjects are all either adolescents or individuals below the age of twenty-eight years, who have inherited a defective brain. After a preliminary but transient stage of depression or excitement the patients pass into a state of complete lethargy. There are no delusions, no muscular resist-

ance, and no attempt is made to swallow food placed in the mouth. There is an utter lack of mimetic expression, diminution in weight, loss of vaso-motor tone, with cyanosis of the extremities, lowering of the reflex functions of the cord, and sluggish pupils, together with a complete abeyance of the will power.

Patients may remain in this condition of absolute automatism for weeks and months, but the majority eventually recover with no recollection of events that have occurred during their illness. There is nearly always a predisposition for these cases to relapse, not into the same condition, but into some other of the more common forms of insanity.

The causes of acute dementia are to be sought in some exhausting strain upon the already unstable nervous system of the individual. By far the greatest number of cases come on at the period of life when the sexual functions are assuming prominence. Masturbation is a common immediate cause, and excessive sexual intercourse may be equally a factor. Overwork or overstudy, mental and moral shocks about the time of puberty, acute febrile diseases—typhoid fever, for example—trauma capitis, or even the ingestion of a few doses of alcohol or some other drug which affects directly the nerve-cell metabolism of an unstable brain, have been known to induce the acute dementia. Thus among my patients I had a young man, eighteen years of age, who after indulging in a few glasses of beer became passively stupid, every function of the brain being suspended. He showed considerable vaso-motor disturbance, no reaction to irritation of the skin or to loud sounds, and remained in this anergic state for two weeks before he showed signs of returning mentality.

The *pathology*, so far as it is disclosed by the condition of the fundus of the eye (Aldridge, Krafft-Ebing), seems to depend upon an acute anæmia of the brain centres from vaso-motor paresis, the fundus showing a condition of bloodlessness, and at a later stage, even œdema.

The *treatment* is mainly tonic. Quinine and strychnine should be exhibited with abundance of food, and if there be weakness of the heart's action, digitalis in moderate doses. Hot baths with after-stimulation of the skin by friction are often very efficacious.

Three types of primary curable dementia are distinguished: 1. Stupor as an expression of brain exhaustion from inanition. 2. Acute stupor from psychical shock. 3. Stupor from direct injury to the brain substance induced by traumatism. The most

prominent manifestation in all forms is the more or less complete inhibition of the mental faculties, as evidenced by the mental inertia, vascular paralysis, and disturbances of nutrition. Occasionally during some epoch in the course of the disease there are periods of excitement, during which the patient may show indications of having hallucinations and delusions. These several forms of acute dementia may occur at any age, particularly in traumatic and post-febrile cases, but the most typical, that occurring after acute brain exhaustion, is a disease of youth, and is to be carefully distinguished from the states of permanent stupidity from non-development of the faculties in the lower grades of imbecility.

1. The first and typical form of acute stupor occurs in young neuropathic individuals who exhibit the corporeal brand-marks of degeneration. The time of puberty is the most usual period for its development. As causative factors, sexual excesses of all kinds stand in the first place, and next in order, pregnancy, loss of blood, and the various febrile affections.* Overstrain in study, with onanism, is also a frequent cause. Alcoholic intoxication has already been mentioned, and to the list poisoning by illuminating gas and carbonic oxide may be added.

The facial expression is apathetic, expressionless; mimetic movements of the face are lost; the patient is mute, perhaps reacting sufficiently to turn the eyes toward the person addressing him, but in severe cases remaining absolutely passive. The deep reflexes are increased, usually to a considerable degree; the skin reflexes remain normal or are diminished. The pupils are usually dilated, and react sluggishly to light and accommodation. The reaction on stimulation of the skin of the neck (sympathetic reflex) is present, but slow. Ordinary tactile sensibility, and heat and cold sensations, are lost, or rather do not make sufficient impression upon the cerebrum to be noticed by the patient. Pain sensations are hardly perceived at all, even the application of the faradic current passing unnoticed in the mental torpor.

Tremor is present only in well-marked cases, but the muscular tone is always lowered, and passive movements made by the examiner meet with no resistance. Cataleptic indications are met with only in the later stages, when the stupor has passed into dementia. The heart's action and pulse tonus are indicative of the loss of general nerve power. The cardiac contractions are slow and feeble;

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* See chapter on the Febrile Psychoses.

the pulse at the wrist shows a redueed rate and a small volume, the artery being rather dilated than contracted as it is in melancholia. Owing to the diminution of the circulatory vigor, the extremities are inclined to be eold or even eyanotic; posture œdemas are frequent, and there is a corresponding lowering of the general bodily temperature. The respiration is slowed and superficial. In the acute stages there is always slow but progressive diminution of the bodily weight.

The urine shows fairly constant abnormalities, the prineipal change being an increase in the earthy phosphates. Only rarely is albumin demonstrable, but hyaline casts are frequently discovered.

Patients suffering from acute dementia do not remain eontinuously in this stuporous condition, but have intervals in which there is a partial return of the speech faculty as well as of motion, at which times they may show some temporary exeitement, or even anxiety and impulsive delusions. In all the severer forms, feeding through the stomach tube or with the spoon is neeessary, since the acts of mastication and swallowing are performed apparently automatically and are not dependent upon any volition on the part of the patient.

The majority of cases not resulting from grave vascular lesion the result of febrile affections, recover after running a course of some months. The return to health is slow; the patient begins to speak little by little, and gradually to move himself by voluntary effort. The mimetic expression becomes more active, nutrition increases, the phosphates in the urine decrease in amount, the circulation and with it the bodily warmth become normal, until finally the person returns to his usual state of health, but retains little or no remembrance of the length of his illness or the events that have oecurred during that time.

When no history is obtainable, these cases are liable to be mistaken for the amentia of idiocy, or stuporous melancholia. The diagnosis is especially difficult in sudden dementias following apoplexies, but it must be remembered that these do not ordinarily oceur in early adult life.

2. In the hereditarily burdened, an intense mental shock, a narrow escape from some form of sudden death, the sight of another person mangled in an accident or murdered before their eyes, the sudden death of a near relative, or other causes, may evoke a train of symptoms similar to those deseribed in the preeeding pages. The stupor may begin directly after the shock, or be delayed for a

few hours, during which the patient exhibits intense emotional disturbance. The condition seems to be directly induced by a spasm of the blood-vessels not only of the pia and brain, but of the entire body, which is followed by an œdema of the brain substance, manifesting itself in an abnormal anxiety, mild delirium, and increase of the bodily temperature, followed by a deep lethargy. The duration varies from days to weeks, according to the degree of instability of the nerve tissues and the profoundness of the shock. The diagnosis can be accurately determined only from the history.

3. In some instances of trauma capitis the affected individual does not recover full consciousness, but remains for days or weeks thereafter stupid, sleepy, able to answer questions only irrelevantly if at all, and evidently does not comprehend what is being done for him or what is going on about him. Hearing, eyesight, and the other special senses are apparently normal, but the impressions conveyed by them obtain imperfect interpretation in the central organs.

The deep reflexes are disturbed, more often depressed than elevated; the pupils are equal, moderately dilated, and react rather slowly to light and skin stimuli. The gait is uncertain in character and resembles that of a drunken man. Ordinary skin perceptions are intact, but the muscular system is lacking in tone, and there is a want of all spontaneous motion. Delusions and hallucinations are not necessarily present. Aphasia of the motor type, as well as word-deafness, have been occasionally observed. Vertigo and vomiting do not always occur. The symptom-complex apparently depends upon an increase in the intracranial pressure.

Recovery is the rule, even without any special treatment; but in the cases in which trauma is suspected, careful examination should be made of the head for the evidences of depressed fractures, bleeding, or any other discharge from the ears following fracture of the base.

STATES OF PSYCHICAL ENFEEBLEMENT CONSECUTIVE TO THE ACUTE FORMS OF INSANITY

a. Forms with slight mental weakness.
b. Chronic delusional insanity.
c. Terminal dementia, agitated and passive.

Though a permanent acquired mental weakness is not sequential to the psychoneuroses alone, but belongs equally to any chronic mental disease, this condition is so often found after the so-called primary forms of insanity, both without and within the walls of asylums, that it becomes necessary to add a few lines to what has already been said in previous pages.

Not a few cases, that have apparently recovered from an attack of melancholia or mania and have not relapsed after a considerable length of time, show on careful observation a slight impairment of judgment and will power. The patients have lost their former mental vigour, have become indolent, physically as well as mentally; when studied closely they are found to show the remnants of vague hallucinations, or more frequently delusions, and an entire lack of originative ideas. On the other hand, they are bidable, will carry out the plans of others if not too complicated, and with care may be made fairly useful members of the community, the occasional spells of irritability or excitement, to which they are all more or less subject, not rendering them dangerous or intractable.

Many of these individuals, although the finer edge of their faculties has been worn away by the morbid stress to which the brain has been subjected, can be taught various forms of manual labour, which serves not only to keep them occupied, but also to prevent them from becoming a burden to their families or to the State.

A more profound form of the mental decline consecutive to the psychoneuroses is presented by the states of persistent delusion, the *chronic delusional insanity*, *die Secundäre Verrücktheit* of Krafft-Ebing, the *monomania* of English writers who follow the nomenclature of Esquirol. The rapidity of cerebration of the maniac or the mental inhibition of the melancholiae has now passed,

and in the mental weakness following the tumult of the storm we find a period when depression and exaltation cease, but the patient retains the delusions of the more active period of the disease, which become fixed and permanent. The intellectual faculties, logical thought, and associative remembrance being retained in only a minor degree, the patient does not recognise the falsity of his intellectual conceptions, but, on the other hand, while they appear real to him, he is incapable of defending them on logical grounds as the paranoiac will attempt to do. Accordingly, the individual is only capable of thought within the circle of his fixed ideas; his *ego*, and even the appearance of his surroundings, have totally changed in his conception. The *I* has become another being, the view of the external world a conception embodied only in the delusions that govern him. The essential feature of this phase of mental reduction is the absence of outward action, and the rise of a perverted ideation which dominates completely the life of the individual. He is calm; egotistical feelings dominate more and more his being; he becomes a prince, a hero, a prophet, a saviour to the world, even the Deity himself, and his exalted personality shields him from contradictions and trivialities. The type of the insanity remains non-progressive, incapable of further conception, or modification of the fixed ideas.

Delusional insanity is more frequent after melancholia than after mania. It is stationary in the sense that the patients remain for years in the same condition, though eventually they sink to a lower plane of mental degradation.

The last form of mental reduction, the *terminal dementia*, represents the lowest plane to which man can fall from the height of his intellectual prominence in the animal world. Not alone is it the outcome of all cases of the primary insanities that fail to be restored to mental health, but it is the eventual result of any form of alienation that does not undergo a restitution to integrity.

The force of the disease being spent upon the higher levels of intellectual life, there results a total destruction of the mind in all its aspects. Only the body now remains, with its automatic and vegetative functions intact, a ship the (intellectual) engines of which have become worn out and incapable of movement, leaving only the hull, useful perhaps as a carrier of burdens under the guidance of other more active vessels. Even this capacity lasts only a limited time, before the now useless hulk has to be laid up in dock, to decay or presently to be broken up.

The change in the intellectual life of the patient is well shown in the altered physiognomy, which is wanting in mimetic expression. The facial innervation is irregular, resulting in dissimilar action of homologous groups of muscles, so that at times one side may show activity of the muscular groups while the other remains passive. This lack of innervation is especially noticeable about the

FIG. 17.—CATATONIA FOLLOWING AN ATTACK OF MELANCHOLIA. The patient is mute, requiring to be fed with a spoon, and will remain for hours in any forced position in which she is placed. The face is entirely devoid of expression. The left hand is seen to be permanently contractured. The photograph was taken after the arms had remained elevated for twenty minutes.

muscles at the angles of the eyes and mouth, resulting in a passive leer. The loss of tone in the orbicularis also permits the constant dribbling of saliva, rendering the patients very difficult to keep clean.

Trophic disturbances are not uncommon. Early appearances of senility in the form of grayness of the hair, disappearance of the subcutaneous fat, wrinkling and dryness of the skin, are noticeable. Vaso-motor pareses, shown by the blueness of the extremities, low tension of the arteries, and œdematous conditions of the feet are

equally frequent. Arteriosclerosis is present in a large proportion of cases, even those occurring in earliest adult life. The vegetative processes, nutrition, sleep, offer no anomalies, unless there be some constitutional affection complicating the mental trouble.

The terminal dementia, though consecutive to both, is rather more commonly the result of mania than melancholia.

Clinically two forms are differentiated: 1. In the *agitated dementia*, after the active stadium of the disease has passed, there remains a certain degree of restlessness, mainly automatic in character, the remnant of an imagination, and more rarely a mechanical use of a limited number of words without a clear conception of their meaning and without association of ideas. The individual is usually calm and childish, but at times there may be exacerbations of agitation that bear some superficial resemblance to attacks of mania.

2. The other form, representing the lowermost degree of mental apathy into which a man can fall, is called *passive dementia*. The physiognomy is now completely without expression, the limbs,

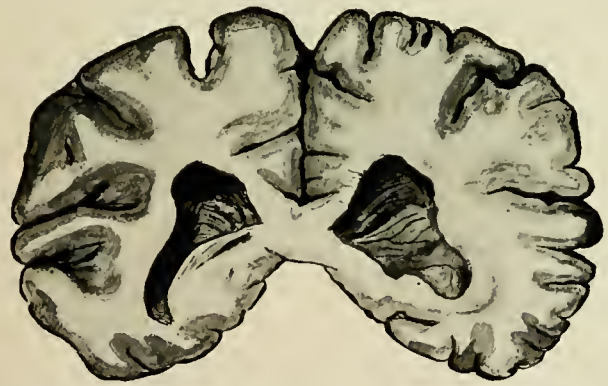

FIG. 18.—DILATATION OF THE POSTERIOR HORNS OF THE VENTRICLES, WITH SHRINKAGE OF BOTH WHITE AND GRAY MATTER. From a case of chronic mania. Reduced about one sixth.

half paretic, are twisted under their owner, who remains for hours without motion, even to the raising of an eyelid, with the chin sunken upon the breast, the saliva flowing from the mouth. He is incapable of attending to the necessities of life, having to be fed and looked after as a little child, hardly knowing hunger or thirst. Dangers may threaten, but he is unaware of their imminence; joys may come and go, but there are none for him; he lives in a veri-

table "land of darkness, as darkness itself, and of the shadow of death, where the light is as darkness."

This condition may persist over years, but, owing to the enfeeblement in the bodily vigour, is usually cut short by an intercurrent diarrhœa, pneumonia, or some other acute affection.

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GROUP II

INSANITIES CONSECUTIVE TO ORGANIC LESION OF THE CEREBRAL SUBSTANCE

PROGRESSIVE PARALYSIS OF THE INSANE

That malady of modern life, the product of "civilization and syphilization," as Krafft-Ebing has styled it, known under the various names of *general paralysis of the insane*, *dementia paralytica*, *progressive paralysis*, or, for short, *paresis*, a century ago was one of the curiosities of medicine. It was first described by Haslam, an English physician, in 1798. In the years immediately following the era of the Napoleonic wars there seems to have been a decided increase in the number of cases observed, so that by the end of the third decennary of this century the disease had become fairly well recognised. In support of the view that the affection is growing more and more prevalent, the following striking figures may be cited from the statistics of the Vienna State Asylum: In 1838, 12.6 per cent of all cases admitted; in 1867, 18 per cent; in the ten years preceding 1897, cases of progressive paralysis had come to represent nearly 30 per cent of the total number of admissions. The number of admissions to institutions in the United States do not show such an alarming increase, the proportion ranging from 6 to 10 per cent; but these statistics are less trustworthy than those from European sources, for the reason that our people—especially among the better classes—usually keep any relative suffering with a mental disorder at home just as long as he is manageable.

Another element that has in very recent years become of importance in the consideration of general paralysis is the ever-increasing number of women that are attacked by the disease. Ten or fifteen years ago it was an affection of relatively rare occurrence among them, the proportion of the cases being 9 or 10 in men to 1 among women. To-day, in some portions of Russia, the proportion

is 2 men to 1 woman (Greidenberg); in England, 4 to 1. In our own country the disproportion is greater—8 or 7 to 1.

Despite these facts the disease in most instances still passes unrecognised by the general practitioner, at least in the early stages, when treatment, if it is to be of benefit at all, is imperative. Too often the condition is diagnosed as neurasthenia, hypochondria, general nervousness, or some functional malady of indefinite character.

Think twice before contenting yourselves with a diagnosis of neurasthenia in a man or a woman who in middle life shows well-defined reflex pupillary disturbance. The prognosis is ominous.

In this connection I would cite an illustrative case that recently came under observation. A gentleman of this city, aged thirty-six years, the owner of a large wholesale business, was noticed by his family, in the summer of 1897, to be "not quite himself," in that there was now and then an unusual though transient irascibility and a tendency to forgetfulness. In 1898 these symptoms increased, and during an illness of his wife, an emotional state, not at all warranted by her condition, was added. Incomplete paralysis of the internal rectus muscle of the left eye next occurred, for which he saw an oculist, and was provided with the usual glasses, and told that it would be necessary to have the muscles cut, unless their use proved sufficient to correct the trouble.

The course was now from bad to worse. The emotional state reached such a pitch that the patient became hypochrondriacal, and was sent by his family physician to consult a medical man of note. A diagnosis of "neurasthenia" was made, and the patient was treated accordingly, only with the result that the progress downward became more and more rapid. In the spring of 1899 mental symptoms of a character to alarm his family supervened, and the case came to me for consultation. A diagnosis of dementia paralytica at about the beginning of the second stage was made, and the family were warned of the prognosis. A few days later the man became maniacal, attempted to kill several persons, and probably would have succeeded in doing so had not all deadly weapons been removed. I elicited a history of a syphilitic infection ten years previously, and also of former excesses in alcohol.

At the first examination I found the pupils rather small, and reacting slowly to light and accommodation. The consensual movements of the iris were completely lost; the knee and wrist jerks were absent. There had been "rheumatic pains" extending over a period of several years, and the skin about the plantar surfaces of

the feet showed a slight degree of tactile anæsthesia. There was insufficiency of both internal recti, which dated from a few months before, and a slight lateral nystagmus. Even more striking than the motor symptoms was a well-marked fatuity, with a tendency to alternating silly laughter and depression. The handwriting showed a slight tremor. There was a pronounced tremulousness about the muscles of the angle of the mouth. Speech defect, though not marked in degree, was also present.

Here was an almost typical case of progressive paralysis, showing all the cardinal symptoms of the disease, yet at a time when treatment might have been of some avail it was not recognised. In fact, the procedures advised, far from benefiting the patient, were, if anything, calculated to do harm.

The ordinary maniac, while he may be temporarily destructive and a menace to the lives of others, is by no means the dangerous person that the paretic is to his family or the community. The disease afflicting, as it does, all classes, the judge upon the bench, the banker handling the savings of many, the trustee of the widow and orphan, or the military official holding the power of life and death over those under him, may all be affected equally with the ordinary labourer.

Very often one of the first symptoms is an alteration of the character of the affected individual. The moral and religious person becomes a devotee of Venus and Bacchus; the abstemious man takes to drinking heavily; an individual who has spent his lifetime in accumulating a few hundreds or thousands of dollars will fritter all away in a week in useless presents to chance acquaintances, or will even scatter the money upon the street. The banker or trustee will use the funds committed to his care in some wildcat speculation, ruining hundreds at a venture; while the father of a family will become irritable, emotional, indulging in extravagant pleasures before unthought of, to the detriment of his business and home.

In one case that came to my knowledge a somewhat opposite picture was presented. A railroad official, well known for his thrift and business ability, who had not previously shown any symptoms of mental disease, went to a small town in western Virginia where he was known; he took a room at the principal hotel, purchased several pieces of property, and afterward elaborated to his friends among the towns'-people the following magnificent scheme: A railroad, he said, was to run through the place, and he had bought up certain properties in order to forestall the projectors of

the road, as they wished to locate their depots and offices on these sites. The man was so well known for his business acumen that a syndicate was immediately formed by the local people and the land was rebought at an advance of $30,000. The man left the town with his gains, which he dissipated within a few days, and landed in a western insane asylum. The whole story was a myth evolved in an insane brain, but it left his friends and acquaintances considerably poorer in worldly goods.

This case illustrates very well the almost universally prevailing restlessness present in the first stage of general paralysis, which drives the unhappy individual to acts and deeds totally inconsistent with his former habits of life. Herein lies the explanation of many offences against law and order committed without any apparent motive, of collisions with the police, or aimless thefts. On one occasion, for example, a patient of mine deliberately broke the window of a tobacconist's shop, abstracted a handful of cigars, and then as deliberately sat down upon the curb-stone to enjoy them, and this with sufficient money about him to supply his needs.

A sadder picture may also be presented in the home life of the family of the paretic. Too often the members of the household are subjected to unreasoning attacks of fury; they see the father become a shameless drunkard, and addicted to every form of profligacy; their honour, their means of support are vanishing, but there is left them no hope or redress, since the individual in the eyes of the average medical man is not insane, nor is he held so by the law until some overt act of transgression has been committed.

The place, and the only place, for the vast majority of paretics is the asylum, where their extravagant ideas cannot be carried into effect, and by these means alone can the welfare of their families and clients be guarded from the consequences of their mental degradation.

Etiology.—As in its half-brother tabes, syphilis is considered to be of pre-eminent importance in the origin of paresis. An eminent German writer goes so far as to state that lues is probably the single and only etiological factor, when taken in connection with the intensity of the strife for existence of the present and immediately preceding generations. On this assumption he felt himself justified in inoculating, in various parts of the body, eight general paralytics with secretions taken from fresh chancres. The subjects were watched for six months; none of them acquired syphilis. Hence he concluded that in all of these patients syphilis was latent, and

that they were thus rendered immune against a fresh inoculation—a deduction which must be characterized as certainly unwarranted.

Statistics of the proportion of syphilitics among paretics vary so greatly that it is here hardly necessary to quote them beyond stating that the ratios are all the way from twenty-five to ninety per cent. Here in Baltimore I have never been able to ascertain that more than thirty per cent of paretics indubitably had had lues, with about twenty per cent additional of doubtful cases—that is, at most not more than one half of the total number. In any event there must be a proportion of cases of paresis, and a considerable one too, that cannot be laid at the door of an antecedent syphilization.

The French writers of former years, and to a less extent of the present time, lay more stress on alcohol than upon any other etiological factor. But while it must be conceded that a large number of paretics have been drinkers, and that a form of paresis known as pseudo-dementia paralytica is undoubtedly due to the degenerative effects of alcohol, these are not the typical cases, nor do they usually run the course belonging to the true type of paresis.

Mental overexertion is also assigned as a cause, and undoubtedly cases have followed excessive mental study or business worries. But although this fact may be sometimes utilized to spare the feelings of the family, we shall generally feel convinced that underlying such influences there is some agent not so readily ascertainable, but which must be regarded as the true basis of the malady.

Traumatism and sunstroke are also reckoned as etiological factors; but here again it must be remembered that the cases resulting from these forms of brain injury do not follow the identical course of true paresis, but bear only a certain resemblance to it.

Finally, we reach the second of the great etiological factors of the disease—*heredity*.

It is quite curious to note the wide differences of opinion on this subject, so well illustrated by the respective views of Sommer of Würzburg and Näcke of Hubertusburg. Thus, Sommer would regard paresis as the direct antithesis of the functional psychoses, in that the former is directly owing to the acts of the man himself, and not to any heredity. According to him, when we find a father and his two sons paretics, the latter suffer not on account of any inheritance of the paralysis, but because they also have subjected themselves to similar conditions, which have brought about a like injury to their nervous systems.

Näcke, on the other hand, in a most careful investigation on one hundred paretics, found that in fifty per cent with certainty, and probably in the case of a greater number, there was a history of inheritance of mental defect. Further, he considers it probable that the brain in the majority of paralytics is defective from birth, and that when to this vicious inheritance an acquired syphilis is added, the result of the combination is a quickly degenerative process taking place in the brain tissues. He would therefore regard an invalid brain plus syphilis as most frequently responsible for paresis, and holds that without the defective cerebral development the luetic poison could not induce the disease. For a number of years the writer has held a somewhat similar view, basing his opinion not so much upon the clinical histories of patients, as upon observations of errors in development of the brain convolutions and of defective growth of the hemispheres, but above all upon the microscopical evidences of irregular construction and anomalies in the cortical cells. It would seem, however, to be going too far to deny that syphilis may sometimes be a primary factor in the etiology of the disease, since the evidence is rather in favour of the view that in certain cases, without hereditary defect, the luetic poison has by itself been sufficient to induce the changes leading to the dementia paralytica.

The consensus of opinion, then, is that in heredity and syphilis we have the most potent influencing factors in the causation of this protean malady, a mental disease unparalleled in the history of medicine.

Symptomatology.—Though the types of general paralysis have been subdivided into a large number of groups according to the prominence of ever-varying combinations of symptoms, it is sufficient for the general purpose of the clinician to separate them into three divisions: 1. Those that show more or less excitement during the first and early second stages of the disease. 2. Those that are hypochondriacal or melancholic. 3. Those who without any marked degree of excitement or depression gradually pass into a condition of dementia. That the subdivisions are largely artificial is shown by the fact that one often finds forms of paresis in which depression and exaltation alternate, the individual one day exploiting the most extravagant schemes, while on the morrow he is plunged into an abyss of despair. In recent times there has been a decided increase in the frequency of the demented forms of paresis, whereas formerly the excited ones predominated. In the records of the

local asylum this alteration in the nature of the disease is very striking.

Although, as a rule, no distinct line of demarcation can be made out, one period passing insensibly into the other, it is customary to divide cases of typical general paresis into three stages. The first is termed the prodromal stage, the second that of active maniacal excitement, while in the third and last stage the sufferer loses completely his intellectual faculties, and becomes helpless and demented to a degree hardly found in any other malady of adult life.

First Stage.—The length of the prodromal period varies within wide limits, but is usually prolonged over months, or even years.

The restless, unusual activity, both motor and psychical, the irritability, the loss of self-control under contradiction, the waywardness and general impression entertained by the individual that he is superior mentally and physically to his fellow men, are very striking to the careful observer and should at once suggest a probable diagnosis. In other cases, instead of overweening complacency, gloom and despondency may for a time be present and alternate with the general restlessness and egotism.

The moral perversion before mentioned is often a prominent symptom, the utter shamelessness and overtness of the acts of indecency and lapses from the decalogue, thefts, drunkenness, violence, and indecent assaults being more flagrant than in any other form of mental disease.

All these evil doings are marked by an absolute want of premeditation and by their utter objectlessness. Even when they seem to have been premeditated, the closest questioning will fail to elicit any definite motive, or if such have been present for the moment it has already been forgotten by the sufferer.

These lapses from the self-contained power of logical thought are very characteristic of the disease, and show that there is already present a degree of obtundity of the intellect which marks an incipient dementia. The faculty of reasoning, too, is on the wane, the subjects no longer being capable of collecting and assembling their ideas in serial form, but passing from one subject to another with an amazing lack of constancy. On more than one occasion, in forcing a beginning paretic to do an arithmetical problem or to follow out some train of thought for which a certain amount of concentration of the mind was necessary, I have noticed that the attention soon begins to languish, and if the individual is rallied and forced to continue there may occur a temporary unconscious-

ness, or more rarely a genuine epileptic convulsion. Indeed, transitory amnesic states, even when there has been no undue strain upon the attention, are fairly frequent in the late prodromal stage of the disease. Another feature often noted is a forgetfulness from one day to another of the ordinary duties and details of business or household affairs, which leads to acts inconsistent with former conduct and apathy to the ordinary claims of family or friends. Mental weakening is therefore characteristic of the earliest as well as latest stages of paresis, and is most striking to the observer, occurring as it does in men of fine physical development that have not yet reached the time of life at which a beginning decadence of the mental faculties might ordinarily be looked for.

Foremost among the motor troubles that are present at this stage are the pupillary anomalies to be referred to in greater detail later on. Sixty-eight per cent of the cases show sluggishness or immobility of the pupils to light, so that this is rightly considered as one of the most important early diagnostic symptoms. Loss of the consensual reflex is sometimes noted when no other indication of disease is present. Pupillary anomalies have been known to antedate by years the full development of the disease, and in the vast majority of cases their presence may be noted for months before they are overshadowed by other features of paresis. Loss or exaltation of the deep reflexes is another prominent symptom; and even at this early date there may be a fine tremor, or even twitchings, about the muscles of the face and tongue, together with some degree of motor inco-ordination in the muscles of the hands and arms. Slight anæsthesias or paræsthesias, so frequent in tabes, and transient attacks of vertigo are not uncommon, although direct questioning is often necessary in order to elicit a history of their presence, since, as a rule, the paretic, owing to his general sense of well-being, does not complain of any definite symptoms. Accompanying these vertiginous attacks, flushing or pallor of the face and headaches are noted. The circulation is often sluggish, and various digestive troubles are present. The temperature at this stage is ofttimes a fraction of a degree above normal, but there is rarely any marked pyrexia.

As the most important diagnostic points in the determination of a case suggesting paresis in its early stages, it may be said that, when a man in early middle life comes before us who has shown a recent alteration in his whole character, restlessness, irritability, together with utter indifference to the needs of others, and pronounced ego-

ism; and when on examination we can demonstrate the presence of pupillary anomalies and abnormalities in the deep reflexes, we are fairly safe in concluding that we have to deal with a paretic.

Besides the pupillary anomalies, there are a number of intra- and extraocular phenomena that are present with more or less frequency in the early stage of the disease. Of these, atrophy of the optic nerve is by far the most frequent, while paralysis of the recti muscles, usually of an incomplete and transient character, is occasionally met. The fundus of the eye shows noticeable alterations in about six per cent of all cases, but only in the advanced stages.

Second Stage.—In the form of general paresis in which there is a slow decline of the mental powers without any marked development of delusions of an optimistic nature, the transition from the first to the second stage is not well marked. With those varieties in which hypochondria has been a prominent feature, and particularly in the one in which there is great motor restlessness with ever-increasing delusions of personal importance, the second stage is often ushered in by attacks of transient or prolonged maniacal excitement, in many respects resembling ordinary mania, but characterized more particularly by a blind, unreasoning fury, the patient resisting any attempt to care for him with an uncalculating violence that is entirely regardless of injury to himself or to others. The intensity of the excitement is extreme; there is absolute sleeplessness, incessant restlessness, and a degree of mental reduction far greater and out of all proportion to that present before the maniacal attack began. The grandiose delusions are the controlling feature of the paretic's thought. He has become the possessor of millions or hundreds of millions of money; he owns countless houses or a whole city, has a hundred wives, is President of the United States, or lord of the entire universe. Such are only a few of the wild fancies which hold sway in his disordered imagination. The patient now comes before us tremulous with emotion, his eye bright, as the overpowering visions of wealth and grandeur float before his mind. Contradiction, or any attempt to show him the absurdity of his delusions, may anger him for the moment so that he may even attack the doubter, but in a moment he is again pacified and is asserting with even stronger emphasis his extravagant and preposterous fancies. The nature of these delusions is essentially sensuous and ever changing, new ones are added from day to day, the old ones are forgotten, and a fresh series is ever floating in procession before him. The picture is the direct antithesis of that presented by the

paranoiac whose occasional extravagant delusions are essentially of a fixed nature.

Hallucinations are by no means so prominent a feature of paresis as are delusions. Some writers, as Magnan, deny that they are symptomatic of the disease, while others hold that they occur with great frequency. Mickle found them present in fifty-five per cent of the cases especially examined in this connection. The more prominent forms of perception fallacies, when they do occur in paresis, are usually so fleeting that they may be readily passed by unnoticed

Fig. 19.—Facial Expression of Two Paretic Dements, Late in the Second Stage. The mental condition of the one on the right has been stationary for two years; the one on the left has rapidly gone downward. Demented form of the malady.

by the physician. Visual and auditory hallucinations are the most frequent forms, and gustatory false perceptions are occasionally noticed. In the more advanced stages of the disease there is usually perversion of all the special senses, the patient showing visual, auditory, olfactory, and tactile dulling, the result of the advancing degeneration of the neurones of the cortex.

The mental storm has produced other changes besides those of a delusional nature. There is greater difficulty in fixing the pa-

tient's attention on any subject; he passes from one to another in a desultory manner; he is no longer capable of rational judgment on any point, and the faculty of logical thought has sunk more and more into abeyance.

The motor troubles have now augmented; defects in speech are striking, the muscular tremor has increased; the face is devoid of expression, and the patient has an apathetic, vacant look (Fig. 19). The disturbances of the ocular and deep tendon reflexes have become intensified, and to a degree permanent; later, congestive seizures

FIG. 20.—FACIAL EXPRESSION IN THE TERMINAL STAGE OF GENERAL PARALYSIS. The patient was completely degraded. Demented form of the disease.

simulating transient apoplexies and epileptiform convulsions may occur; even monoplegias and slight hemiplegias have been observed. The bladder and rectum become paretic, the general muscular strength shows a gradual decrease; above all stands out the slowly increasing dementia, amounting to an utter reduction of every mental faculty. Finally, the patient entering the *third stage* becomes helpless, and is either bedridden or sits in a chair grinding his teeth, replying to questions only in an inarticulate jargon. The apoplectic seizures now show an ever-increasing frequency and severity. As the patient becomes more and more helpless bedsores may appear and a

septic process begin, ending finally in death; or, owing to paralysis of the muscles of deglutition, particles of food find their way into the larynx and a pneumonia ends the scene. Death may also occur in one of the frequent apoplectic attacks and serous congestions (Fig. 20).

Galloping Form.—In a small number of cases of progressive paralysis, the disease, instead of following the course belonging to any of the usual forms, assumes a truly malignant aspect, characterized by the rapid progress of the psychomotor troubles and elevation of the temperature up to 104°, with a fatal outcome, usually within a few weeks. Such cases are ordinarily found among the excited forms of the disease, but may develop after a few inconsequential prodromal symptoms. In one very striking example among my patients, slight irritability, with alteration of the disposition, was followed within two weeks by the highest degree of psychical and motor excitement with delirium and fever, the malady running its whole course in five weeks. The microscopic examination of the cortex showed intense congestion of all the vessels, large and small, inflammation of the outer sheaths of the arteries, and profuse diapedesis of the white elements of the blood into the lymphatic channels. The nerve elements were but little disorganized.

As a rule, the acute malady presents a symptom-complex closely resembling that of *delirium acutum*, with which it is not infrequently confounded. With ever-increasing excitement and hallucinatory delirium, the patient becomes confused to such an extent that he has not the slightest recognition of his surroundings; he mutters single syllables interspersed with an occasional complete sentence, sometimes grandiose in its sentiment, sometimes indicative of persecutory ideas, such as of being constantly followed by thieves or detectives. Suddenly he breaks out into inarticulate cries, rushes up and down the room, strikes with his feet and hands at the door or walls, and is entirely sleepless for days and nights. Food is rejected, and if placed in the mouth is spat out. The urine and fæces are passed unconsciously. During the excitement the temperature rises and runs irregularly. The pulse is small and frequent, the heart tone lowered. The bodily weight decreases rapidly, and toward the end the temperature sinks below normal, and indications of collapse become apparent. The excitement has now passed the acme, the patient becomes stuporous, the lips and tongue are dry, covered by sordes and brown fungous growths, a diarrhœa sets in, accompanied by cold sweats and muscular jactitations, fol-

lowed by an ever-deepening coma and death, which may be preceded by apoplectiform seizures.

A few cases recover from this acute delirium, and afterward run the ordinary course of general paresis. One of my patients is still living, four years after the inception of the fulminant excitement, and though very much demented, still shows the characteristic myotic pupils and increase of the knee and wrist jerks.

The most prominent somatic symptoms of dementia paralytica merit a more detailed description.

Eye Symptoms

Disturbances on the part of the pupils are frequent, and of great importance for the diagnosis. The direct light reflex, the presence or absence of dilatation on cutaneous stimulation, and the consensual reflex movements must all be inquired into, as well as the power of accommodation, the mobility under ordinary stimuli, and the size of the pupils. Slight irregularities or slight differences in the size cannot be considered of importance, as they are fairly frequently observed in the normal man. It should also be determined whether there has been an antecedent iritis.

The most common departure from the normal in the condition of the iris is the so-called spastic myosis, where the pupils are extremely small, perfectly fixed on exposure to light, and do not expand when the eye is shaded. One pupil is not infrequently more myotic and less reactive than the other. This condition, which is due to paralysis of the dilator fibres of the iris, is rare in insanity, except in paresis.

Siemerling recently investigated this condition of reflex pupillary immobility in 9,160 insane persons, and found the symptom present in 1,639, divided as follows:

General paralysis	1,524 times.
Psychoses accompanying tabes	29 "
Senile dementia	19 "
Syphilis of the nervous system	17 "
Localized lesions of the brain	19 "
Alcoholism	15 "
Paranoia	7 "
Hysteria	4 "
Epilepsy	4 "
Traumatism	1 "
Total	1,639 times.

Among a total of 3,010 cases of paresis he found this symptom present in 2,084, a percentage of 68.

Gudden, in a material of 1,386 cases, found the pupillary reactions present in 22.3 per cent, weak in 35.5 per cent, absent in 34 per cent.

In examining a patient for this condition of reflex immobility, great care should always be taken to insure the absence of accommodative movements, by making the person fix the eye on a near object. If this precaution is forgotten, the test may prove deceptive and false conclusions may be reached.

Inactivity of the pupil on one side only is seldom persistent, since the other soon becomes affected. Pupillary myosis has been known to antedate the full development of the disease by ten years. In examining a patient for the first time, the possibility of a transient iritis, or the effects of atropine, opium, or eserine, should be kept in mind.

The loss of the consensual light reaction is next in importance to myosis.

The consensual reflex consists in the narrowing of one pupil and its subsequent wavy dilatation on the admission of light to its fellow. In the healthy eye this movement, according to Listing (cited by Lewis), begins two fifths of a second after the opening of the other eye, and lasts about one fifth of a second, after which the pupil dilates slowly and vibrates for some seconds. The consensual dilatation he observed to commence about half a second after the closing of the other eye, and to continue with diminished rapidity for one or two seconds. In a considerable number of cases I have noted this symptom before the loss of the light reflex, and its presence when combined with mental phenomena has led me to make a tentative diagnosis of paresis.

Less frequent than these deviations from the normal is an unusual dilatation of the pupil. In rare cases, however, one or both pupils may be widely dilated and react sluggishly, or not at all, to the influence of light. Such conditions are usually associated with some defect in vision, grayness of the disk, or optic atrophy. In Gudden's table double mydriasis is mentioned as occurring in 4.9 per cent of his cases.

A sluggish reaction to light may also be present when the pupils are normal in size, and accommodation reactions still remain active —the so-called iridoplegia. The consensual reflex is then, as a rule, absent.

Loss of the power of accommodation is not very frequent, except with the pin-point pupil. It is to be regarded as a symptom of the later rather than of the earlier stages of progressive paralysis.

The reflex dilatation of the pupil on stimulation of the neck skin and sympathetic nerves (sympathetic reflex), normally present, is often absent at an early date. Lewis found it to be completely abolished in 67.6 per cent, and natural in only 11.3 of his cases. Its absence can sometimes be demonstrated when the light and consensual reflexes are retained, and though not generally mentioned in text-books, is a symptom of much importance. The "attention reflex" is impaired as soon as there is a perceptible degree of dementia.

The ocular fundi are ordinarily normal in the earlier stages of paresis; rarely is there atrophy of the optic disks.

Amblyopia is occasionally seen, and may be associated with passive dilatation of the retinal vessels. Atrophic optic changes have been noted in from one quarter to one third of cases in the terminal stage.

Cranio-spinal Nerve Symptoms

The similarity between certain symptoms of general paralysis and those of locomotor ataxia is so striking that it is necessary to say a word in reference to their relation. The majority of physicians interested in insanity look upon paresis as an independent disease, having little or nothing in common with tabes. This view is warranted by the cases in which there are no organic spinal symptoms (absence of the knee-jerk, anæsthesia, etc.), or the presence of symptoms opposite to those belonging to tabes (exaltation of the knee-jerks).

On the other hand, in France and in Germany there is a constantly growing conception that the two diseases, having a common etiology for the majority of cases in a specific degeneration of the nerve elements, should be regarded as essentially similar, though differing ofttimes as to the especial portion of the central nervous system affected. A final answer to these questions can only be reached when the most intimate morbid anatomy of the two affections is better known. But while it is at the present time sufficient for every purpose to regard them as having essentially the same etiological factors for their production—syphilis and heredity—it must be remembered that the ever-changing character of the spinal phenomena in paresis would rather argue that the lesions are not

identical with those of tabes, a fact accentuated by pathological examinations.

In about eighty-five per cent of all cases of paresis there is some disturbance of the knee-jerks. An exaggeration is somewhat more frequent than a diminution of the normal jerk, but it is worthy of note that the reflex may be sluggish or abolished at one period of the disease, and yet at a later stage may become exalted; or the order may be reversed. The skin reflexes are often sluggish or lost—according to Mickle, in forty-one per cent of his cases.

With very considerable exaggeration of the reflexes there is often none of the spastic walk pathognomonic of the so-called lateral sclerosis. On the contrary, we often find that the step of the patient is firm and elastic, with full vigour of the leg musculature, although a pronounced irido-motor paresis may be present. Similar conditions are often noted when the knee-jerk is sluggish or impaired, and a true tabetic gait in paretics, while it does occur, is comparatively rare.

The patella reflex in the first period of the disease is more frequently altered than in the second, and in the second more frequently than in the third (Montyel).

Anæsthetic and paræsthetic conditions are fairly uncommon in paretics in the early second, or in the prodromal stage. Their presence points to a true implication of the peripheral nerve apparatus extending to the cord, or to a lesion of the posterior root fibres. At a later stage of the disease there is very frequently a general dulling of sensibility in the cutaneous surfaces to all kinds of common sensations, as well as to heat and cold.

The tremor of general paralysis is eminently characteristic. It is fine, fibrillary, involving the muscular strands, and not the muscle *en masse*, as in alcoholism. It appears earliest about the small muscles of the angle of the mouth, or about the tongue, while at a later period it is found in the small muscles of the hands and feet. In the terminal stage of the disease the whole body may become tremulous from the general weakness, a condition entirely different from that with which we are now dealing.

One of the earliest and most significant indications of this incipient tremor is the change in the handwriting, in which we learn to recognise the beginning loss of control of the more finely co-ordinated movements, which later reaches an extreme degree. The alteration is first noticed in the upward stroke of the letter, which presents an irregular saw-edge line. At the same time there is a

tendeney to make the letters of an unequal size, and to put letters in the same word out of the horizontal plane (Fig. 21). At a later stage the increase in the tremor shows itself in more serious deviations. The letters are formed slowly, and as a consequence the tremor is seen not only in the up-strokes, but in those which run laterally and downward. Hence the writing becomes more and more illegible, and finally consists of nothing beyond disassociated irregular lines, the patient nevertheless asserting that his handwriting is the most beautiful in the land. Again, there is nearly always a tendency to omit syllables or entire words in taking down a sentence from dictation.

Owing to the defeetive innervation of the facial muscles there is a characteristic lack of expression about the face of the paralytic. It is heavy, apathetie, and the naso-labial folds are more or less obliterated (Figs. 19, 20). Irregularities in innervation are frequently present, and sometimes amount to a true paresis of one half of the faee. This point is most readily determined by making the patient read aloud or whistle, when the laek of tone at once becomes apparent.

Articulatory troubles of a characteristic nature are found in a considerable proportion of all eases. The speech is hesitating; syllables or entire words are slurred, or even omitted; the enunciation is blurred, or may be of an explosive order. The consonants give the patient especial difficulty; test words, such as "Rappahannock River," "constitution," "truly rural," "hippopotamus," being pronounced with the elision of one or more of the syllables. Strenuous effort on the part of the patient often makes matters worse, and results in the enunciation of an unintelligible jargon. In advanced stages the speech defects grow in intensity, until only here and there can an intelligible word be recognised.

Cerebral Seizures

Sometimes in the early—nearly always in the later—stages of paresis there occur nerve storms, sometimes epileptiform, sometimes apopleetiform in nature. In the rare instances in which a patient has died as an immediate consequence of one of these attacks, the customary finding is an œdematous and congested condition of the brain without ruptnre of any vessel. The symptoms, therefore, in the early stages are referable to a spasm of the vaso-constrictor nerves of the pial vessels, with subsequent damming back of the returning blood; the eonsequent irritation of the nerve elements

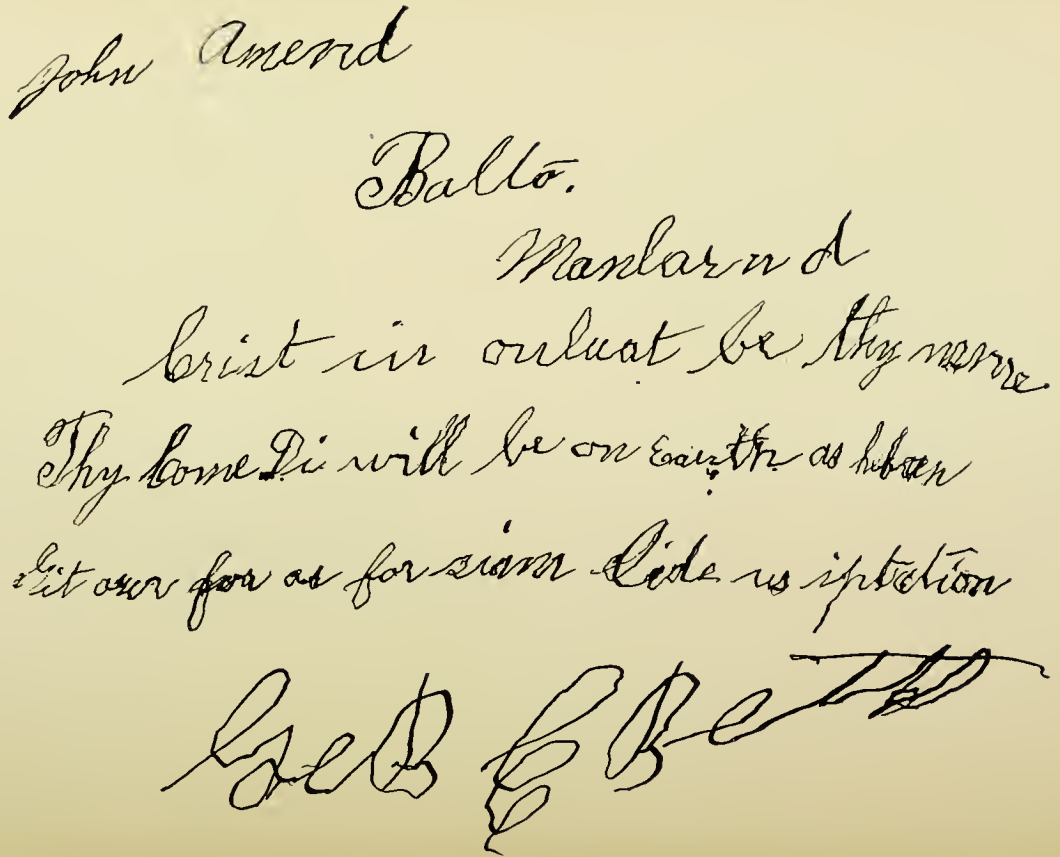

FIG. 21.—SPECIMENS OF THE HANDWRITING IN PROGRESSIVE PARALYSIS. The central lines are a portion of the Lord's Prayer from dictation. The first three words are in the German version, the balance in English. It will be noticed that the letters progressively become more illegible, and that the gaps in the text are greater toward the end.

by effete plasma, together with poisonous albuminoid products contained in it, producing an explosion. In the later stages the occlusion of the perivascular lymph channels is quite sufficient to account for them.

The epileptiform seizures are characterized by transient loss of consciousness, pallor, wide dilatation of the pupils, with slight twitchings of the face and limbs. One of the peculiar characteristics of these attacks is the spreading of the convulsive movements, from any given point, over the limbs or the entire body. In one patient in whom I carefully observed this condition the convulsive movements started in the left shoulder; thence they gradually spread to the muscles of the arm, then to the face, and finally to the leg of the same side. After a repetition of the attack they involved successively the right leg, the right arm, and eventually the entire body. Nystagmus and unilateral movements of the eyes frequently accompany these convulsions. Now and then the head and eyes are turned, as if looking over the shoulder, and the arm may be raised as if pointing to some object. These movements are usually of short duration, but they are sometimes prolonged over hours, or even days, and, when recovered from, leave the patient both mentally and physically reduced.

Apoplectiform seizures are not so frequent as the other variety, but are of graver import. The patient somewhat suddenly becomes heavy and lethargic; convulsive movements are slight, or may be entirely absent. The face is deeply flushed, the surface of the skin hot; the respiration is heavy and laboured, and the individual may become deeply comatose. Paralyses, mainly of a monoplegic order, follow these states, and though usually of transient duration, are sometimes persistent. The deep reflexes are always exaggerated. The chief danger to the patients in this condition is from hypostatic engorgement of the lungs, and from dysphagia.

Bladder and *rectal* difficulties are present sometimes in the earlier, almost always in the last stages of the disease. Incontinence of a paralytic type is frequent, and is one of the most troublesome and annoying symptoms of dementia paralytica, necessitating careful and constant attention.

Retention of the urine is usually an indication of paralysis of the muscular coat of the bladder, but sometimes is due to a spasmodic contraction of the urethral sphincter. Both incontinence and retention require equal watchfulness on the part of the physician to prevent over-distention of the bladder, it being notoriously

true that incontinence requires as frequent assistance as absolute retention, the paralysis of the contractile muscles of the bladder permitting an accumulation of the urine within the viscus, the condition being relieved hardly at all by the constant dribbling away of a portion of the contents.

Paralysis of the anal sphincter, while quite as annoying, is not equally dangerous to life. These several conditions for the most part come on as the result of loss of the cerebral control, and are rarely directly due to disease in the lumbar regions of the cord.

The *urine* of the paralytic contains no substance especially characteristic of the disease. There is usually, in the second stage, a tendency to polyuria, the urates and phosphates being diminished, while the chlorides are increased. A trace of albumin, with hyaline casts, is frequently found, and acetone and peptone are now and then present (Klippel et Servaux). About seven per cent of general paralytics show a trace of sugar in the urine (Ball).

Blood examinations have demonstrated a diminution in the amount of hæmoglobin, with a lessened number of red corpuscles to the cubic millimetre, and a moderate increase of the polynuclear leucocytes.

Differential Diagnosis

The true *manias* and *melancholias* among men are affections of early, not of middle life. With women, on the contrary, functional psychoses are relatively frequent between the ages of thirty-five and fifty years. Accordingly, when we have a man between the ages of thirty and fifty years, with a supposed attack of simple mania, or perhaps melancholia, who has a history of never having had a similar attack in his earlier life, it behooves us to make a very guarded prognosis. If to the mental excitement the organic ocular and spinal symptoms are superadded, the diagnosis of general paralysis may be made with certainty. In the case of women the conditions are far more complex, but even here the organic symptoms may be relied upon. If indications of tabes exist, a careful inquiry should be made as to the previous duration of the spinal symptoms, as the prognosis is more favourable if these are of long standing than if they have been recently acquired. It must be remembered, however, that psychoses occurring in the course of locomotor ataxia are rather rare, as shown by Siemerling's table.

The ideas of grandeur in the ambitious form of *paranoia* may be distinguished by their fixed character, which makes them stand

out in strong contradistinction to the fleeting delusions of the dement. Organic symptoms do not occur in uncomplicated examples of paranoia.

Certain forms of *chronic alcoholism* are exceedingly difficult to differentiate from the true paresis. The intelligence is lowered, the patellar reflex is annulled, when there is neuritis of the peripheral nerves. The anomalies of sensation, the epileptiform seizures, the tremor, imperfect innervation of the facialis, speech and writing defect, may all be present. But here once more the examination of the eyes is of assistance, the spastic myosis and other ocular phenomena being infrequent. Again, the tremor of alcoholism is usually of a different order, being a tremor *en masse* instead of fine fibrillary twitchings. In the assemblage of the mental phenomena there are also obvious differences, the alcoholic often exhibiting hallucinations, delusions of jealousy and of marital infidelity, intermingled with the grandiose ideas.

The differential diagnosis between *neurasthenia* in some of its varied aspects and paresis cannot be passed over without grave consideration. Both affections have a multitude of similar and misleading symptoms. The irritability, the lowering of the faculty for serial thought, the headache, vertigo, disturbance of sleep and of digestion, may be equally prominent in both diseases. The same is true for the frequent tremor about the hands and face, even of the tongue. Again, the two maladies belong rather to the middle epoch of life, and in the one and the other a history of heredity can often be elicited. In both figure excesses of all kinds, alcoholic as well as intellectual, and an hereditary history of lues is not of minor importance.

Naturally, only a small proportion of neurasthenias develop into cases of general paresis, yet even this small number among a vast multitude is important enough to warrant ample consideration. It is an undeniable fact that a certain percentage of neurasthenics, who on the closest examination have shown no indication of organic lesion, at a later period undoubtedly become paretics, the disease in these cases running its ordinary course, though naturally, as a rule, the patients show both in the earlier and later stages the organic signs, especially the oculo-motor changes, in addition to the ordinary symptoms met with in neurasthenia.

An inquiry into a case of pure neurasthenia will usually elucidate the history of a train of nervous symptoms dating back into early life. This is an important diagnostic point, since the typical

paretic does not develop any symptoms until he has reached middle life. On the other hand, a host of rapidly advancing indications of nervous weakness, coming on without a history of trauma or recent illness, should awaken fears of some grave organic trouble.

The tremor of the neurasthenic, again, is different from that of the paretic. Gross muscular jerkings are the rule, and not the fine fibrillary tremor.

The depression of the neurasthenic may be diverted for the moment, and influenced for the better; the paralytic remains in his melancholic condition, and no reasoning or attempt at diversion will affect him or raise his spirits. The neurasthenic details with the most minute precision his manifold somatic symptoms and his thousand small woes; the paralytic lays stress on but few, and these only striking symptoms. The cases of functional nerve-weakness do not show the beginning loss of judgment or the evident failure of memory of the paretic; on the contrary, their recollection of details is painfully accurate. Above all, in neurasthenics, the oculomotor symptoms, especially the pin-head pupil, the changes in the deep reflexes, and the epileptiform seizures are absent, nor do they develop delusions of self-importance, but rather the reverse.

In conclusion, it may be said that though it is impossible at times to make a positive differential diagnosis between the early forms of paresis and neurasthenia, yet the majority of the subjects of the graver disease show manifest and recognisable symptoms of the approaching nerve storm. Thomson, of Bonn, found in a collection of seventeen hundred cases from the eye, nerve, and psychiatrical clinics of the Charité, that ninety per cent of the patients showing reflex immobility to light became tabetic or paralytic. Many of these came to the several departments solely on account of so-called neurasthenic symptoms.

Even less readily distinguishable from general paresis are certain instances of *precocious senility*, accompanied by grandiose delusions, progressive dementia, and frequently by mydriasis and abnormalities of the knee-jerk, occurring in individuals between the ages of fifty-five and sixty-five years. Fortunately, a differentiation is not so important in these cases, as for all practical purposes, social and medical, they may be classed according to the prognosis, which is uniformly unfavourable for a complete restitution of the mental powers. But here the downfall into a state of physical and mental degradation is neither so rapid nor does it reach so profound a degree, so that many of these individuals may be returned to their

friends, demented, it is true, and with many insane though harmless delusions, but still capable of entering again into their home life.

Grandiose delusions with motor symptoms may also be present after *apoplexies*, especially those of the cortex cerebri.

A differential diagnosis between *syphilitic affections* of the cortex and true paresis is often impossible in the present state of our knowledge of the two maladies. *Tumour* of the brain when it affects the cortex is sometimes accompanied by delusions of an expansive nature. The only possibility of making a differential diagnosis depends upon the presence of a choked disk, which is not found in true paresis.

To enable one to differentiate between *multiple sclerosis* and paresis we must look for the "intention" tremor and the nystagmus, usually with absence of grave intellectual defects—a symptom-complex quite different from that of dementia paralytica.

Bruns has lately called attention to the fact that certain cases of uræmia present many symptoms suggestive of general paralysis, such as weakening of the intelligence, irritability, epileptiform and apoplectiform attacks, with disturbance of speech and of the handwriting, tremor of the tongue and hands, and muscular weakness. I have seen within the past year several similar cases, which at first sight were indistinguishable from ordinary paresis. The differential diagnosis is made by means of the urinary examination, and by the occurrence of asthmatic-like attacks, nausea, and other somatic indications of the underlying trouble.

Cases of advanced cerebral *arteriosclerosis* have occasionally epileptiform and apoplectiform seizures resembling those of paresis, but except in rare instances these patients do not show the rapid decline of the intelligence, nor the expansive delusions and cerebrospinal phenomena.

Saturnine poisoning should also be kept in mind, as there are occasionally points of similarity between it and general paralysis.

The clinical resemblance between these several forms of pseudoparetic dementia and the true paresis will be dealt with more in detail in the appropriate chapters on these affections.

Racial Influences and Civilization.—So far as is known, the savage tribes and the Eastern and African nations have not acquired the unenviable distinction of being subject to dementia paralytica. The Irishman has to come to America to be attacked by it, for at home he seems to be immune. In the country districts, far from the large towns, the disease is comparatively unknown. It is in

the cities, in the populous districts, where rum and syphilis dwell in close fellowship, where the strife and excitement of modern civilization is ever at flood-tide, that general paralysis is rife. Under these conditions of life no race seems to be exempt; the Teuton, the Slav, the Gaul, the Greek, and even our American negro, are among its victims. The last-named race affords a striking example of the deleterious effects of "civilization and syphilization." Before the civil war, and for some few years afterward, the disease was unknown among them. Little by little the number of cases grew in frequency. Such patients were at first regarded as curiosities, but at present in Baltimore paretics represent approximately the same percentage, according to the total population, in negroes as they do among the Caucasians; nor do the general types of the disease differ materially in the two races.

Duration.—The duration of progressive paralysis from the prodromal stage to the final ending varies within wide limits. The average length of life from the beginning of the second stage is less than three years, but many patients live on in a demented condition for ten, twelve, or even fourteen years, and are then carried off by some intercurrent disease.

On the other hand, I have seen a number of patients die a few weeks after the inception of the second stage, either from exhaustion attending intense maniacal excitement, or from a simple progressive decline in the vital powers, the end being ushered in by a series of apoplectiform seizures.

Age.—The majority of cases of progressive paralysis begin between the thirty-fifth and forty-fifth years of life, the average age being 40.5 years (Hirschl). After fifty-five the disease is rare, but has been known to occur after a late-acquired syphilization. In one case, mentioned by Hirschl, of a man who contracted syphilis in his fifty-sixth year, the symptoms of paresis began at sixty.

Especial attention has been drawn to an early form of paretic dementia by Krafft-Ebing, Karplus, Alzheimer, Lührmann, Gudden, and others. But that the disease is not common in childhood is shown by the fact that Alzheimer in his monograph was able to assemble only forty-one cases in which the diagnosis was unassailable. Of these patients twenty were males and twenty-one females. The earliest case began at nine years of age, after which the number showed a gradual increase to the fifteenth and sixteenth year (eleven cases), and later a diminution to the age of twenty-one and twenty-two years.

Hereditary syphilis seems to be the most prominent factor in these juvenile cases, for in fifty per cent there was an indubitable history, in thirty-five per cent additional it was almost certain, and in six per cent more it was extremely probable—a total of ninety-one per cent.

Besides the early type of the affection, with paralytic symptoms, atrophy of the optic nerves, and apoplectic seizures, there is in this part of the country a form of progressive dementia affecting young persons between the ages of twelve and sixteen years that is very similar to the true form. These patients, without previous indications of exaltation or depression, become apathetic, lose all interest in their surroundings, and gradually lapse into a state of progressive dementia which increases as time goes on, until they become profoundly degraded. A large number of these cases have a history of inherited syphilis, while in others there is only the usual family history of neuroses and insanity.

Treatment.—It is only in the earlier stages of progressive paralysis that we may hope to accomplish anything by therapeutic measures. In the face of a history of syphilis, or even upon the suspicion of a taint, an active treatment should be at once inaugurated with inunctions of blue ointment or oleate of mercury, or with the hypodermic administration of the bichloride, or the sozoiodolate of mercury in salt solution. Hydrotherapeutics in combination with the internal administration of mercurials are often of benefit. Iodide of potassium in doses gradually increased to sixty grains or upward, thrice daily, may be administered, but my own preference is for the mercurial salts. Iodides in the later stages are often positively deleterious, inasmuch as they cause a decrease in nutrition, and are apt to give rise to an irritative diarrhœa.

Above all things, we should attempt to build up the general health of our patients with tonics, quinine, strychnine, and iron, and especially preparations of cod-liver oil combined with pure phosphorus or with the glycerophosphate of lime and soda.

The food should be rich and plentiful, and the patient should rather be over- than under-fed. Milk, eggs, albuminous foods of all kinds, vegetables, particularly fresh spinach, celery, asparagus, and fruits, should be freely allowed. Eggs beaten up in milk, or in the form of custards, are one of the best and most easily digested food combinations, and may be allowed between meals. Alcohol in any form should be strictly prohibited, as it is notorious that maniacal attacks and epileptiform seizures are frequently induced

thereby, and that the mental deterioration is more rapid under its influence. Nothing can be worse for the paretic than over-indulgence in spirituous liquors.

Summarized, the most important points in connection with dementia paralytica are as follows:

1. General paralysis is a disease having the cardinal symptom of progressive mental enfeeblement, accompanied by certain oculomotor and spinal symptoms of a paralytic type, beginning in the best years of a man's life, and leading to absolute physical and psychical annihilation.

2. A general alteration in the character of an individual in middle life should suggest the possibility of an oncoming progressive paralysis.

3. Gradually increasing defects of intelligence arising at a similar period of life should be equally regarded with suspicion.

4. Hypochondriacal and melancholic conditions, such as are prominent in the neurasthenic, when combined with recently acquired defective intelligence, are ominous with regard to prognosis, since they are suggestive of something more than nerve weakness.

5. Patients showing mental disturbances accompanied by the indications of tabes dorsalis almost always develop into cases of progressive paralysis.

6. Reflex pupillary immobility, when combined with ideas of an expansive nature and progressive mental weakening, is sufficient ground upon which to base a diagnosis of progressive paralysis.

7. Changes of accommodation in the pupils should be carefully differentiated from those connected with the reaction to light.

8. Slight inequality of the pupils, and slight changes in the innervation of the facialis, when not accompanied by other symptoms, cannot be considered to be of importance.

9. The absence of ocular and spinal symptoms is not a positive indication, when there is mental disturbance, that the affection will not eventually become progressive paralysis.

10. Loss of the knee phenomena occurs in depressive forms of insanity, notably in the confusional manias and melancholias, but is then usually of short duration.

11. The expansive delusions of the paretic are manifold, and change from day to day.

12. Maniacal outbreaks, occurring about the time of early middle life, except when recurrent, are always indicative of progressive paralysis.

13. A progressive dementia not of traumatic origin, and not arising after a febrile disease, occurring between the ages of thirty and fifty-five, even though unaccompanied by delusions of grandeur, is always of a paretic nature.

THE PATHOLOGICAL ANATOMY OF GENERAL PARALYSIS

Gross Pathology of the Brain and Membranes

The appearances of the meninges of the brain are usually characteristic. The *dura* is often thickened and vascular, the vessels, both veins and arteries, are tortuous and knotty, and upon the visceral surface red-brownish patches of varying size are occasionally found, marking old or more recent transudations of the hæmocytic elements. The membrane is abnormally adherent to the cranial bones, or, owing to abundant proliferation of cells from the neighbourhood of the vessels, the reverse condition—an unusual looseness—may be noted. In the subdural space there is an increase of pellucid or turbid cerebro-spinal fluid. Thickening of the cranial bones with disappearance of the diplöe may also be demonstrable.

The appearance and relation of the *pia* to the cortex may be very different in individual cases, but as a rule these features are highly characteristic.

In autopsies that are obtained at a fairly early period of the disease, when, for instance, the ascertainable symptoms have not lasted for more than one year, the pathological appearances are constant. But when the process has been going on for many years the pial changes take on a different character and no longer present the highly pathognomonic condition of the earlier months.

Over the fore and mid regions of the brain, usually in a less degree toward the occipital poles, the pia is covered with numerous, smaller and larger, dilated and congested vessels lying in a thickened milky or opaque membrane, the regions of greatest vascularity and thickening being over the sulci between the convolutions. The visceral and external layers of the pia are proportionately thickened. When removed from the brain substance the torn membrane is found to be tough, and exudes a turbid fluid slightly stained from the blood which has oozed from the ends of ruptured vessels, if the autopsy be performed within an hour or two after death. This œdematous condition is everywhere present, in the furrows

and upon the surface of the convolutions, distending the pial meshes and permeating the cortical substance. Except in a few cases, the hypertrophied (milky), and œdematous pia is no longer readily separated from the surface of the convolutions. So strongly adherent is it, especially over the apices of the convolutions, that an attempt at removal brings away also bits of the adherent cerebral substance attached to thickened vessels.

Microscopic Pathology of the Pia.—A histological examination of the pia over the convolutions reveals a number of interesting conditions in these fairly early cases. The trabecular framework of both laminæ of the membrane is greatly thickened, the meshes are pushed apart one from the other, and the lacunæ in the tissue, especially the lymph channels, besides containing *débris* of hæmatoidin and cellular products, are filled with multitudes of small cells, having a nucleus large in proportion to the amount of cellular protoplasm. So abundant is this new formation that where the inflammation has reached its greatest intensity the channels for the lymph percolation are entirely obliterated, with the exception of one here and there, which, owing to the increase of fluid sent through it by the heightened pressure, appears to be distended. The point of primary departure for this new cellular outgrowth appears to be in the connective-tissue sheath of the arteries and veins. In certain areas where the process is least florid the adventitia is found to be thoroughly permeated with the round nuclei, stretching and distending the fibrillary elements; where it has been most intense the pial meshes and adventitia are so closely filled by the cells as to be inseparable one from the other. The media of these diseased vessels also has undergone morbid alteration; the sheath is thickened, though to no great extent, but the component elements show beginning degeneration of the nuclei, with hyaline changes in the muscular cells, or the whole layer is so infiltrated with round cells as to render the proper elements indistinguishable. The membrana elastica is often undisturbed, occasionally reduplicated, and may even present a number of shirt-frill new formations. The intima is often slightly thickened, especially as regards the subendothelial elements, but only in rare instances is there any great degree of narrowing of the lumen or disturbance of the endothelium, although what is present must be sufficient to cause some diminution of the blood-carrying capacity.

The region of the epicerebral space shows, perhaps, the point of greatest intensity of the nuclear proliferation. The process, start-

ing from the outer sheaths of the arteries and veins descending into and ascending from the gray matter, fills with thick masses of cells, at times even laminated, the visceral layer of the pia. Hence they overflow across the epicerebral space and penetrate among the elements of the brain tissues. This space is now completely filled by the new elements, the lymph channels are blocked, except just at the points of exit of the larger vessels, where there is left a channel of smaller or greater size for the flow. The pia at these points is raised completely away from the surface. In the spaces intervening between the vessels, the pia and brain matter are now intimately connected and cannot be separated without destruction of membrane and brain substance. Beneath the peridyme the new cells penetrate in numbers, having their point of departure not from the sheaths of the arteries, but by a direct extension from the new cellular elements filling the epicerebral space. At certain places, however, in the depths of the furrows, nuclear proliferation and penetration by the new elements into the tissues may be seen extending from a vascular sheath, but this latter condition is more marked in the extrapial regions of the cortex when the disease is rapidly advancing.

In older cases, those that have run a course of years before death has resulted, often after a series of epileptiform attacks, and also in those cases that are not so directly due to specific infection, the inflammatory process in the pia and adjacent brain areas is neither so florid nor so distinctive. The pia is not so thick nor so packed with proliferated round cells, nor is the membrane so intimately adherent to the cortical surface, but shows a minor amount of infiltration, while the vascular lesions are much less prominent.

In the very old cases, with a clinical picture of advanced and permanent dementia, in which signs of any active morbid process have long ago disappeared, the hypertrophied pia shows little tendency to adhere to the cortex, but is rather lifted away from it by the œdema, now a prominent feature of the morbid process. The vascular lesions also are decrescent, though thickening of the internal lining is not wanting and the media is commonly hyaline. It is probable that in these late cases the inflammatory proliferation and thickening of the pia mater and adventitial layer of the connected vessels has undergone retrogressive changes, leading to partial absorption of the new products of cell proliferation and leaving prominent the resistant trabeculæ and the thickened media and intima of the arteries.

Lesions of the Cerebral Tissues.—In all cases in which the disease has been prolonged over years the brain is atrophic, filling out only incompletely the skull cavity. On section, the convolutions are markedly thinned and shrivelled, or else flattened; the vessels are distended as if from paralysis or actual disease of their muscular coat; the medullary substance is infiltrated with an abundant serum; and the ventricles are markedly dilated. Even after the imbibition of the serous fluid the brain of the paralytic has lost considerably in weight, averaging 1,050 to 1,150 grammes, although in rare instances it may weigh more than the normal average.

The different parts of the hemispheres have usually suffered unequally in the morbid process. The stress has fallen principally upon the anterior and middle lobes, while in the posterior lobes the atrophy is not usually so great. The cortex in the first two regions may be reduced to a narrow band, representing only the half or third of its former thickness. It has also suffered in colour, the normal gray being replaced by a dull-white or gelatinous gray, hardly distinguishable from that of the medullary masses. The consistence in advanced cases is also increased both in the gray and white substance, which are rather leathery in their resistance to the knife, having lost some of their natural softness. Capillary apoplexies are uncommon in chronic paresis.

In the infrequent instances of the acutely progressive form, which have come to autopsy, a condition is seen which can be readily imagined to be the forerunner of that found in the prolonged cases. The brain substance, especially in foci, appears to be intensely hyperæmic; the vessels are distended and engorged, and where the vascular turgescence is greatest, there is swelling of the substance, due partly to the congestion and partly to the œdema. The hyperæmic spots may extend over an entire lobe, or may be scattered here and there over the anterior or parietal lobes. One hemisphere is often much more extensively implicated than the other. The pia over the surface shows similar foci of hyperæmia, marking local extensions of vascular disease, and it is at these points that the membrane becomes most strongly adherent to the gray matter, its removal producing the so-called *decortication* of the surface.

Microscopic Pathology of the Cortex

Although the lesions of the cerebral substance seen under the microscope in cases of general paralysis are manifold, no single one of them can be strictly said to be pathognomonic of the disease.

The changes here present many points in common with those in the meninges, the lesions of the vascular system being distinctly of an inflammatory order, those of the nerve structures and neuroglia representing degenerations.

The nutrient artery and vein, the lymph channels, and connected lymph-neuroglia system, the structure of the nerve cell together with that of the related nerve fibre, all show morbid alterations.

The several views as to the primary point of departure of the process are as varied as are the several morbid alterations of the structures involved. According to some the vessels are primarily implicated, while others hold that the changes start in the nerve cell and nerve fibre and thence invade other structures.

There has been a growing tendency within the past few years to regard the lesions of the blood-vessels as dependent in a majority of instances upon the direct or indirect effects of syphilitic poison. Certain it is that the intrinsic lesions and the weight of the evidence, as a whole, obtained from the autopsy table, favour this view. Under the older chrome-hardening methods, not a few varieties of vascular diseases escaped notice, since they did not show up with sufficient distinctness to allow of an accurate determination of their nature, even with the microscope. With the introduction of the alcohol, sublimate, picric acid, and aniline methods, we are now able to demonstrate these with absolute certainty. Quite a long list of writers could be cited, including, among others, Binswanger, Koppen, Bevan Lewis, Colella, Siemerling, Mendel, Clouston, Moll, all of whom have found early changes in the vessels, some antedating any ascertainable alteration of the neuroglia or nervous structures. The arterial departures from the normal are fairly constant in their character, consisting of a periarteritis of the nutrient arteries, with secondary alterations in the media, usually in the form of the ordinary hyaline degeneration.

Mendel's experiments in centrifuging dogs, thereby inducing a pseudo-paresis, go to show that vascular lesions are readily produced whenever any intense disturbance of the circulation of the brain has been produced, either by an œdema from retardation of the lymph flow, or by direct hyperæmia of the brain from dilatation or paralysis of the arteries and veins. A constant finding at the earliest autopsies on the human paretic consists in a vascular dilatation and hyperæmia of the cortex, which is always, however, accompanied with or preceded by distinct vascular lesion.

While it cannot yet be regarded as an established fact that vascular disease precedes all cases of paretic dementia, this theory, while affording a ready means to account for the pathological etiology, would enable us to follow out the various steps in the clinical picture of the disease.

Thus, the first stage, that of mental change and irritability, would correspond to the inception of the vascular disease, slight proliferation of new elements in the sheaths, on account of which the nutrient serum encounters some difficulty in finding its way through the thickened arteriole-capillary wall. The second stage, that of active delusion and motor excitement, would come when the nuclear proliferation, dilatation of the lymph space, and filling up of the same with cells and cellular *débris*, would be sufficient to dam back into the brain tissue the devitalized serum, inducing both œdema and cell-hunger from the imperfect circulation of the necessary nutrient fluid. Many of the epileptiform and apoplectiform crises, no cause for which can be found in the naked-eye examination, might readily be due to the plugging of the perivascular lymph canal, either temporarily with leucocytes, or later permanently with proliferated round cells. It is not even necessary for the whole lumen to be filled up, since a sufficiently serious damming back of fluid into the brain, with its attendant nerve storms, could be induced by the partial closure of the canal extending from the nervous matter through the pial channels. The final stage, that of dementia, would occur only when the arteries are profoundly diseased, and their surrounding canals completely obstructed by the cellular overgrowth and accumulation of *débris* from many sources. According to this view the degeneration of neurones and neuroglia play an entirely secondary part, the cell atrophy and scleroses of the tissue following the lesions of the blood-vessels. The implication of the vascular neuroglia would also be consecutive to that of the blood-vessels, the swelling of the podasteroid cells occurring at a comparatively late period, when the disintegrating nerve cells afford a large amount of dead tissue to be absorbed and carried off by the corresponding lymph system. The molecular matter cast into the lymph channels helps in these later stages to block the canals in the brain and pia.

The weak point in this vascular theory of the causation of dementia paralytica is the comparatively small degree of proliferation of nuclei in the external sheath, and the comparatively slight blocking of the lymph channels demonstrated in a minor number of cases.

It is true, however, we find here vascular lesions other than those calculated to destroy the efficiency of the lymphatics—hyaline alterations in the media and thickening of the more internal layers—and these would certainly be sufficient to deprive the neurones of a considerable portion of their nutriment. We also know that the adventitial proliferation after reaching a certain stage of growth has a tendency to retrograde, leaving only the altered middle and inner layers to mark its former presence. The question of hereditary instability of tissue should also be taken into account in a consideration of the vascular theory of general paresis. It cannot be doubted that a much slighter disturbance in the flow of the natural nourishment to the nerve substance would induce in one individual cell lesions of far greater import than in another with strong hereditary stability; just as we find that an advancing arteriosclerosis and atheroma in the aged may affect one individual to a far greater extent, so far as the intellectual functions of his brain are concerned, than another of more positive equipoise, even though in the two the vascular lesions are of the same extent. According to the vascular theory of the inception of general paresis, therefore, we have a diffuse parenchymatous degeneration, with eventual atrophic alterations in the nerve cells and part of the neuroglia structures, as the result of an inflammatory process starting in the sheaths of the arterioles.

As has been shown above, the lesions of the lymphatic system are entirely secondary to the inflammation of the coats of the pial and cortical vessels, the epileptiform crises and transient paralyses, which result largely from their stoppage, only coming at a comparatively late stage of the disease, when the lymph ways of the pia are in part occluded, and the perivascular channels obliterated or narrowed by the abundant cell growth. In still later stages, when the paretics usually come to necroscopic examination, the channels have again been partly cleared by the resorption of disintegrating cells. This is often seen both in the pia and cortex, but especially in the optic thalamus. Such a lymph channel will afterward remain enlarged, with the vessel clinging closely to one corner of the extravascular space whither it has been pushed by the florid outgrowth; but by this time the damage to the neurone is past hope of repair, and the removal of the obstruction is of no avail.

The new growth of round cells, at first confined to the adventitia, then spreading into the lymph sheath and brain substance as

well as through the meshes of the pia, forms the most frequent vascular alteration of paresis, and presents little difference from that found in various syphilitic processes in the brain. The starting point is not always in the vessels of the meninges or in the larger arteries at the base, but is quite frequently within the brain substance itself. Indeed, the pial arteries are sometimes only slightly involved at a time when the intracortical vascular lesions are profound. In other cases the reverse may be seen. Veins as well as arteries are implicated, and except that the inflammation may be more intense at one point than another, the disease may be strictly said to be universal throughout the hemispheres. It is unlikely that the ordinary renal lesions, so commonly seen in paresis, and which for the most part are on the order of sclerotic degenerations, have any significance further than that they belong to a general process of deterioration affecting the tissues of the entire body. But it should be remembered that a chronic uræmia, with contracted kidneys, sometimes gives rise to symptoms similar to those of progressive paralysis, and that the chronic periarterial changes may also be present in such cases.

While the round-celled growth in the adventitia is far more common than any other lesion, hyaline degeneration of the media, without any pronounced degree of adventitial thickening, is also met with, even in the most acute cases that come to the autopsy table. The morbid change is quite similar to that described in the chapter on vascular degenerations, and is accompanied by a compensatory thickening of the internal layers, with some narrowing of the lumen. In the vascular lymph spaces, particularly in the inner one, are found red and white blood cells, coagulated lymph, amorphous and crystalline blood pigment, raising the adventitia away from the media. Here the degeneration in the nerve elements must be referred to starvation, together with toxic effects arising from the more active inflammatory process attending the periarteritis, though in this latter instance there may be also a direct disorganization of the nerve elements, in focal areas, from the penetration among them of myriads of newly formed cells.

Simple endarteritis of the variety described by Huebner is rather infrequent in paresis. When it is present, cellular alteration may result in unstable tissue in the same manner as with the mixed medio-endothelial form.

Lesions of the nerve-cell structures may present quite a variety of forms in this disease. Nissl is to-day the chief exponent of the

doctrine that in general paralysis the primary implication is in the neurones. But upon what grounds he bases his conclusions it is difficult to determine, since in the very earliest obtainable autopsies the protoplasmic alterations found are most indefinite in comparison with those in the vascular apparatus. In a recent case that died at the beginning of the second stage after a period of prolonged excitement, the vascular lesions were intense, and the implication of both the vascular and support neuroglia was profound, and yet the investigation of the neurones gave practically negative results, both by the methylene blue or the more usual carmine method. Thus with the former stain the disposition and size of the granula were shown to be quite normal, and the achromatic substance exhibited no abnormalities in its tingibility; there was no atrophy of the cells, and the only pathological change consisted in a slight thickening in many of them at a certain point in the nuclear membrane.

In the late second and third stages of paresis all the lesions of the neurone assume a retrogressive character. Chief among these is the pigmentary degeneration, which involves the cells not only of the cortex, but also those of the basal ganglia and cord; indeed, the degeneration is universal throughout the nervous system. Fatty metamorphosis in the cells is also seen with comparative frequency, the infiltration with flat globules leading to eventual atrophy and destruction of the entire cytoplasm.

Hyaline change, vacuolarization, and swelling of the cell are also mentioned by various writers, but this last form of degeneration I have never met with in the brain of the paretic.

Calcareous deposits are not often seen within the cells of the cortex, although they occur now and then in advanced stages. The protoplasmic processes are short, stumpy, twisted, or bent upon themselves. The protoplasm is shrunken, granular, with irregularly stained particles embedded in it, and the cell may eventually dwindle to a small mass confined to one corner of the cellular space.

Simple atrophy of the nerve cells is comparatively frequent. There is now no increase of cell pigment; the cytoplasm absorbs more than the normal amount of the aniline dye, is finely granular, and ultimately disintegrates into a small mass of detritus, the atrophying nucleus being distinguishable to the end stages among the deeply stained molecular detritus.

The pericellular spaces are often either actually widened, or they appear to be so, owing to the shrinkage of the cell body. They

seldom contain anything beyond a few wandering cells and the detritus of the nerve cell.

The nuclei of the nerve cells show changes similar to those of the cytoplasm. When the vascular lesions are advanced, and the cell is atrophying, the nuclei also participate in the necrotic process. The membrane becomes irregular and shrunken, the caryoplasm is altered in its staining properties, and the chromatin filaments disappear. The nucleolus and adnucleolar particles diminish in size, though still remaining near the centre of the nuclear ring, and the nucleolus is finally reduced to a hardly distinguishable pin-point of deeply stained substance. Cells that show no nuclei are also frequent, but this appearance is usually owing to the covering of the vesicle by overstained protoplasm.

In a majority of cases of advanced paresis there apparently occurs a disappearance of the cells *in toto*, especially of the third layer. Areas of considerable size are found in which no nerve elements are left, and a close examination with high powers will reveal either entirely empty spaces, or the *débris* of the cell in one corner of the space. In the immediate neighbourhood of these much-atrophied cells, other areas that present but little ascertainable alteration of the cell body can be found.

The Golgi and Nissl methods have, unfortunately, added but little to our knowledge of the conditions of the neurone in paresis. Various changes in the receptivity of the granular and achromatic substance to the blue dye are noticed, but they are of such an indefinite character that it is impossible to draw sure deductions from them. The silver method shows varicose atrophy of the dendrites, which may be altogether a post-mortem change, though in addition shrinkage of the protoplasm may be noticed, the latter condition being hardly attributable to alterations after death. The method has also the fault of staining the apparently most healthy cells, and leaving those affected by disease untouched by the impregnation.

Since Tuczek, Kronthal, Friedmann, Meyer, and others discovered that in the convolutions of the paretic there was a considerable diminution in the numbers of the intrinsic medullated tubes, various hypotheses have been built upon this disappearance of fibres as the primitive lesion of the disease. In the brain of any advanced case of paresis, loss of the tangential as well as of the radial fibres may be determined in Weigert-hæmatoxylin or aniline-blue-black preparations. In the early cases this decrease is not profound, but in the later ones it amounts to absence of a large part of all the medul-

lated fibres from the cortex. The change is coexistent with the degeneration and consequent absorption of the nerve cells, and cannot be regarded as being separate and apart from these processes. It implies solely that the death of the protoplasmic body finally entails the death of the entire neurone, the degenerating fibres being found not only in the cortex but also in the white medullated masses of the centrum ovale, and occasionally in the descending pyramidal tracts to the cord. Nothing is known of the condition of the fibres that ascend from the medullary masses into the gray rind, though, presumably, they in common with the autochthonic ones are destroyed.

Lesions of the neuroglia are demonstrable in the majority of established cases of paretic dementia, and even in the incipient stage presumptive evidence is not wanting. The first lamina of the cortex is nearly always converted into a mesh-work of neuroglia fibrils, showing here and there the stellate body of a cell, from which numerous long fibre-processes radiate in all directions. Scattered through all the gray layers, as well as in the subjacent white substance, stand out cells of a type similar to those in the higher regions. These cells, especially with the alcohol-safranin method of staining, are invisible in normal preparations, except for their nuclei, but in paretic dementia the body becomes very prominent, taking on a pale yellowish colour that immediately attracts the eye. Nuclear changes are also visible in these altered elements. Some of these are proliferative in character, the nucleus being in process of division, while others are apparently undergoing retrogressive metamorphosis, the nucleus shrinking and its contents assuming a very granular character.

The chrome-silver method renders in the case of the neuroglia a more distinct service than with the neurones. In well-marked instances of paresis, everywhere, but particularly in the most external and internal layers of the cortex, dense aggregations of long-rayed star cells with long extensions, felted together in fine mesh-works, take the stain. When the nerve elements are almost or completely degenerated, those of this type in the neuroglia are apparently more numerous than in health, marking an advancing sclerosis of the brain rind.

The vascular neuroglia cells are much less readily determined in their final relations to the other structures than the long-rayed support elements. When the perivascular channels are partly or completely obliterated, and the neurones are degenerating, the cells

become swollen from the accumulation within their bodies of absorbed detritus. Afterward they are not readily stained, and from the indistinct pictures that are obtained it would seem as if they also were destroyed in their attempt to remove the *débris* of the nerve cell. In those localized areas of the cortex that retain a portion of the nerve cells more or less intact, the vascular neuroglia persists to the end stage of the disease, neither proliferating nor degenerating. There are always some arterial areas, even in the most diseased portions of the cortex, that show far less implication than those adjacent to them, and though, by the Golgi stain, these cannot be differentiated with certainty from the less healthy areas, it is more than probable that the retained nerve and vascular neuroglia cells belong to them.

In concluding this chapter, it should be stated that general paralysis of the brain is a malady not limited to the cortex in its pathological features. It is true that this portion of the nervous system is the most important of the regions involved, and for this reason it has been selected here for especial study. But it must be thoroughly understood that all the rest of the nerve tissues, the basal regions, ganglia, cerebellum, and cord, as well as the thoracic and abdominal viscera, particularly the renal organs, are sooner or later implicated in the progress of the disease; and as Siemerling and Boedecker have shown, the bulbar nuclei may be affected in precisely the same way as the cells of the cortex, while the cranial nerves may undergo degeneration of their medullated fibres.

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SYPHILITIC INSANITY

The implication of the mental functions in cerebral syphilis is of comparative frequency, for despite the fact that lues never directly affects the nervous tissues, the secondary degenerations following diminution in the blood supply from arterio-venous disease, together with the increased intracranial pressure and retardation of the return of the blood from the cranial tissues, as a result of syphilitic inflammation of the meninges and tumour formations, lead to degradations of the nerve cells and fibres, that manifest themselves in the most varied bodily and psychical symptoms.

So far as I have been able to ascertain from private records, as well as from those of the City Asylum, syphilis with disturbance of the functions of the mind is quite as frequent or even more common than general paresis and tabes dorsalis. I am aware that the statement is strangely out of accord with the statistics of Clouston, who in over three thousand cases of mental alienation, from among all classes of society admitted to the Royal Edinburgh Asylum, found only sixteen cases of syphilitic insanity. Perhaps the divergence may be explained by the fact that all cases under forty years of age that are hæmiplegic or monoplegic, with temporary or permanent mental disturbance, and in whom there are no indications of renal or cardiac lesion, are with us ascribed to syphilis, as are likewise many of the obscure dementias that occur between the twenty-fifth and fortieth years.

The age at which syphilitic insanity appears is somewhat more varied than is the case with its congener, paresis. Approximately about one half the sufferers are in the third decade of life at the time of the onset, about one third in the second, and most of the remainder between forty and fifty, with a scattering number after the last-mentioned age (Gowers).

The localization of the disease within the brain may begin at any period after the infection. The commonly accepted belief that cerebral syphilis is one of the late manifestations of the poison, is, like many other accepted creeds, an error. It has been known to

begin within one month after the date of the infection (Gilles de la Tourette, Alelakoff), or to be delayed for more than forty years thereafter. Certainly psychoses of specific origin are by no means so rare during the florid period of syphilis as has been supposed, a majority occurring within the first three years after the date of the appearance of the ulcer. Statistics on these points vary but slightly. Heubner, for instance, among fifteen cases of syphilitic tumours of brain and cord with accurate histories, found that while only two began within a year after the inception of the disease, the majority had just passed a three-year limit, but at the same time there were also two examples in which the cerebral implication commenced thirty years after infection. Gowers gives the following synopsis of 26 cases of syphilitic brain disease: 3 began within the first year; 6, within three years; 4, within six years; 4, within nine years; 2, within twelve years; 2, within fifteen years; 1, within eighteen years; 1, within twenty years (nineteen years after infection). Thus, 16 cases, or nearly 62½ per cent, began within the first six years after the appearance of the initial sore. Schulte found among 49 syphilitics that 6 showed cerebral symptoms within the first year, 16 within ten years, 7 within twenty years, and the balance, 40 per cent, at later periods. His cases show a larger number of later manifestations than those of any other writer. Hjelmann, in a much larger material, comprising 230 cases from the Helsingfors Hospital, and 200 from the literature, found that localization began in the brain in 25 per cent of the cerebral cases within the first year, and in 50 per cent within three years; from that time on the frequency diminished, and after twenty years it was exceptional. The same writer finds that among every 1,000 persons afflicted with the loathsome disease, even when general paresis and tabes are excluded, from 15 to 25 have brain syphilis.

There are no ascertainable statistics bearing upon the percentage of psychoses in cerebral lues beyond the doubtful statement of Heimann, that about forty-five per cent of cerebral syphilitics show mental disturbances. It is certain, however, that they do occur with considerable frequency, as might well be supposed from the peculiar territory of the brain affected by the disease—the meninges and blood-vessels.

The pathological substratum of syphilitic insanity consists in (1) syphilitic tumours, gummata, or syphilomata, and (2) specific disease of the brain arteries. I am inclined to believe, from the

records of the autopsy table, that the latter is by far the more frequent type of the affection. In these two forms of intracranial disease we have the essential elements in the causation of insanity: insufficient supply of nutrient plasma to the nerve cell, and direct increase of the intracranial pressure.

The question why one man affected with cerebral syphilis has mental implication, and another diseased in the same way escapes it, has caused much discussion. The explanation probably lies not in any difference in the quality of the poison circulating through the blood channels, but in the individual susceptibility of the tissues of the person to disease in general, the one previously constitutionally sound resisting to the utmost tissue degradation, the other with inherited tendencies to cell decay falling a ready victim to the toxine.

While most complicated in its symptomatology, syphilitic insanity has always been of extreme interest to the psychiatrist, as it is the one form of alienation in which the post-mortem appearances fully correspond with the clinical symptoms. These pathological lesions have been so fully considered in the chapters on syphilitic lesions of the blood-vessels and dementia paralytica that it is unnecessary to repeat them in this place, and we can pass on at once to the numerous clinical expressions of the disease. Psychic and somatic symptoms are so commingled that it is difficult to classify them as belonging to typical forms, though we are obliged, necessarily, to give those having mental prominence the first place.

In nearly seventy-five per cent of all cases there has been complaint first of headache, chiefly of a nocturnal character, often of great severity and unrelieved by ordinary means; then of sleeplessness, partly owing to the continued pain, and lastly of vertigo. These constitute, in the majority of instances, the prodromal indications. Afterward follow a series of mixed motor and psychical disturbances of the most varied character, among which may be especially mentioned fleeting pareses and paralyses, epileptiform convulsions, sudden faints, abrupt attacks of furibund mania followed by half-comatose conditions, from which the patient may be awakened to answer slowly but coherently questions addressed to him, only to return again to his dreamy state when the stimulus is removed. The pupillary symptoms, though not so frequent as in paresis, are on the same order; also irregularities in the size of the pupils and mydriasis are more often met with than spastic myosis.

The sudden change from mental health to the depths of a dementia, the frequency of agonizing pain and convulsions, the wildness and confusion of the delirium, attended in many cases by partial pareses, are all typical of the luetic process. Combinations of paralytic affections of the extremities with ptosis, abducens, and ocnlo-motor paralyses occurring with mania and stupor, should always attract attention to the true character of the disease, and should suggest to the attending physician the necessity of immediate and active treatment. The fundus of the eye would often give the required clinch to the diagnosis, certain forms of optic neuritis being pathognomonic of specific trouble, but unfortunately it is often impossible in a wildly excited or half-stuporous person to determine anything positive by an examination either of the retina, vessels, or optic nerve. Nevertheless, when circumstances admit it, the examination should always be attempted.

In all cases presenting the above described symptoms, in which no history of an infection can be obtained, a close examination should be made of the iris for adhesions, and of the skin for the remains of symmetrical, papular, or pustular eruptions, as well as for any bronzing, which persists sometimes over many years. Healed or still persisting caries of the cranial or other bones, syphiloma of the testicle, or the characteristic swelling of the lymphatic glands will often rivet the diagnosis.

The principal mental disturbances occurring in brain syphilis are: 1. Sudden, furious delirium of short duration, followed by half comatose states. 2. Delusional syphilitic insanity. 3. Various forms of slowly progressive dementia attended by incomplete paralysis of the extremities and external ocular muscles. 4. Dementia attended not by paresis, but by epileptiform attacks. 5. Syphilitic epilepsy.

Furibund Delirium.—The first form is more characteristic of the florid syphilis than of the later stages. I have seen it in patients within six months after infection, when the roseolar and squamous eruptions were still most vivid. On the whole, however, it is an infrequent manifestation. The prodromal symptoms are headache, vertigo, occasionally blurring of the vision, with alteration of the disposition even to moroseness. Then ensues a more or less sudden attack of mania of a furious type lasting for days, more rarely weeks, which gives place to a half-comatose state, the patient lying with quivering eyelids day after day or week after week, requiring to be fed, and only roused for a moment from his sleepy

state, at which time he can answer questions coherently, but in a curious, slow, disjointed manner. There is ordinarily a slight elevation of temperature marking the acuteness of the brain process, which, from the few autopsies of which there is any record, must be ascribed to neoplasms in the vessels.

This form of specific psychosis is, under energetic and efficient treatment, fairly curable, but leaves the patient always a little demented, or, at best, seldom equal to his former self.

Syphilitic delusional insanity is a rare form of psychosis. If there has been only a slight degree of arterial disease, perhaps attended at its height by minor apoplectiform seizures, although the morbid process has afterward retrogressed, there may still remain behind a certain warping of the functions of the brain owing to the deficient nutrition of certain areas of the hemispheres, that shows itself in the gradual evolution of delusions of persecution. This delusional type is found especially in persons who have inherited a strong predisposition to insanity, and may closely simulate paranoia.

The delusions are very varied—persecutions of the individual by unseen agencies, tortures by diabolical instruments worked by hidden hands, attempts to poison him, and similar perversions. Aural hallucinations are sometimes noted, but are rare. More commonly met with are perverted sensations in the skin arising from changes due to the irritation of the cutaneous nerves by the virus. Treatment of these cases is ineffectual, the lesions being organic and permanent.

The third form, *progressive dementia with paralysis*, is perhaps the most frequent of the several types, and from the presence of fleeting paralysis affords an extremely striking clinical picture.

The prodromal symptoms are the usual headache, a feeling of physical inability to accomplish work of any kind, then incomplete ptoses or oculo-motor paralysis. This decrease in power in the ocular muscles comes about slowly, and never attains to an entire loss of their functional activity. Implication of the external rectus is more frequent than of the other straight muscles. The peculiarity of the paralysis is that it is never complete; the ptosis is partial, the eyelid not drooping sufficiently to completely obscure vision, and the paralysis of the recti is rarely enough to show a squint of a decided character. Combinations of paralysis of the several ocular muscles, the oblique and straight, are sometimes seen, and nystagmus is a not infrequent accompaniment. The oblique muscles are

less frequently involved than the recti. With the ocular symptoms anæsthetic patches are frequently found over the eyebrows and on the skin of the nose and cheeks. Loss of vision from optic neuritis is fairly frequent.

The partial paralysis of the ocular muscles may persist for days or weeks before the onset of mental symptoms. The latter are varied, and, like those affecting the eye muscles, often change from day to day, being now intense, now mild. There is nearly always a stage of irritability lasting for days, usually several weeks, and occasionally amounting to maniacal excitement, after which the patient may be for a time depressed. By this time a noticeable degree of mental reduction has been reached, the finer details of life being forgotten and neglected. Rarely are there more than transient delusions, some fanciful, others approaching expansive forms. The delusions of to-day may be entirely lost on the morrow and never recur.

Unless the disease is arrested at this stage there now begins a series of phenomena of grave import. The patient may waken in the morning with a paresis of the arm, leg, or face, which during the succeeding days slowly recedes until complete use of the part is regained. Motor aphasia now and then accompanies the paresis, and is also transient. At other times similar attacks occur during the waking hours. Epileptiform seizures or the mixed form—convulsions followed by transient pareses of one or more extremities—is even more frequent than the apoplectiform or epileptiform seizure alone. They are usually heralded by indications of intense cerebral hyperæmia and stasis, the face becoming at first congested, afterward of a livid blue, the pulse being full and of high tension, so that death from acute œdema may seem imminent. Convulsions now begin, frequently limited at first to one extremity, then becoming more widespread, and finally universal, if the seizure be prolonged. In a few days physical health is again restored, but with each successive insult the patient is left more and more demented. The general mental condition after a time becomes exceedingly degraded, the patient being apathetic, somnolent, untidy, the passage of fæces and urine into the clothes being customary. Seldom is there any actual bladder paralysis.

The end is reached either after a series of epileptiform seizures, the convulsions following one another with great rapidity, or the patient, ceasing to suffer from the apoplectiform and epileptiform attacks, may become demented to the last degree, incapable of feed-

ing himself or attending to the necessities of nature, and may remain in this state until removed by the chance occurrence of some acute pulmonary or abdominal trouble.

The pathology of this type of specific disease seems to be entirely in the vascular system. All forms of periarteritis and endarteritis are found narrowing the lumen of isolated vessels, finally almost shutting off the blood supply. Local softenings are then seen in the immediate neighbourhood of such obliterated vessels. Inflammatory conditions of the pia are almost always present in the earlier stages and may afterward recede.

Dementia without Paralyses.—The fourth form is also probably dependent on a luetic process in the arteries of the brain substance and meninges, but the lesions occur in more scattered foci, and the resulting symptoms are less violent. In the few cases I have had the opportunity of examining microscopically, mixed forms of arteritis were seen together, or in isolated areas throughout the central and anterior regions of the hemispheres, the posterior lobes being much less affected. The process rarely proceeds to obliteration of the lumina of the arteries, which, though narrowed, still remain sufficiently open to admit of a fair blood supply. The perivascular spaces contain few round-nucleated elements; hæmatoidin crystals are not numerous, and there is consequently a better passage for the lymph flow.

The prodromata are headache, mentally a change of character, irritability predominating, ill-founded suspicions, loss of self-control. Occasionally there is increase of the *nisus generativus*, more frequently a total loss of sexual desire. Following these come increased irritability, a tendency toward violent actions, loss of the power of co-ordinate thought, and eventually an incomplete dementia, the patient retaining the ability to reason in a feeble, child-like way. There is usually some progressive loss of muscular power, as well as a drift toward anæmic conditions. Paralyses of the extremities, or of the facial muscles, are quite rare, but epileptiform and apoplectiform attacks are fairly frequent. The patient may live on for many years in this half-demented state, never becoming worse, never better, until relieved by death from some intercurrent disease. In the wards of asylums these cases are rather common, though they usually pass unrecognised in the great mass of the secondary dements, from which they differ but little to the untrained eye. Nearly all of them seem to have a thickened condition of the peripheral arteries.

Only in the earliest stages of the process can we hope to accomplish anything by the use of antisyphilitic remedies, and then only by their vigorous application.

The last form of syphilitic psychosis with which we have to deal is the *genuine epilepsy of luetic origin*. While presenting the ordinary indications of that disease, more fully described in the chapter on Epileptic Insanities, it has this pathognomonic indication, that it is always acquired in middle or advanced life (thirty to fifty years) after antecedent luetic infection. The convulsions may be either partial or universal, but are usually attended by complete unconsciousness. Post-epileptic mania and lethargy, in my experience, are more frequent in the specific than in the idiopathic forms. This form of epilepsy shows more rapid mental deterioration, slowing of thought, weakness of memory, and eventual dementia, than the idiopathic variety.

Slowly increasing pachymeningitis would account for the majority of these clinical symptoms, but the records are lacking at the present date. All the cases I have examined have had some arterial disease that could be recognised. Gummatous new formations have also been found lying upon the convexity of the hemispheres, especially in the motor region.

The *treatment* of these several forms of syphilitic psychoses does not differ from other luetic affections, and need not be entered upon *in extenso*. Mercurial preparations are the chief reliance at all stages, either in the form of inunctions of blue ointment, oleate of mercury, or the sozoiodolate. The last is rapid in its effects, but its use cannot be long continued, as it is very irritating to the skin, and gives rise to a pustular eruption. The inunctions should be used frequently, and not in too small amount. Better salivation with cure than a progression of the disease to dementia; and, besides, it is remarkable how much mercury these cases will take without the production of disagreeable effects. When there is doubt if the disease is specific, it is better to apply an energetic mercurial treatment than wait for some positive indication to develop. Even *in foro conscientiæ* many syphilitics will not admit of the possibility of the presence of the vile poison, and their positive assertions to the contrary must be taken with much allowance. Hypodermics of the bichloride, or bichloride carbamidated, the albuminate of mercury, and other preparations of the metal, are all extremely painful, while it is doubtful if they are more rapid than the inunctions, if the latter are efficiently made. If after five or six

weeks' vigorous treatment with mercurials there is no response, it is better to stop than to continue on indefinitely, as mercury undoubtedly causes, when used for too long a time, a serious tissue degradation.

The internal administration of the various salts of hydrargyrum should not be neglected, either during or after the inunctions. The bichloride, green iodide, and other salts, are in common use. I prefer to combine the bichloride with iodide of potassium, gradually raising the quantity of the last-named salt to high doses, believing that it has some effect in promoting the resorption of the products of inflammation around the vessels.

Iodides alone should be given only in tertiary syphilis; even then it is better to add a small quantity of the bichloride to it. The dose of iodide of potassium or sodium for any individual case cannot be accurately set down here; one patient may improve on half a drachm a day, while others may require as much as an ounce. Warm baths should never be neglected in the treatment of cerebral syphilis. Not only do they allay cerebral irritation, but they promote the absorption of mercurial ointments through the skin.

Tonics containing iron, phosphates, and other tissue-builders are indispensable in syphilis. Diet should never be neglected. It should be full, but not too stimulating, and should consist mainly of eggs, milk, vegetables, and wheat meal in all forms. Meat should not be allowed in any great quantity.

In Hjelmann's statistics eighty-two to eighty-eight per cent of the cases had had either no previous treatment before the beginning of the cerebral affection, or it had been insufficient. Collins is doubtful of the efficacy of antisyphilitic treatment to prevent cerebral implication.

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THE PSYCHOSES OF OLD AGE

The truism that a man is as old as his arteries finds an apt illustration in the insanities of advanced life. With individuals who have inherited a sound vascular system, *cæteris paribus*, the signs of physical decadence may be delayed far beyond the biblical threescore years and ten; while with others whose inheritance has not been so good, and more particularly in those who have superadded alcoholic excesses to constitutional predisposition, the retrogressive alterations in vessel and nerve cell begin at a much earlier period of life—from the forty-eighth to the sixtieth year. In individuals commencing at this relatively early date to present indications of arterial and mental decay, the condition is designated *presenile* degeneration, while a similar change beginning after the sixtieth year is termed *senile* degeneration.

With somewhat unnecessary refinement, Wille and other German writers have separated the senile psychoses into two main groups, the *functional* and *organic*, but since in both the underlying basis consists in vascular scleroses and brain atrophy, from a pathological standpoint at least, the distinction would appear to be superfluous.

The clinical segregation of the several classes of psychoses after the forty-eighth or fiftieth year would therefore be:

I. Presenile Insanities.
   a. Excited forms.
   b. Depressed forms.
   c. Confused forms.

II. Senile Insanities:
   a. Depressed forms.
   b. Excited forms.
   c. Confused forms.
   d. Senile dementia.
   e. Senile epilepsy.

I. The *maniacal* forms of presenile alienation are more frequent, in my experience, than those of a depressive type. The usual prodromata consist in a change of disposition, irritability, digestive dis-

turbanees, a varying degree of memory defect, loss of the power of logieal criticism, an inclination to delusions of an expansive nature, the imagined aequisition of wealth or power, intermingled with ideas of an erotic tendeney. Hallucinations, partieularly those referable to vision, are not a prominent feature of these eases. There is ordinarily eonsiderable motor unrest combined with loquaeiousness, and at night the patients are noisy, ineoherent, and obstinately sleepless, though rarely frenzied. The clinieal picture elosely resembles that of one of the forms of general paralysis, and indeed the diagnosis may at times be doubtful.

With the mental symptoms are usually combined some minor disturbanees of the lower funetions of the nervous system—reflexes irregular or somewhat increased, pupils reaeting slowly to light, aeeommodation, and sympathetic stimulation, but rarely spastic myosis or loss of the knee-jerk. Slight speech defeets are now and then observed, most eommonly a persistent hesitation or syllable elision. Nearly all cases show a distinet degree of arterioselerosis, usually not confined to the temporals or radials, but pereeptible in the brachials, femorals, or arteria dorsalis pedis. Advaneed atheromatosis of the eerebral arteries may, however, be present without any very definite thiekening of the radial or temporal arteries.

The *course* of presenile maniaeal exeitement is essentially different from that of paretie dementia. A considerable proportion of the patients recover from the exeited condition within a period of from two to four months, and although they may show minor signs of weakening of the mental powers, as forgetfulness, and an indisposition for the retention of new impressions, they are eapable of returning to their oeeupations for a time, and again beeoming members of the general eommunity.

In a smaller number the mental breakdown is more serious. During the existence of the maniaeal symptoms there may be repeated indications of eerebral stases and eongestions, followed by transient aphasias, perhaps a paretie eondition of one or more members, lasting for a day or two, with ineomplete restitution. These patients soon lose their delusions and motor agitation, beeome passive, and finally demented, remaining in this eondition until eventually they are removed from the scene by some advaneing renal arterioselerotic trouble or a pneumonia.

The *depressed* forms approach mueh more elosely than the maniaeal to the usual types of the funetional melaneholias. After the eustomary prodromata of *malaise* and somatie derangements, the

patients exhibit delusions of self-abasement. They are sunken in the deepest gloom; dreadful misfortunes have befallen them; their property is lost; the world has come to an end; they are condemned to eternal damnation.

These cases are prone to be very slow in returning to mental health, and a proportion, much larger than is found in the primary forms of melancholia, become chronically insane. Those that do recover show less loss of judgment and dulness of the apperceptions than favourable cases of the maniacal form. The prognosis is generally not good, for the reason that those whose mental health is restored remain well only for a time, and usually relapse after a few months. Instances are, however, occasionally met with in which there is a full and complete restoration to mental vitality, but in these the arterial lesions are necessarily not pronounced.

The forms of *presenile mental confusion* are somewhat rare, and usually present the indications of an atypical hallucinatory-confusional insanity, with more frequent remissions that are ordinarily seen with this type of alienation from other causes. Recovery is the rule unless the psychical obscuration is profound, the motor agitation severe, and the remissions are infrequent. It would seem that in the cases proceeding to recovery there is a restoration with equalization of the circulation in the brain, which allows of a return to health.

II. In the insanities of the later epoch, the symptomatology is necessarily influenced by the advancing changes in the bodily nutrition, the so-called "senile marasmus" that precedes nearly all forms of senile mental disturbance. The dry yellow skin hanging loosely over shrunken muscles, the eyes deep set in their sockets, the pronounced arcus senilis, and the high degree of calcareous degeneration of the arterial system—all are typical of the process of retrogression in which the brain shares equally with the other organs of the body. With the physical involution come sensations of dizziness and fulness in the head, ringing in the ears, various paræsthesias of the cutaneous surfaces, caused by the insufficient nutrient supply to the cutaneous nerves derived from vessels no longer able to properly perform their duties. In addition there appears a growing difficulty in the ready recognition of faces, together with a loss of remembrance of the events of daily life, and a tendency to withdraw into the memories of long-past days. Vaso-motor disturbances are frequent; the extremities become cyanotic, and frequently scaly brownish patches form upon the wrinkled skin of the hands.

Nausea is often complained of. Cardiac irregularities accompanied by a sense of suffocation trouble the individual, and are especially prone to come on during the night. The loss of sleep at night renders the person more or less somnolent during the day, and the consequent disregard of the proper meal hours goes far toward aggravating the disturbances of digestion. Rather frequently the sexual appetite is renewed, and increased to a pathological degree. Indecent assaults upon young girls, or exposure of the person upon the public streets, are by no means rare, and are an evidence of increasing weakmindedness. There is often a pronounced tendency to resort to alcoholic liquors, for the stimulus they afford to the circulation as well as for the lightening of the mental hebetude; but, as might be supposed, the apparent benefit is only temporary, and their use only renders the increase in the mental and moral decrepitude still more rapid.

Melancholic depression in senility is by far the most common form of acute mental disturbance. Hypochondriacal notions are usually intermingled with those of a more distinctly melancholic nature. The forms of melancholia attonita are rarely seen, the depression ordinarily assuming the simpler types. There is slight mental inhibition, loss of will power, and growing incapacity for active employment. Delusions of personal unworthiness are noted. The patient has lost his property; destitution is falling upon him or his immediate family. In other cases those of a religious nature predominate. He is lost eternally; the wrath of Heaven is descending upon him for past misdeeds. Hallucinations are rarely present. Suicide in these states is more common than at any other single period of life, and is more frequent among men than among women.

Melancholic indications in the aged are of serious moment, as they ordinarily mark the beginning of the period of active decay ending in a more or less permanent dementia. A few of these patients after a time have their faculties restored, and may live on for years without the recurrence of the depression, but this is rather exceptional.

The senile melancholiac, above all other sick people, requires persistent feeding. This is usually resisted by the patient, and the use of the stomach tube may be necessary—a matter of much difficulty, and not infrequently of actual danger.

Mania is far less common than melancholia. It rarely is of a very severe type, though on several occasions I have witnessed states of extreme frenzy in the aged. As a rule, there is incessant

motor excitement, the patient never resting, but continuing to make aimless movements hour after hour, until one wonders how so much strength can be retained in the emaciated frame. Accompanying the excitement is an incessant garrulity, though with marked poverty of ideation and aural and visual hallucinations. Erotic tendencies are usually uppermost, revolting language is made use of, and masturbation is open and shameless. Indecent assaults, or attacks upon attendants, are frequent. The tendency after a prolonged period of excitement is toward dementia. Recovery, full and complete, is now and then seen, but the trend is naturally toward annihilation of the faculties. Death from exhaustion is by no means rare, and may happen even in curable cases, unless the person is carefully looked after and forcible feeding is resorted to as soon as ever it becomes necessary.

Hallucinatory Confusional Form.—This variety of senile insanity has been more particularly studied by Fürstner. It resembles in many respects that beginning after acute inanition of the brain, and is often associated with advanced atheromatosis. Among other causes may be mentioned excesses in alcohol and venery, and possibly, in rare instances, an autogenic infection following cystitis. Hallucinatory insanities following chronic changes in the renal organs are not infrequent in advanced life.

The prodromal symptoms are headache, constipation, vertigo, irritability, sleeplessness, and emotional states, followed occasionally by transient attacks of unconsciousness or stupor. Added to these is pronounced memory defect, sometimes amounting to absolute oblivion of current events, and more or less disturbance of the faculty of speech. The onset of the breakdown is always acute, much more so than with other senile psychoses. There is extreme excitement, followed within a few hours or days by confusion. Hallucinations are now the dominant feature, accompanied by the indications of extreme anxiety. Aphasia, loss of facial innervation, irregularities of the pupils, and absence of the deep reflexes are among the common somatic manifestations.

The *prognosis* is not unfavourable, as about one half the patients return in the course of a few weeks to their previous natural condition. Enforced feeding, with such medicaments as combat the defective circulation (alcohol, digitalis, belladonna), form the appropriate treatment.

Senile Dementia.—The natural changes in the various tissues of the body before alluded to as incidental to old age tend, with every

one of advanced years, to bring about a mental decrepitude. With the majority this amounts only to the loss of a certain power of mental assimilation for the events of to-day, with a constant reversion to those of youth and early middle life, which stand out in ever clearer perspective. To these infirmities are added a certain degree of forgetfulness, and a loss of the power of logical criticism.

In not a few instances, to these symptoms are added a mild degree of motor unrest, periodic rather than constant in character, a purposeless wandering hither and thither without aim or object, especially during the night season, in which these patients are sleepless and disquicted. Garrulity, and an inclination to repeat over and over again the trivial events of their past lives, are also commonly noted. Gradually fabulous tales are added to actual reminiscence, and lacunæ in remembrance are filled in by silly extravagances.

The comprehension suffers more and more as the months roll on, mental digestion in abstract and precise matters falls into abeyance, thought becomes more difficult and automatic, and eventually a degree of mental reduction is reached, which varies with each individual.

Throughout this evolution of a senile dementia the individual's own personality is always uppermost; his eating, drinking, difficulties of digestion, the daily alternations in his corporeal perceptions, good or bad, are always uppermost in his contracting mind, and the perpetual brooding over trivialities induces mild hypochondriacal and melancholic states. Events that do not directly concern himself in his eyes are of no consequence; relations or children may die, all his worldly possessions may be lost; so long as his creature comforts are obtainable, other things make no impression, and it is only when they are lost or omitted that he is roused to angry recrimination and excitement. Every denial irritates the senile dement; dictatorial, egotistical, and cruel, he has absolutely lost all consideration for the rights or feelings of his neighbour.

In his temperament he often shows a curious compound of silly mirth and tearful depression, mingled with increasing complaints of the lack of attention received from those who should care for him in his old age. Not uncommonly the sexual desire is greatly increased in these dotards, though they may lack the actual power of gratifying it in a natural way. In such cases the proclivity not infrequently finds vent in lewd speech and obscene letter writing. Plans of marriage are formulated and declaimed upon. Less fre-

quent are attempts at rape, especially upon children. Shameless exposure of the genitalia in public places not uncommonly brings them into conflict with the civil authorities, which ends in incarceration in an institution. With women, sexual delusions of a different char-

Fig. 22.—Senile Dementia. The patient had periods of extreme loquacity followed by a mild depression during which she would complain of her fears that she was not to have Christian burial. The facial expression is one of anxiety. From a photograph kindly loaned.

acter are more prominent. They are nightly ravished, or carried to houses of prostitution; or they imagine that they are followed through the streets by men who wish to assault them.

Definite hallucinations are somewhat rare among the aged insane, and those that do occur are of an elementary order. The fre-

quent advancing deafness gives rise to failure to appreciate properly impressions received from external agencies. The clanging of bells, the whistling of locomotives, or the whir of the trolley car is misinterpreted, and converted into the imperfect perception of voices. Hallucinations of sight are even less frequent. On the other hand, the faulty registration of cutaneous sense impressions are interpreted and spoken of as due to the machinations of imaginary enemies.

Of the various delusions that afflict the senile insane, those of persecution are the most usual, and are an outcome of a certain well-recognised mistrust and suspicion observed in the majority of dotards. Every hand is now unfriendly to him, poison is placed in the food to rid the world of him, he is to be killed, his bowels are to be torn out—these are only a few of his insane fancies. All is changed, the world is darkened, unpleasant dreams disturb his rest at night, and he wanders forth seeking his former home and quiet. The previous occupation of the patient frequently exercises a direct influence upon this nocturnal unrest. The carter wanders around his house seeking his horses and calling them by name; or the huntsman may imagine himself surrounded by his dogs and all his equipments for the chase. When a correction is offered to these fallacies the person is intolerant of his advisers, often telling them to respect their seniors. To him, what he seeks is real. The past is his only life; all else is in "the swallowing gulf of dark forgetfulness and deep oblivion."

The duration of senile dementia is very variable. The disturbance of sleep and progressive emaciation may go on for years until fatty-atheromatous alterations in the heart or large vessels end life by the occurrence of a hæmorrhage into the brain or lung tissues. These apoplectic attacks are often preceded by vertiginous and aphasic seizures which are usually transient. Lesions of the renal organs, principally those of vascular origin, are very common, and aid in bringing life to a close.

Senile Epilepsy.—In rare instances, apart from the apoplectiform seizures that accompany a considerable number of the psychoses of old age, a genuine epilepsy is observed, occurring periodically, and accompanied by all the indications of the idiopathic form. The attacks may at first take the form of a *petit mal*, with or without loss of consciousness; but as time goes on they may become ever more and more severe, until the convulsive movements are universal and are followed by profound unconsciousness and biting of

the tongue. These epileptic seizures are of grave moment in the prognosis, as they betoken a partial or complete closure of some important artery of the brain from advancing atheromatosis or other constricting disease of a vessel, a lesion from which recovery is impossible, and one that may progress to atrophy of focal areas in the brain substance. Extensive arteriosclerosis of the vertebrals and carotids is also met with in which the symptomatic expression consists in repeated epileptic fits.

When epilepsy begins late in life, particularly when there is already present some form of mental disturbance, the mental downfall is much more rapid than when the psychosis is uncomplicated.

Heredity.—To have reached the age of sixty years or upward without a mental upset is in a measure evidence that the person has received from his forefathers a fairly stable brain tissue. Heredity in senile psychoses naturally is not excluded, but the proportion of cases of recurrence of some of the forms of insanity of advanced life, generation after generation, is very small. When a predisposition to insanity is inborn, the tendency is for the disorder to appear at an earlier age in the descendant than in the forebear. The idiot and many low imbeciles have become senescent often before their twentieth year, and the majority of types of the degenerative insanities begin before the thirtieth year of life. Even in paranoia tarda the individual has throughout early and middle life shown numerous peculiarities that stamp him as an individual apart from the mass of humanity, although it is only the beginning of an early senescence that brings the disease process to a climax. In women the insanities of the post-climacteric period may be regarded as the evidence of a beginning senile involution, which may be retarded, or progress, attended by numerous delusions of persecution, until the end of life.

To the careful observer the clinic affords abundant evidence that for a man to live upward of fifty years without showing indication of altered mentality is a proof of a fairly strong nervous inheritance. These persons seldom show the high arched or flat palates, ocular or buccal defects, stunted growth, anomalies in skull formation, or the other numerous brand-marks of the degenerate.

With the senile psychoses it is rather a question of the inheritance of bad arterial tubing than of nervous instability, for the mental decay is almost always secondary to the vascular degeneration. As a dictum it may be stated that for a person to have a strong, vigorous mind, it is necessary for him to possess sound, well-

constructed arteries in conjunction with well-developed nerve cells and appendages. Rarely at the autopsy table does one find healthy vessels of normal calibre in the hereditary weakling.

As a result of postnatal diseases, or the action of poisonous drugs, however, the vascular tubing may be so modified that a vessel, which at the start was well developed, may readily undergo pathological changes. Thus, owing to the fact that the several conditions are almost invariably the result of vascular degeneration, one can often observe in chronic alcoholism the identical forms of irritability, memory defect, amnesia, maniacal and melancholic conditions, and epileptic states, that appear in the senile insane.

Pathology.—At autopsy in the case of the brains of persons who have undergone nothing more than the physiological processes incident to old age, who have shown during life no indications of mental disturbance further than a slight weakening of the intelligence, perhaps vertigo, and an increasing tendency to mental torpor and sleeplessness, there is found, almost without exception, a shrunken condition of the convolutions as well as of the white matter of the centrum ovale, and perhaps also, although to a minor degree, of the basal ganglia, with dilatation of all the internal cavities of the brain. Furthermore, there can be observed thickening of the membranous envelopes, especially of the pia mater, which, although turbid from accumulation of *débris* in the choked lymphatic spaces, shows no undue adherence to the gray matter of the brain surface. Almost universally accompanying these senile changes is one of the several forms of arteriosclerosis, ordinarily the atheromatosis, with calcareous deposits in the vascular wall, at times most extensive, at others less pronounced. The degree of atrophy seems to a large extent to correspond with that of the degenerative vascular changes, which in turn may vary very much. In some cases, while everywhere present in the larger arteries of the base, the alterations are observed under the microscope to have especially implicated the nutrient arteries of the cortex. The territory supplied by the middle cerebral artery is ordinarily most severely affected, and next to it, in order, come those depending upon the anterior cerebral, posterior cerebral, and cerebellar arteries, possibly owing to differences in the blood pressure in the several vessels.

In the arteries visible to the naked eye a variety of conditions are seen. Most commonly the walls appear to be unequally thickened, with here and there a calcareous plaque, of sufficient size, especially at the angles where collateral branches are given off, to

decrease perceptibly the lumen of the vessel. At other points in the course of an artery, similar bands of hard calcareous material have been deposited in localized areas, beneath which, in the middle coat of the artery, is found a collection of grumous, fatty material. Occasionally this annular atheromatosis proceeds to such an extent as to almost close the vessel, and may lead to the formation of blood thrombi in the narrowed channel. On several occasions in examining the brains from senile subjects, I have found, in the region beyond these local annular thickenings, that the blood supply had been sufficiently shut off to occasion a partial necrosis, the neighbouring tissues being much softer and friable than in other portions of the hemispheres, though there was no actual breakdown. In other forms of arteriosclerosis the vessels may be uniformly reduced to thin, chalky, rigid tubes, with a lumen slightly above the normal in calibre. This last variety does not seem to be followed by the graver indications of organic cerebral disease, such as accompany the first and more common arteriosclerotic change. Various other forms of endo-meso-arteritis may be seen in persons advanced in years; some of these have caused a narrowing of the arterial lumen from thickening of the endothelial and subendothelial tissues, while in others the muscularis has become hypertrophied, with secondary fibrous or hyaline alterations.

In the arterioles and capillaries of the pia and cortex the morbid process often progresses by extension from the larger vessels. The alteration may not necessarily be universal, but is more apt to be of irregular distribution, being much more pronounced in one locality than in another, a condition analogous to that often found in syphilitic affections of the cortical arteries, in which some vessels are severely implicated, while others afford a nearly normal nutrient supply. This irregularity in the distribution of the disease process probably accounts for the vague and uncertain character of the symptoms that attend arteriosclerotic involvement of the arteries of the brain rind.

The most common lesion observed in the capillaries and walls of the smaller arteries consists in an apparent loss of their elasticity. The mouths of the vessels stand wide open, and the walls show the presence of sclerotic calcareous alterations, as well as loss of the definiteness in the outlines of the component layers and indistinctness of the nuclei, which, as the morbid alteration advances, become shrunken, misshapen, and distributed far apart from each other. With the sclerosis come irregularities in the sheaths of the

arterioles and capillaries, localized bulgings in the form of the so-called miliary aneurisms, or more diffuse distortions of the contours of the vessel. Hyaline degeneration or pigmentation in the walls of the arterioles is not infrequent. The adventitia of the arteriole is not usually affected, except in so far as it shows some proliferation of the nuclei at the forking of the vessels, and contains inconsiderable amounts of pigment granules, usually those derived from the hæmatin of the blood. The perivascular spaces are nearly always widened, and contain white-blood corpuscles, more rarely a few red cells, much *débris* and hæmatoidin crystals, and sometimes an unusual number of fat granules.

This picture of vascular degeneration may be considered as normal in persons above seventy to seventy-five years of age, and solely as an indication of progressing senile decay. What we would regard as pathological at the age of forty-five years has now become physiological—using the word in a rather forced sense. In the vessels of the abdominal organs, particularly in the kidneys, which in their terminal arrangement most closely correspond to those of the brain, similar alterations are prevalent, and may be of even more serious moment than if present alone in the brain, for the non-excretion of certain products of tissue metabolism, which act as nerve poisons, hastens and aggravates any disturbance of the cerebrum.

When we pass in our examination from the vascular structures to the brain cells, we find certain pathological changes so constantly that we immediately associate them in our minds with senile involution. I refer to the masses of coarse yellow-brown metaplastic granules that fill, sometimes to repletion, the protoplasmic bodies. So far as my own observations extend, a man up to his fortieth year should have few or none of the metaplastic granules in the pyramidal cells of the second and third layers of the cortex, unless he has been addicted to alcohol or has suffered from some prolonged cachexia. Beginning from the end of the fourth decade, however, they gradually accumulate, the vascular supply being, perhaps, less abundant than in earlier days, and as the years pass the pigment granules increase in number. Their presence is a mark of an imperfect metabolism that may go on for a long time without seriously affecting the workings of the cell, but which in the period of active retrogression finally brings its functional activity to a stand-still.

The appearance of the nucleus gives an accurate idea of the effect exerted by this fatty pigmentary deposit upon the entire cell.

As the granules multiply, it is, as a rule, pushed before the advancing mass, until the periphery of the body or the base of an extension is reached, beyond which point it cannot recede. The staining properties of the nucleus at this stage also show clearly that chemical changes in the cell are proceeding outside of the sphere of the pigment granules. Basic stains are now rejected, particularly by the nucleolus, which, for example, in eosin-hæmatoxylin preparations, is unaffected by the hæmatoxylin, and is represented by a bright red spot in the centre of the vesicle. Sometimes the nucleus exhibits in other ways the lack of proper nutrition. The membrane becomes thickened at isolated points from a deposit of calcareous material, or the entire nucleus becomes distorted, losing its chromatin contents in part or completely, and appearing as a light refractile vesicle; or, again, it may eventually entirely disappear, after becoming smaller as well as more and more deeply stained, until it appears as a minute dark point surrounded by brown metaplastic granules.

While the essential pathological changes cannot always be determined to belong to the vascular apparatus, certainly the majority of all forms of senile insanities, particularly the senile dementia, depend definitely upon the disease of the nutrient vessel, so that, broadly speaking, we possess a morbid anatomy more precise than is found in any other insanities except such as are based upon syphilitic lesions. The vascular lesions of the kidneys should be remembered, as they occur nearly always concomitantly with those of the brain, supplying a portion of the pathological picture. The senile contracted kidney and the atrophic brain hemispheres are nearly always associated at the autopsy table. These patients during life have a small hard pulse of high tension that at once attracts attention when the finger is placed upon the radial artery. The urine usually shows nothing of grave moment. The specific gravity is fairly high (1,022 to 1,025), with the urea normal and the acid urates slightly increased. A few hyaline, more rarely granular, tube-casts, are found in the sediment, but the ordinary tests for albumin (heat and acid, the Heller test, or picric acid) rarely show clouding. With the acetic acid and potassium ferrocyanide test a slight milkiness is seen in about one half the examples of senile dementia, indicating the presence of some form of albumin in quantities not perceptible by the more common methods.

When the cranium of a chronic case of senile dementia is opened, besides the varying degree of arteriosclerosis and calcification of

the vessels, there is found increased density of the cranial bones, with partial or complete absence of the diplöe, thickening of the inner table of the skull by the new formation of bony material upon it, strong adherence of the dura to the bones, enlargement of the Pacchionian granulations, and occasionally pachymeningitis hæmorrhagica. The pia mater is much thickened and turbid, with gelatinous milky deposits, especially over the middle and frontal regions of the brain; along the edges of the interhemispheric fissure it is adherent, but everywhere else can be detached more readily than is normal from the gray substance, owing to the accumulation in the epicerebral space of an exudative material derived from the lymph passages of the brain. Occasionally there is a considerable degree of pigmentation of the pia mater noticed over the parietal and occipital lobes.

The encephalon with the adherent meninges does not completely fill the cranial cavity, the subdural and arachno-pial spaces containing considerable quantities of a pale yellow serous fluid. The encephalon with the inner membranes, when placed upon the scales, is found to have a weight considerably less than normal for early adult life, now ranging between 1,000 and 1,100 grammes, the average of a number of brains being 1,061 grammes. On removing the pia the sulci are found to be wide, the convolutions narrow, and of a pale grayish hue. On section the gray substance is seen to be thin. When cuts into the hemispheres are made after the manner of Pitres, not only is the cortex found diminished in volume, but also the white matter of the centrum ovale is evidently atrophied; the ventricles are widely dilated, and filled with the same serous fluid that bathes the subdural space. The basal ganglia, especially the corpus striatum, also share in the atrophic state. The ependyma of the ventricles is frequently thickened, the choroid plexuses are granular, and filled with little bladder-like vesicles containing clear serum.

Microscopically quite a variety of conditions are demonstrable. First in importance come the arteriosclerotic degenerations, which assume a varied form, and are wont to be much more intense in one locality than in another. In the cortex the hyaline degeneration of the middle lamina of the moderate-sized arteries, with thickening of the endothelial and subendothelial elements, is the most frequent; while at other times the inner and middle layers may be converted into a sclerosed mass of connective-tissue fibres without line of demarcation between the two laminæ. The loss of elasticity from the weakening of the muscular wall by the hyaline degeneration of its

elements tends to the formation of irregular bulgings of the sheaths or to the development of miliary aneurisms. The adventitia is less often extensively involved in these morbid processes than the other layers, though at times there are new formations of round nuclei within it, and clumps of hæmatoidin crystals and *débris*, fat, and pigment granules upon it.

The condition of the perivascular spaces varies according to the character of the vascular lesions. Where there is solely thickening and hyaline degeneration of the muscularis, the spaces are not usually distended, but when there is extensive blocking of the extra-adventitial space by accumulations of hæmatoidin, round nuclei, and leucocytes, there may be considerable dilatation. This varies very much in different cases, but at times may be so marked that the spaces can be seen with the naked eye honey-combing the centrum ovale, and less frequently the cortex—the *état criblé* of the French writers. Besides the above-mentioned hæmatoidin and cellular elements, the enlarged space sometimes contains a plasmatic exudate, staining faintly with eosin.

In the larger arteries of the basal regions changes more distinctive of atheromatosis are found. The walls are still hyaline, but the endothelial structures are hypertrophied, and calcareous plaques are now and then seen covering one of the so-called atheromatous abscesses. The walls of these calcareous arteries may be either thin and rigid, or there may be extensive thickening of the inner tunics almost to complete closure of the lumen. A high grade of local or general hypertrophy of the inner coats, progressing to almost complete obliteration, is generally reserved for vessels of considerable size.

One peculiarity of hyaline degenerations of the blood-vessels of the brain is frequently seen in arterioles of medium calibre. The degeneration does not proceed equally throughout the whole course of the vessel, but stops here and there, to begin again a little further on. Wherever the lesion has advanced to any considerable extent the muscular tissue undergoes a transformation, refuses to accept the ordinary stains, and becomes fibrous or slightly laminated. The nuclei shrivel, stain darkly, become irregular in outline, and eventually disappear. Similar alterations affect the nuclei of the intima, and in places none are visible for a considerable space in the long diameter of the vessel (Plate IV^{b}, Fig. 10).

In the capillaries morbid changes of a similar order are noticed. More frequent than any other is a rigidity of the tubes, the lumina

standing widely and irregularly open. The walls of these capillaries are usually thinner than normal, the nuclei are scant, and those that are seen are very granular, irregular in outline, shrunken, and sometimes vacuolated.

Ruptures of the small arteries and arterioles in the cortex, white matter, or ganglia are not often found, being confined for the most part to the larger vessels of the meninges, ganglia, or centrum ovale. On the other hand, the partial obliteration of the smaller arteries by thickening of the inner coats, occasionally followed by thrombosis, whereby the lumen is reduced to capillary fineness, is by no means infrequent, and may be accompanied by localized softenings and calcareous transformation of the surrounding tissues. When the process of obliteration has been very slow, there may ensue partial death of the nerve elements in the contiguous nervous matter, followed by proliferation of the lower forms of the neuroglia cells.

The veins do not usually play an important part in the process of vascular degeneration. The larger ones, in which there are considerable numbers of scattered muscular fibres, show a slight hyaline degeneration, which only affects their elasticity in a minor degree; in addition there is also an apparent dilatation of the lumen, caused by resistance to the exit of the blood through the hypertrophied pial meshes.

These various morbid changes of the nutrient arterial system result in a number of recognisable lesions in the nerve and neuroglia tissues, the local manifestations depending upon the distribution of the arteries involved.

The nerve elements respond to the decreased plasma supply chiefly by the exhibition of simple atrophic alterations. The most frequent—indeed, the almost universally prevalent—form in senile dementia is characterized by an accumulation of yellowish-brown pigment in the cytoplasm of the pyramidal cell. This granular metaplasm rapidly increases in amount as the denutritive process extends, and from occupying a small corner of the cell becomes diffused throughout the entire substance, finally accumulating in masses sufficient to cover or completely displace the nucleus. Sooner or later a necrobiotic process begins, the cell disintegrates, the granules lie loose within the perivascular sac, and the protoplasmic body shrinks into a small angular fragment (Plate V, Figs. 1–4). Other changes of an atrophic nature are also found; the cell may undergo a fatty degeneration, with accumulation of fine fat

globules in the body. In others the protoplasm is rarefied and assumes different staining qualities, while the nucleus becomes distorted and takes up the acid in preference to the basic stains; or the whole caryoplasm takes on an uniform colouring. Simple atrophy of the protoplasm of the cell with a fine angular granulation of the protoplasm is also not infrequent. The basal and apical processes shrink within the pericellular limits, the body is reduced in size, and from occupying the whole of the space, now takes up but a small proportion of it (Plate V, Figs. 5–8).

Changes in the neuroglia are much more frequent in the localized lesions, to be later described, than in those more diffuse. There is usually some prominence of the neuroglia nuclei, particularly along the margin of the brain rind and along the edges of the larger vessels, but nothing approaching a gliosis is observed. The condition of the vascular neuroglia in senile atrophy is unknown.

The medullated tubes, especially those of the tangential layers, show very important pathological alterations. Numbers of them completely disappear, and in advanced cases numerous globules of a fatty character are occasionally seen along the horizontal planes formerly occupied by the fibres. As a whole, the fibres of the cortex show an extensive diminution, which affects principally the finer ones, leaving the radial bands to a certain degree intact. The intercellular fibres are diminished in number, as are likewise those in the white masses beneath the convolutions. In the diminution of the connecting fibre elements of the cortex is found a ready explanation for the loss of memory and incapacity to associate and assimilate the data of recent events.

Besides the general changes outlined above as especially prominent in the advanced forms of senile dementia, others of a more localized character are seen, particularly in the early senile and presenile cases. Alzheimer has paid especial attention to these early forms of senescence, and as his results correspond with my own, I have followed his classification. All the different varieties are dependent upon the sclerosis of the arteries.

Senile sclerosis of the cortex results from degeneration implicating the small nutrient arteries, and in pure examples affects only the gray layers. Small areas of the superficial gray substance look as if they were eroded. On closer examination these are found to be wedge-shaped, with the base toward the surface and the apex toward the white subcortical matter. On microscopical examina-

tion the nerve elements are found to have disappeared, and are replaced by the support elements. In examples of long standing the whole wedge-shaped territory, corresponding to that of a small vessel, may have undergone complete calcareous degeneration. This condition is found more often in advanced than in early examples, though on one occasion I observed it in a man of fifty-five years. In other portions of the brain in which these local lesions are discovered the indications of a more diffused process may be found, with general wasting of the convolutions and dilatation of the ventricles.

Advanced arteriosclerosis of the long vessels of the centrum ovale leads to atrophy of the tissues, which is especially prominent in the white masses of this region and is not infrequently accompanied by localized patches of softening along the course of profoundly diseased vessels. If large enough to be visible to the eye, they may be distinguished as yellowish points that are readily washed away by a stream of water. In the earlier stages they show numerous granular cells and leucocytes with the *débris* of nerve fibres. Old foci show an increase of the fibrillated neuroglia, with complete destruction of the nervous elements. Swollen fibres are seen along the borders of the spots, and in the somewhat exceptional instances in which such foci are found in the gray layers, nerve cells in all stages of degeneration are demonstrable. The cells are swollen, pale, non-receptive to aniline stains; the nuclei, which are almost invisible, have sought the periphery of the protoplasm, and are often in process of disintegration.

Besides the white matter of the hemispheres the basal ganglia are often the site of these minute softenings, and from the fact that the vessels are larger than in the subcortical white masses, the necrosis of the tissue is more extensive and striking to the eye. In this region, more particularly when the process has been of long standing, absorption of the necrotic material has gone on, with the formation of minute cysts in the substance of the ganglia. The necrobiotic areas are found at all ages after forty-five to forty-eight years, when there is extensive arteriosclerosis with marked tendency toward the localized obliterations of vessels from thickening of the intima and media. In very many examples of advanced arteriosclerosis, where the disease has not proceeded to closure of the vessel, there is frequently noticed, in microscopic preparations, along the perivascular margin of the artery a thin line of partly disorganized tissue which stands out from the surrounding substance by

its less intense staining qualities. A close examination of these areas, particularly those in the gray rind, will show numerous nerve cells and fibres in various stages of morbid alteration, marking the lowered vitality of the whole tissue.

Therapy.—In its cardinal principles the treatment does not differ materially from that of all mental diseases. Good food, good nursing, and hygienic surroundings are essential. Many of the senile dements have to be cared for at their homes, and unless they are unmanageable and degraded in their habits, this can readily be done, provided a capable and attentive nurse can be obtained. The main difficulty is to overcome the nocturnal restlessness. Hypnotics, though inadvisable as a routine measure, must sometimes be resorted to; and of all the sedatives at our disposal, sulfonal in the very moderate doses of ten to fifteen grains is probably the best. A mild stimulant, as ale or beer, at bedtime, perhaps with the addition of a simple meal, succeeds with some patients better than drugs. These old people should always have as much fresh air as possible, as it induces a healthy degree of fatigue and restfulness at night. Food should always be unstimulating, though nutritious. Much meat, or strong meat soups, should be avoided. Cream, containing as it does a considerable proportion of fat, and cod-liver oil, should be given freely, as the senile patient always requires a considerable amount of hydrocarbons.

The treatment of the arteriosclerotic conditions of the blood-vessels, especially in the presenile cases, should always obtain consideration. It is surprising in some cases how much improvement in the arterial condition may be accomplished by the use of suitable diet and drugs, and how completely such measures fail with others. Naturally something depends on the form of the sclerosis in the individual with which we have to deal, and this, unfortunately, is often impossible to ascertain during life.

As we obtain in the various foodstuffs used in our daily diet a varying quantity of lime, a substance to be avoided in calcification of the arteries, it is desirable to include in a diet list only such articles as are comparatively free from it. Fortunately this is readily accomplished. Meats, fish, shell-fish, fruit, cheese, rice, spinach, potatoes, butter, and eggs, contain a minimum of the calcium salts. Sugar need not be especially avoided. Bread should be allowed in moderate quantities. Milk, on the contrary, contains an abundance of lime, and should not be allowed. Attention should be paid to the drinking water used by the patients. A light spring water free

from excess of inorganic salts, or distilled or boiled water, should be taken freely. Boiling precipitates most of the salts, and affords the cheapest and readiest means of obtaining a lime-free drinking water. A distilled, artificially carbonated, water may be ordered for those patients who object to the flat taste of ordinary distilled water.

Among the medicaments, potassium iodide holds the first place, its effects as an alterative being well known. Hydroiodic acid is not nearly so efficient. Lactic acid seems to have some effect, and Rumpf advises the lactate of soda, made fresh every few days. A brisk laxative, in the form of calomel or Rochelle salts every third day or so, assists materially when digestion is not disturbed thereby. Hoppe-Seyler recommends the subcutaneous injection of corrosive sublimate in combination with the internal administration of the iodides, but experience has shown that this substance is irritating, and not well borne.

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PSYCHOSES FOLLOWING GROSS ORGANIC BRAIN DISEASE

There is a large class of cases following post-apoplectic, embolic, or thrombotic processes, tumours, abscesses, disseminated or diffuse sclerosis of the encephalon, primary hydrocephalus, meningitis, and trauma capitis, in which there is a considerable degree of mental reduction. The type of affection is ordinarily a dementia, a progressive lessening of the mental powers, accompanied by paralysis of one or more of the limbs. Since such patients rarely need much restraint, the wards of an almshouse always offer for study a much larger number of these cases than an institution for the insane, and the clinical material for this section, comprising a large variety of the several forms, was mainly obtained from the City Pauper Institution, while from the City Asylum only a score of cases could be drawn, which, however, represent a nearer approach to the true forms of mental alienation.

The most common type is that following thrombotic or embolic processes in the central ganglia and white substance of the hemispheres; next in frequency comes the post-apoplectic form, the two together including over ninety per cent of the whole number. The analogy between senile insanity and these forms of mental disease is very close. The majority of the instances occur in elderly individuals, and result from the same general causes that predispose to senile aberration—advancing sclerotic changes in the vascular system.

Hereditary instability of the tissues plays a very important part in organic psychoses, a fact that is more particularly noticeable in the young than in the aged. Thus I have seen, in the case of a large tumour of the frontal region of the brain in a young woman, almost no mental symptoms beyond an advancing hebetude; while in another, with a new growth in the same situation, there was wild excitement lasting for weeks, until coma ushered in the rapidly fatal end. This difference must largely be explained by hereditary instability, the latter patient having a profound neuropathic history, while the ancestors of the former had been free from nervous dis-

orders. Furthermore, one often sees at the autopsy table large foci of softening in the corpora striata and lenticular nuclei, when the only mental indication during life has been a mild degree of forgetfulness and intellectual obtundity, while in other patients with lesions in the same locality there has been a clinical history of motor restlessness, shouting, and emotional states, superadded to the loss of memory.

In one rather remarkable case, in a woman seventy-five years old, the thalami, corpora striata, and lenticular nuclei were riddled with cysts from the size of a pea to that of a large bean, and yet there had been absolutely no motor restlessness accompanying the paraplegic symptoms. In another instance in which repeated embolism of cerebral vessels had occurred following grave valvular lesion, there was progressive dementia but no active disturbance. Death followed the plugging of a large vessel after coma lasting three days.

The hereditarily stable will preserve their mental balance, and be calm, reasonable, and manageable, despite extensive destruction of the cerebral tissues, whereas in the individual of unsteady equilibrium the mental functions will be overwhelmed by a single tiny apoplectic clot or spot of softening. Something depends upon the situation of the lesion, and whether it is or is not accompanied by intracranial pressure. Thus, a hæmorrhage into the meninges is more likely to evoke active symptoms than one situated more deeply in the cerebral substance.

Symptoms.—In organic insanities maniacal are much more frequent than melancholic manifestations, although there may be for a time a moderate degree of depression. The melancholia, when it does occur, is usually of the passive stuporous rather than of the delusional resistive type. In one instance of the stuporous form of organic dementia in a middle-aged woman, the convolutions of the parietal, occipital, and præcuneal lobes, as well as that of the hippocampus, were studded with areas of necrosis of small and large size with entire destruction of the layers of the cortex, while proliferation of the long-rayed support elements in the adjacent parts was demonstrated. There were no motor symptoms during life, though an infection had been the probable cause of the lesions.

The *symptomatology* of the most common form of organic dementia is very similar to that of the demented type of senility. Indeed, the two conditions are closely related, and the pathology

is often the same. Vertiginous symptoms, headache, a feeling as if a band were drawn about the head, or numbness with paresis of one or more of the extremities, are the usual indications. With these there may be weakness of the intellect, somnolence, or sleeplessness, muscular tremor or spastic states of the entire muscular system, and an asthenic condition of the bladder. Rarely does the exaltation amount to anything more than a hilarious childishness. The majority of these cases occur after the fifth decennary of life, and in nearly all there is advanced arteriosclerosis, with probable tissue necroses in the central ganglia and white matter of the hemispheres. Mingazzini states that the true organic psychoses are invariably the result of focal softenings in the brain; but that this rule has numerous exceptions is shown by the records obtained from the necropsy table. Nevertheless, post-apoplectic passive dementia, and not a maniacal or melancholic condition, is the usual type of insanity.

Ordinary Forms of Organic Dementia

Dementia, Post-apoplectic and Embolic.—A man in early middle life may have several apoplectic strokes before exhibiting a marked dementia. With the aged the course of events is different, unless the amount of brain tissue involved in the rupture is small and none of the important association paths are implicated.

The immediate symptoms following the stroke are confusion, non-recognition of surroundings, complete or incomplete hemiplegia, and motor aphasia. After a short time the patient may return to a more normal state, or, instead, there may be active motor excitement, with screaming, constant talking, and attempts to get out of bed and wander from the room. The excitement is usually transient and passes off within a few days, but a degree of memory defect always remains. The patients after this partial recovery are liable to wander from home and be unable to find their way back; they forget names and dates; time is of no consequence to them, arithmetical sums are incorrectly done, and whatever facility of thought remains is connected only with the long past. Aphasia in all its forms aggravates their difficulties, and the impossibility of correct speech increases the apparent dementia. Deafness, which is frequent with this class of patients, also renders association with the outer world more embarrassing, and as a result they become more and more apathetic.

In the dementia following embolism from cardiac disease the same clinical picture of paralysis with progressive general weak-

mindedness and incapacity for continued thought is seen, especially when there has been a repetition of the attacks. Embolic dementia is much more common in middle than in advanced life.

The mental disposition in both forms is querulous, lachrymose, with alternations of silly garrulity and despondency. Epileptic convulsions not infrequently complicate old cases. Moral obliquity in this class of the insane is common. They steal articles that are of no use to them, annoy the household, seek the society of the pothouse, where they dissipate their little possessions, and are readily led away by evil associates. A few develop grandiose ideas of wealth, high station, and power. The picture is often pitiable to a degree—an old man, a mental and physical wreck, paralyzed, demented, helpless, but still the prey of the idle fancies of his disorganized brain, and consequently self-willed and ambitious.

Thrombotic Dementias.—These are by far the most common of all the forms of organic dementia, and are an outcome of advanced arteriosclerotic disease, especially of the ganglia and medullated tissues. The partial or complete loss of the normal supply of blood induces more or less extensive softenings of the brain tissues with destruction of the association fibres, passing to the bulb and cerebellum, or of the intrinsic fibres of the hemispheres.

The *symptomatology* is quite varied. The majority of the patients have some pronounced motor symptoms, usually tremulous or thickened speech, with flaccid paresis of sets of muscles in one or more extremities, but rarely a complete paralysis. Others have a general muscular tremor that incapacitates them from active movements, while still others suffer from tremor combined with a spastic condition of the extremities.

The bladder muscles are not ordinarily paretic. Epileptic seizures, beginning after the motor symptoms, are not infrequent. Senile marasmus and the arcus senilis is found in one half of the cases over sixty-eight years of age. The deep reflexes are, as a rule, slightly exalted, sometimes to a marked degree, and occasionally a difference between the two sides can be demonstrated. Gangrene of the extremities, particularly of the feet, is now and then seen, the amputated limbs without exception showing an obliterating disease of the arteries. The accompanying mental manifestations are those of a progressively failing memory, especially for recent events, loss of judgment, increasing apathy, somnolence or sleeplessness, and growing irritability. Maniacal conditions of great intensity are occasionally met with, the motor agitation, loss of fore-

sight for consequences, and the loquacity being extreme, and often only terminating with the death of the patient. The strength manifested during these attacks is often marvelous. One might suppose that the incessant activity and sleeplessness would soon completely exhaust the sufferers, but frequently they go on in this way for weeks, even with the imperfect feeding that can be managed. Melancholic are more frequent than maniacal states and are longer continued, but the difficulties in treating the patients are not so extreme.

The *urine* in cases of dementia from arteriosclerotic softening shows a surprisingly small amount of albumin, and only occasionally can the presence of tube-casts be demonstrated. In twenty-eight cases chosen so as to include an equal number of the several types, only thirty-three per cent showed a considerable clouding with the ferrocyanide-acetic-acid test, an additional thirty-three per cent giving a very faint clouding, while with the nitric-acid test only thirty-three per cent had sufficient albumin to be perceptible to the eye. One third of the total number also had either granular or hyaline casts, the same proportion that showed the presence of albumin by nitric acid.

Rarer Forms of Organic Dementia

Abscess of the brain, particularly when it is of slow evolution, is rarely followed by dementia. In more rapidly growing abscesses, especially after trauma or infection, there is not infrequently a progressive dulling of the faculties; the patients are confused, slow of speech, and are sometimes delirious, with active hallucinations. Later there may be epileptic seizures, aphasia, and the general indications of irritation or destruction of the cortex.

Primary internal hydrocephalus in the aged is of rare occurrence. The patients become progressively stupid, with spasticity of all the extremities; or there may be pronounced contractures. There is loss of the eyesight or narrowing of the field of vision. Rarely is there any true speech disturbance. The bladder is no longer controlled by the will, and the urine as well as the fæces are passed in the bed. Examination of the brain at autopsy shows extensive dilatation of all the ventricles, with a thickened ependyma and inflammation of the choroid plexuses, as well as atrophy of the medullary substance.

Post-meningitic dementia is quite an infrequent form, and is more likely to occur in the course of syphilitic affections than of other diseases, although it has been known to follow cerebro-spinal

fever, pneumonia, typhoid fever, and a number of infectious processes. In the specific varieties there is usually thickening of the dura mater—chronic pachymeningitis. In the form resulting from the infectious disorders, the vessels of the pia are ordinarily the seat of the primary lesion. After the acuteness of the febrile disturbance has passed, the patients become more or less passively demented, and remain in that condition without undergoing further degradation for months and years. Improvement sometimes occurs. The affection is much more frequent in children and young adults than in the later years of life.

The syphilitic pachymeningitic dementias follow the usual course of an ordinary specific dementia. Death not infrequently results from the rupture of a large vessel in the dura, and consequent effusion of a quantity of blood upon the surface of the brain, with paralysis, coma, and death within a few days.

Syphilitic Dementia.—The manifold clinical symptoms in lues cerebri have been already detailed in the chapter on Syphilitic Insanity. The varying nature of the specific process naturally brings about a corresponding variety in the degree of dementia found in the affected individuals. When accompanied by active motor symptoms the course of the disease is usually short; when the motor symptoms are few and the changes affect the vascular apparatus solely, the process may remain stationary for long periods, owing to the tendency of certain forms of specific vascular inflammation to recede, though leaving a damaged artery and permanent alterations of the nerve cell.

Dementia in Disseminated Sclerosis.—But few of the subjects of insular sclerosis escape some involvement of the higher intellectual faculties, the degree depending upon the situation of the degeneration, and also upon its extent. There is, as a rule, a simple progressive weakening of the intelligence and of the powers of remembrance, without confusion or excitement. Loss of energy and muscular weakness accompany the psychical indications. To these are added in typical cases the scanning speech, the "intention" tremor and nystagmus. The affection may, in atypical cases, strongly simulate the demented form of general paralysis, but delusions and profound disturbance of the faculties are lacking.

Dementia following Brain Tumours.—The degree of mental disturbance resulting from new growths within the cranial cavity is very variable. The majority of tumours cause an increase of intracranial pressure, and thus give rise to disturbances of the mental powers, manifested more especially by intellectual dulness and obtuse-

ness. The attention of these patients is often difficult to hold, and they very quickly relapse into a half stuporous state. Intense cephalalgia, uncontrollable by any of the ordinary therapeutic measures, is the most frequent indication. The motor symptoms vary according to the locality of the tumour. There may be paralysis of

FIG. 23.—TRAUMATIC DEMENTIA. The patient was struck by an engine, the principal injury being to the skull. A portion of the frontal and parietal bones, together with a part of the brain substance, were removed by a surgeon. After recovering from the immediate effects of the operation the man became maniacal, and had repeated epileptic seizures. Both affections slowly subsided, and left him profoundly demented and incapable of speaking more than two or three words. There is no paralysis of the limbs, though after the administration of an hypnotic the left limb is dragged. Over both fronto-parietal regions there are large lacunæ in the bony tissue. The one on the right side is partly filled in by a fibrous material. This depression measures 9 × 4½ centimetres. That on the left side is 6 × 4 centimetres, and under the skin the pulsations of the brain can be both seen and felt.

one limb or of the entire half of the body, with convulsions, epileptic seizures, and cataleptic attacks. Next in frequency to the headache is optic neuritis and amaurosis from pressure. The occurrence of a progressive dementia with optic neuritis forms a clinical picture that is always ominous.

In certain cases, besides the ordinary mental dulling and irritability, lack of self-control and excitement are found, in rare examples passing into a state of frenzy, followed by coma and death within a few days or weeks. In the maniacal form, hallucinations, generally evolved from the subject's former vocation, are now and then noted. True melancholic depression with brain tumour is infrequent, though the stupor may closely simulate it.

Dementia following Trauma and Insolation.—All degrees of injury to the skull and brain tissues may be followed, sooner or later, by a progressive dementia (Fig. 23). Nor is it by any means necessary that the mental disturbance should immediately succeed the injury, for in many instances of apparently slight traumatism the starting point of the disease has been a morbid process spreading from the inflamed or crushed meninges into the encephalic substance. Active motor excitement is less common than a dull apathy with loss of memory and general weakening of the faculties. An acute dementia occasionally follows a concussion of the brain, and may be fully recovered from (*vide dementia acuta*).

Trauma of slight character may be the etiological factor in a periodic insanity, circular or maniacal in type; indeed, the degree of immunity to grave results from injury to the brain depends greatly upon the stability inherited or acquired by the tissues.

The dementia following *insolation* is not marked by any essential peculiarities, and resembles closely that accompanying arteriosclerosis. Occasionally, as in multiple sclerosis, there may be a series of mixed motor-psychical phenomena strongly suggestive of the demented form of paresis. In these cases the train of symptoms is usually progressive in character, and death occurs within a few months.

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GROUP II

INTOXICATION INSANITIES

SUB-GROUP (*a*). INSANITIES FROM CHEMICAL POISONING

THE ACUTE AND CHRONIC ALCOHOLIC INSANITIES

The effects upon the nervous system of man of alcoholic drinks, and of the ethers therein contained, are so manifold that their study forms a most complicated task. Besides the alcoholic deliria, we may have mental disturbances simulating a whole host of other affections, mania-like conditions, melancholias, chronic persecutory insanity counterfeiting paranoia, epilepsy, stuporous conditions, morbid impulsiveness, and progressive dementias. The essential characteristic of the whole series of alcoholic insanities is to be found in the progressive mental weakening, with consequent deterioration of the finer ethical and intellectual attainments.

That such intellectual perversions should take place under the continued abuse of a substance which may justly be regarded as a powerful poisonous drug, is not wonderful, when we note the immediate effect of its ingestion upon the organism, the complete vasomotor paresis, the suffusion of the integument, and the absolute unconsciousness with pronounced congestion.

When the subject of long-standing alcoholism comes to the autopsy table, unmistakable evidences of the secondary degenerative effects of the drug can be noted in the wide-spreading arteriosclerosis and atheroma of the arteries, the chronic thickening of the meninges, the evidences of retardation of the lymph flow, which have induced cirrhotic changes not confined to the brain, but invading organs essential to somatic life, the kidneys, stomach, liver, and pancreas.

Under the continued abuse of alcohol the whole organism suffers psychical and somatic degradation, which is not confined to the transgressors themselves. As a result of the excesses of the progenitors there appears in the descendants a lowered vitality, stunted

growth, mental and moral imbecility, deaf-mutism, sterility, with the result that within a few generations the family becomes extinct, or consists of members physically and mentally incapable of holding their own in the great struggle for existence.

But besides the gradual bodily and mental deterioration which it entails, the abuse of alcohol influences to a marked degree the course of intercurrent febrile affections. Watch a dozen cases of pneumonia, for example, occurring in alcoholics, and compare the course of the disease in them with that usually observed in those not addicted to the drug. The lesson is instructive.

While heredity is an important predisposing factor in chronic drunkenness, the force of example and environment must not be overlooked. Especially is this true for the lower classes, whose surroundings are often not of the most comfortable character, and who, following the example of their associates, seek the light, warmth, and comfort of the saloon, at first for society and pleasure, and later, as the drink habit becomes fixed, to obtain a brief satisfaction for the cravings set up by a disordered stomach and shattered nervous system.

This state of affairs goes on until the individual becomes reduced to beggary, incapable of work, and fit only for the alms-house, or until, overpowered by the accumulation of the poison, his mental powers give way entirely, and he becomes insane or demented.

It is interesting to note the wide difference in the degrees of susceptibility to the influence of alcoholic drinks that one meets with. One man may stand a daily allowance of a quart, or even a quart and a half, of whisky for weeks and months before he is overtaken by mental and physical collapse; while in the case of his neighbour a few glasses of beer or wine will cause a violent delirium, from which the subject may pass into a condition of acute maniacal excitement. The difference is largely a question of the degree of stability of the nervous tissues, inherited or acquired. The less stable the equilibrium, the greater is the effect of the poison and the more enduring its action upon the organism. A whole host of imbeciles of the higher class owe their nervous instability to drinking habits on the part of their ancestors.

While chronic alcoholism is found at all ages, its especial predilection seems to be for individuals between twenty-five and forty-five years of age, when the man's activities are at their height, his intellectual development is greatest, and his work in the struggle for a competence at its maximum. Nor is this to be wondered at.

From a desire to accomplish more work than he has strength and endurance for, he is too apt to resort to stimulants, in which he finds an immediate lightening of his heavy load, and for the time being a renewed energy, but which eventually produce exactly the reverse of what was sought, the temporary stimulus resulting in prolonged and permanent mental exhaustion.

Age seems to have little influence on the character of the symptoms, the identical forms being repeated in youth and in those of advanced years. Maniacal forms are on the whole more frequent than melancholic types.

Alcoholism, especially among the better classes, is much less frequent among females than among males, though the disproportion has decreased in recent years.

General Symptoms of Alcoholism

In all forms of acute alcoholic insanity, or, to speak more correctly, among the acute symptoms of mental derangement occurring in chronic alcoholism, illusions and hallucinations of the special senses are predominating features. They also characterize certain of the purely chronic forms of alcoholism, to be presently considered. Visual hallucinations are the most frequent, those of aural origin being second in importance, while a combination of the two is of common occurrence. In the more elementary hallucinations the subject sees sparks of fire floating before his eyes; in those more complicated he is annoyed by visions of animals, such as horrible serpents, the objects being in active motion, or by groups of figures, robbers, or sprites, which troop into the room in crowds to torment and harass him. Even more characteristic of alcoholic delirium are the delusions arising from perversions in the functioning of the spinal or visceral nerves, and manifesting themselves as burning sensations, formications, tingling, anæsthesia, or numbness over different portions of the cutaneous surfaces, or electric-like shocks, which are so often complained of. Muscular sensations are also wrongly interpreted, and unequal action of the special nerves to the various groups result in irregular clonic contractions of the facial and trunk muscles.

The perverted mentalization of the alcoholic conceives of these abnormalities of sensation as the result of the machinations of diabolical agents, of witchcraft, of mesmerism, of hidden electric batteries, and accordingly builds upon them a whole host of delusions, mostly of a persecutory type. He has fallen into the snares of

inimical persons, who torment him for their own ends, who restrict the free use of his mind, enslave his thoughts, annihilate his sexual powers, and from a safe hiding place are destroying every joy and pleasure of his life.

Abnormal sensations originating in the generative organs are perhaps more frequent than any other form of perversion of cutaneous sensibility. Next in order follow the gastric hallucinations, having their source in the catarrh of the stomach so common in hard drinkers. Of these, the well-known "epigastric voice" is one of the most common—a sensation strongly suggestive of an aura, and to the patient taking the form of a voice. Other visceral perversions are also met with, resulting from processes going on in the heart, lungs, throat, bowels, and liver. The symptoms of the grosser forms of nerve degeneration in the alcoholic are well known and easily recognised. The neuralgic pains, for example, are largely due to actual morbid changes in the nerves in the form of a neuritis.

As might naturally be expected, the delusions induced by such disturbances of sensation are much more often of a persecutory than of an optimistic character, and this, too, despite the essential egotism of the alcoholic. As a consequence, we find that when ideas of personal grandeur do occur—the patient, for instance, imagining that he is a person of vast importance to the state, that he is the possessor of secrets of great value, or that he has been entrusted with a special mission or is a saviour sent from God—these optimistic fancies are intermingled with delusions of distrust, lest cherished plans are being thwarted by the unfriendly intervention of former friends or members of the family, merely to suit their own selfish ends and purposes.

Hallucinations of smell and taste are more frequent in alcoholism than in other forms of insanity. The patient complains that his food is poisoned, or that foul substances, such as fæces and urine, are mingled with it, that attempts are being made by enemies to chloroform him in his bed at night, that poisonous gases are injected into his room through the key-hole, and that foul odours pervade his apartments.

Goaded by these persecutions, the pursued may turn upon his enemies and attempt to kill or injure them. Indeed, if we except epileptic insanity, there is no form of alienation that is so characterized by impulses to destructive violence and ruthlessness as chronic alcoholic alienation.

In the pronounced forms of chronic alcoholism we find a more decided blunting of common sensations. Thus there may be complete anæsthesia and analgesia over large areas of the skin surface, even dulling of feeling over the entire body, or vaso-motor paresis of the vessels of the extremities.

Nor are signs of motor implication lacking, the most common, perhaps, being a progressive weakening of the muscular power. Indeed, a fine muscular tremor, especially noticeable in the early morning, is often one of the earliest indications of advancing nerve poisoning. It appears first in the small muscles of the hands, the seat of the finest and latest acquired co-ordinated movements. The tremor is not ataxic in character; on the contrary, the patient may have full, though only momentary, control over the co-ordinative movements. Moreover, as the day advances, or when the individual has obtained his accustomed stimulus, the controlling nerves recover their tone more or less perfectly, and, unless it is of a profound degree, the tremor ceases.

Coarser muscular twitchings are also noticeable. Isolated spasms of the orbicularis palpebrarum, or of the orbicular muscles around the mouth, are not uncommon, and result in queer facial distortions and grimaces. Occasionally the spasmodic contractions are so violent that the whole head or extremity is shaken. Asymmetric furrowing of the forehead is found in a large proportion of alcoholics, owing to the irregular innervation, while a drooping of the cheeks from the profound loss of muscular control, with a fixed stolid expression, is seen, though less commonly.

Muscular cramps are frequently complained of. They occur during sleep, or in the interval between the sleeping and waking states, and are often attributed to unseen inimical agencies.

Nystagmus of alcoholic origin is not at all uncommon, owing to the defective innervation of antagonistic eye muscles. Atrophy of the optic nerves is present in a small number of cases.

The knee-jerks and other deep reflexes are usually increased to a moderate extent in delirium tremens and in chronic alcoholism. In severe cases, where there are collapse symptoms, the reflexes are greatly exaggerated, so that at times they are even crossed. Loss of the deep reflexes is met with only when profound organic alterations have taken place in the posterior root nerves (neuritis).

As a rule, the ocular fundus shows nothing abnormal. In isolated cases there may be constriction of the arteries and congestion of the veins, but the vessels are never tortuous. More frequently

there is narrowing of the visual field (retinal anæsthesia). Central scotoma is not found (Krukenberg).

The Clinical Aspects of Alcoholism

1. Ordinary drunkenness.
2. Acute alcoholic insanity (delirium tremens).
3. Chronic alcoholic insanity.

   Alcoholic psychoses:

   a. Melancholia.
   b. Mania.
   c. Persecutory delirium.
   d. Alcoholic mental confusion.
   e. Amnesic forms.
   f. Paranoia-like forms.
   g. Alcoholic pseudo-paralysis.
   h. Alcoholic progressive dementia.
   i. Alcoholic epileptic insanity.

The clinical aspects of alcoholism are most varied, and are of extreme interest to the practising physician by reason of the frequency with which he is called upon to combat them.

While *ordinary drunkenness* is hardly to be classed among the insanities, there are certain mental symptoms appertaining thereto whose principal features demand a brief consideration.

A neuropathic disposition begets alcoholism, and conversely, the abuse of alcohol begets a neuropathic disposition. All hard drinkers, therefore, show signs of nervous disturbance, either acquired or to some extent inherited from their ancestors.

The most striking feature is an unreasonable irritability, which frequently leads to outbreaks of passion of a blindly impulsive character, of which their families or their associates are often the victims. Wife-beating, inhuman treatment of children during the stage of inebriety, attacks upon associates upon the slightest provocation, are of daily occurrence. The brutalizing influence of the drug, too well known to need minute description here, is shown in the loss of moral sense, indifference to the feelings and sufferings of the family, and to the loss of honour, place, or position, which inevitably follows the continued indulgence. The alcoholic is enwrapt in himself; he becomes a brutal egoist, careless of his work, his standing, of everything that he formerly prized. Those dependent upon him may suffer from want, but as long as he has the means to procure his favourite stimulant, no ethical code can bind him; his sole desire and craving is to become stupefied.

As time passes, and the bad habit is continued, there develops besides the moral weakness a mental deterioration, a true progressive clouding of the faculties. Reason is dethroned from her high place, brutal instincts develop more and more, the will-power is shattered, logical thought becomes impossible, there is difficulty in assembling and co-ordinating ideas and unreadiness of perception. The individual is no longer capable of earning a living, the mental degradation progresses, and finally a true dementia ensues and remains permanent.

Among the most frequent of the mental obliquities acquired by the alcoholic is an unreasoning jealousy toward his wife, giving rise to suspicions of infidelity and of a preference on her part for other men, which ultimately become fixed in his mind (*Eifersuchtwahn*). These delusions of marital infidelity, so common in the course of the disease, when once formed, are nearly always permanent, and are naturally the source of bitter strife and constant dissensions between man and wife.

Their origin is to be explained by the fact that alcohol at first heightens the activity of the sexual instincts, while at the same time it decreases the power of sexual satisfaction, whence arise paræsthesias of the genitalia, which are elaborated by the progressive mental weakness into delusions.

Randolph has tersely assembled the striking features of chronic drunkenness in the following lines:

> "It weaks the brain, it spoils the memory,
> Hastening on age, and wilful poverty;
> It drowns the better parts, making thy name
> To foes a laughter, to thy friends a shame.
> 'Tis virtue's poison and the bane of trust,
> The match of wrath, the fuel unto lust."

Few drunkards, fortunately, live to old age. The majority develop arteriosclerosis, cirrhosis of the liver, various inflammatory conditions of the gastro-intestinal tract with colliquative diarrhœa, and frequently pneumonia, which carry them off during middle life.

The only *treatment* for the drunkard lies in the absolute withdrawal of alcoholic liquor of every kind, which is only to be accomplished in a suitable institution, where there is no possibility of obtaining the poison. Treatment in private practice rarely is successful, owing to the many opportunities afforded by our modern saloon system for relapsing from good resolves.

ACUTE ALCOHOLIC INSANITY

a. Classical form (delirium tremens).
b. Abortive form.

The trembling delirium represents by far the most frequent type of alcoholic insanity, and but few of those who have been persistent drunkards escape it eventually. At the same time it is not absolutely necessary that the abuse of the drug be continued over a long period of time, but rather that the quantity drunk be considerable, and that the intervals between the debauches be insufficient to allow of its proper elimination. Since it is a known physiological fact that it is necessary to allow forty-eight hours for the complete expulsion of a dose of alcohol from the system, it can be readily understood that when dose follows dose in rapid succession, there results an accumulation of the poison in the tissues which may be sufficient to cause a collapse of the functions of the nervous system. It would seem, indeed, that the toxic drug expends its force more suddenly and with more paralyzing effect upon the finely organized elements of the nerve tissues; or at least it would appear that the nerve substance reacts more rapidly to the pernicious stimulus, whereas in the less highly differentiated tissues the effects are more slowly apparent. Thus, for instance, in the case of the liver we have not a sudden collapse of all its functions, but a degenerative process—a cirrhosis.

Likewise one sees in chronic alcoholics, when the abnormal stimulus is suddenly withdrawn, precisely the same issue. The stimulant being withheld, the arterial tension is lowered, and inanition of the brain centres results, with symptoms of a collapse similar to that produced by cerebral paralysis from overwhelming quantities of the toxic agent.

There are but few subjects of delirium tremens that have not suffered from some antecedent gastric catarrh (morning nausea), with consequent disinclination to take or inability to assimilate nourishment. Some are kept up on alcoholic drinks alone for weeks before the eventual collapse, and it is just these cases that afford the most typical forms of the acute mental disturbance.

After the long-continued abuse of alcohol, or the ingestion of large quantities within a short time, there follows a period of unquiet sleep, restlessness with præcordial anxiety, and a tendency to recoil in fear on the reception of sudden optic or aural stimuli.

Noises as of the roaring of the sea are heard in the ears, fiery stars appear before the eyes, the individual becomes inordinately irritable, until finally, within a few hours to a day or two, the full symptom-complex of delirium with muscular tremor and albuminuria is developed.

Peculiarly distinctive among the extravagant sense deceptions accompanying the disease are those in which the phantoms take the forms of animals. This variety of hallucination is present in a large majority of cases, and is further characterized by the fact that the objects always appear to be in motion. Snakes, rats, mice, roaches, surround the patient and besiege him ; they crawl over the bed-clothes or upon his person. Dogs jump upon him, bats fly around his head, hideous heads of tigers, elephants, and lions grin at him, or circle around him in uncanny dances. Less frequently the phantoms take the shapes of men, devils, spirits, witches, naked dancing maidens, or bestial orgies and lascivious scenes are enacted before the mind's eye. The simpler sense deceptions are represented by fiery flames, or knots on the bed-covering are converted into gold pieces, and the patient spends his time in assorting and collecting them. Auditory hallucinations, while less frequent than those of sight, are quite common. Wild cries for help are heard, the sound of music, of bells, of locomotive whistles, threatening voices, or plaintive wails fill the air. Combinations of erotic hyperæsthesias with delusions of the special senses are found. One of my patients beheld his wife ravished, then quartered, after which her remains were thrown into the corner of his cell, where he spent hours in assorting the fragments and arranging them to once more form a complete body.

Many patients speak of ants or worms crawling through their skin ; others complain that they are being cut with knives, that needles are being driven into their flesh by unseen enemies, that their genitalia are being cut off. Women will protest they are nightly ravished—all such hallucinations originating from perverted sensibility in the cutaneous surfaces.

Many of these visions of mice, rats, piles of money, wild faces appearing at the windows, and fancied sounds of an appalling nature do not constitute hallucinations in the strictest sense, but are rather illusions, since they are founded upon the actual presence of specks on the wall, knots and stains on the bed-clothing, the appearance of attendants at the doors, the call of distant or near voices, the clanging of bells, and so on, and the false interpretation

of their significance is essentially owing to the perverted (hyperæsthetic) conditions of the retina or auditory nerves.

The disturbed consciousness, which can always be noted to a greater or less degree, perceptibly augments the sensory fantasies. This reduction is usually sufficiently pronounced to prevent the sufferer from recognising his surroundings. He greets strange attendants and calls them by familiar names; he imagines himself still to be in his favourite drinking house; glasses are clicked and wine is drunk to the health of companions. Journeys also are accomplished, and scenes in the home life or discussions and quarrels are repeated. Again, at other times enemies surround him and seek to take his life, and the delirium, at one moment joyous, in the next is filled with horrible fantasies. Despite their lack of recognition of persons and surroundings, few of these patients are incapable of returning direct and sensible answers to questions. The majority can readily be induced by the physician to give him an account of their past lives and present sensations, although the narration may be broken by frequent interruptions, as the hallucinations recur, and the patient may have no idea of the significance of what he is saying.

The disposition of a patient suffering from delirium tremens is exceedingly changeable. At one moment he may be lively, agreeable, at the next he is shrinking before some frightful phantasm, while suddenly, again, he becomes irritable and angry, ready to attack and destroy anybody or anything which may come in his way. The anguish of death and silly inordinate laughter may alternate inconsequently. Some find entertainment in their constantly changing fantastic visions, others shrink from them. The hallucinations of the individual are often influenced or even generated by his previous occupation; thus the butcher slays his cattle, the shoemaker mends his shoes, the waiter calls for meat and drink.

Hallucinations of smell and perversions of taste are observed, but not with the same frequency as those of sight and hearing. The former are the more common.

Delusions are not so prominent a feature of the acute delirium as of the more chronic stages of alcoholic insanity. They arise mainly out of the hallucinations, but their presence implies a deeper reduction than do the sense deceptions. The slight retention of the power to correct the visual phantasmagoria, which is so often noticed, comes to the aid of the patient, and while he is only able

momentarily to rectify the false impressions conveyed by the optic or auditory nerves, even this amount of control is important. The most frequent delusion presumes some alteration in the character of acquaintances, who change their conduct toward him; his wife becomes unfaithful; his children or relatives are dead, for he has seen them die and has touched their cold bodies; he himself is to be hung for his misdeeds and with horror awaits the dreaded hour. The deceptions are seldom optimistic in character. The acute alcoholic does not lose his personality among the spectral animals, nor does he become a god or a king; the self-recognition retained is still too strong to permit of the total annihilation of the *ego*.

The presence of persistent delusions indicates that a long-continued course of alcoholism has preceded the acute outbreak, and the prognosis for a complete recovery is by no means so favourable. Delusions in the final stages of the disturbance are often retained for weeks, to be gradually lost as the patient recovers his strength.

The bearing of all acute alcoholics shows restlessness or anxiety. They cannot control their movements, or keep quiet for more than a few moments at a time; they wander about their apartments, stopping to collect the phantasmic gold pieces or bank-notes; they proceed to drive away the insects or small animals that throng about them, hammer upon the door, answer loudly voices that call to them, shrink from the frightful animals and spirits that surround them, and seek the protection of the attendants; or if at large, they rush to the nearest police station for shelter. Only rarely do they make attempts at self-destruction, though these should always be guarded against. Murderous onslaughts are also comparatively rare, though the subject of delirium tremens is always to be regarded as a dangerous person, especially if he suffers from hallucinations of impending death or slaughter, for then he is liable to seize the nearest weapon and injure or slay any one who comes in his way. Sleep is absent or much broken in the early stages of the delirium. When exhaustion takes place as a result of the long-continued agitation, the individual may pass first into a stuporous condition and thence into a true sleep.

Owing to the coincident catarrh of the digestive tract, and the more or less complete abstinence from food, nutrition is usually at a low ebb. When the insanity has been repeated again and again, from the pre-existent hallucinations delusions may be developed, and the patient may refuse to accept any food at all, from fear of the poison which he believes it to contain.

The *motor phenomena* of alcoholic delirium are of equal importance with the sensorial disturbances, but being less prominent are frequently overlooked.

There is a notable degree of a fine muscular tremor, most marked in the small muscles of the face and hands, but also present in the entire system of voluntary muscles. It is characteristic of this tremor that under psychical stimulation it momentarily ceases, only to begin again as soon as the attention is distracted. A deliriant will thus, no matter how tremulous he may be, obtain control over his muscles sufficient to enable him to carry a glass of water rapidly to the mouth without spilling it; but in severe cases, if the attempt be made too slowly, while the first motions are effected with proper co-ordination, those succeeding are accompanied by a degree of motor jactitation that, while it may not defeat the object in view, renders it difficult of accomplishment. Again, a pin may be picked up, or a button unfastened properly, provided the motions are rapidly made. There is therefore no true incoordination, but an insufficiency of nerve control that amounts to a true paresis of voluntary movement. Any forced extension of the muscles (e. g., extending the hand with the fingers outstretched) tends to bring on the tremor or to increase it perceptibly, and likewise any strained position of the body will equally elicit it. Muscular twitchings and clonic spasm of isolated muscular fasciculi are only present in the severer forms of the acute alcoholic delirium. Of these, contractions of the orbicularis and occipito-frontalis muscles are the most noticeable. Vibratory tremor of the tongue is often found, although there may be complete control of other muscles. Reflex excitability is increased in all cases that approach a collapse delirium, and in rare instances the excitation of the knee-jerk on one side will produce contractions of the corresponding muscles of the other leg. The gait is often uncertain, and there is stumbling on account of muscular weakness. The patients ordinarily stand with equal firmness, whether the eyes be closed or open.

In the domain of the cutaneous sensory nerves there are anæsthesias, paræsthesias, or analgesias, which tend to produce corresponding hallucinations.

The *temperature* in uncomplicated cases of delirium tremens is seldom elevated to any extent; indeed, it is sometimes subnormal. The average rise is not more than 1° F., but in severe cases it may exceed this considerably, and the prognosis is then by no means so

favourable, as the presence of fever indicates the existence of some intercurrent disorder, presumably an infection (delirium tremens febrile of Magnan). The respiration is increased in frequency; the pulse is often weak, rapid, and without tone. Profuse sweating occurs in some cases.

Friis concludes that in the cases observed by him the bodily temperature was considerably higher than that given by the majority of writers on the subject. He found the average to be 102° F., but attributes the difference between his observations and those of others to the inferior quality of the liquor that is drunk in Stockholm.

Leucocytosis in Delirium Tremens.—Elzholz has obtained some very interesting results from examinations of the blood in acute alcoholic delirium. His investigations were made on sixteen cases; in eight he found a distinct increase of the white elements of the blood at the height of the delirium. With the passing off of the delirium the leucocytes decreased frequently to a point below the normal, afterward returning to the natural number. The cases without leucocytosis were afebrile; of those with the increase, some had fever while others had none. With an increased number of leucocytes there was regularly a preponderance of the polynuclear neutrophile forms over the mononuclear. From three to four days after the critical sleep there came a change in these relations, the mononuclear forms attaining to a high percentage, the polynuclears becoming relatively few. The eosinophiles almost vanished at the height of the delirium, but reappeared after sleep.

Albuminuria in Delirium Tremens.—Albuminuria is fairly constant in the early stages of an attack of delirium tremens, and has recently attracted much attention. Fürstner in his cases found 40 per cent with albumin in the urine. Näcke, at a later date, on investigating 11 cases, found albumin to be present in 82 per cent. The last investigation of moment, that of Liepmann, included 72 cases of ordinary delirium. In 56 (or 76 per cent) of these albumin was present. In 40 of the 56 cases the albuminuria was transient; in 16 it remained constantly present while the patients were under observation. Of the cases with protracted albuminuria, 7 proved fatal, and autopsy showed nephritis in 5 of them, while in 2 there were no pathological changes. Liepmann is of the opinion that there is a relation between the presence of albumin and the delirium; when the delirium is intense the albumin appears; as it recedes the albumin disappears.

Friis, among 129 unselected cases, found 32 per cent with albuminuria. Krukenberg found 52 per cent with albumin in the urine among 365 cases of delirium tremens of all types. The clinical records of our local asylum show even higher percentages in the early stages of the disease. The presence of albumoses in the urine is among the rarest exceptions.

Course.—An attack of ordinary trembling delirium of alcoholic origin generally runs its course without serious complications and tends to quick recovery. Only in those cases in which there has been abstinence from food for many days and severe exhaustion exists, together with an obstinate derangement of digestion so that no nourishment can be retained, need a fatal end be anticipated. In the past five years, at the Baltimore City Asylum, there has been no death from the disorder, taking mild and severe cases together.

This death rate at the City Asylum by no means coincides with those reported from both American and German sources, which vary from ten to twenty per cent of severe cases. The difference is hardly to be accounted for by any better quality of the liquor consumed in this region, but rather by the fact that enforced feeding is insisted upon, and, except in rare instances where the collapse is profound, alcoholic stimulants are withdrawn absolutely.

The average *duration* of an attack is from a week to ten days. Many cases recover within three or four, others are protracted over fourteen or even eighteen days. Under prompt treatment the duration can often be shortened, and the restitution to health rendered much more complete.

Usually the first sign of commencing recovery is the recognition on the part of the patient of the falsity of his hallucinations. Intervals of complete consciousness alternate with those of more profound disturbance for several days.

When an individual has had repeated attacks of delirium tremens there frequently linger, after the restitution to the normal physical state, some remnants of various delusions of a persecutory nature, which may go on growing and finally develop into the chronic persecutory insanity of the alcoholic.

The *diagnosis* of delirium tremens is usually not difficult if the cardinal symptoms of hallucinatory delirium, combined with tremor and albuminuria, are kept in mind. Some cases of general paralysis show symptoms similar to those of the alcoholic deliriant,

but the confusion is deeper, and, above all, the constant oculo-motor symptoms help us in the differentiation. Nevertheless, it is well to remember that the second stage of paresis is often directly induced by indulgence in alcoholic drinks.

The alternations of lucidity and hallucination are usually sufficient to differentiate between the confusional forms of mania and the delirium ebriosorum.

Therapy.—Remembering that delirium tremens is essentially a collapse delirium, the main treatment should consist in the administration of nourishing, easily assimilated food, and the production of sleep.

Unless the anorexia and catarrhal state of the stomach are very severe they may be entirely disregarded, and liquid custards and milk diluted with lime or soda water should be forced upon the patient, by the mouth if he will take them, if not, through the stomach tube. Nutriment is an absolute necessity for any case of acute alcoholism. When there is obstinate anorexia, fairly large doses of capsicum and nux vomica should be administered, the capsicum having a most beneficial influence upon the atonic dyspepsia, stimulating the secretions, especially those of the kidneys, while the nux vomica tones the vascular system and directly braces the disordered nerves, while tending to produce appetite. Combinations of essence of pepsin and bismuth with capsicum are also useful. Where there is much bodily depression with a very rapid pulse and loss of arterial tension, digitalis may be employed with benefit, but this drug should be given in only moderate amount. The heroic doses formerly so much in vogue have been proved to be dangerous, since they are liable to produce collapse. Care should always be taken to see that the lower bowel is thoroughly emptied, since, as a rule, such patients have neglected themselves and may be obstinately constipated.

The proper choice of an hypnotic to induce sleep is of great importance. When the patient is young and strong, and there is no evidence of approaching heart failure, chloral hydrate with potassium bromide (fifteen or twenty grains of chloral to thirty of the bromide), repeated at intervals of three or four hours, under careful supervision, is the best medicament, and will succeed more often than any other means. Sulfonal, trional, paraldehyde, in the order named, come next, and are not usually dangerous.

Methylal, given in a ten-per-cent solution subcutaneously, is highly recommended by Krafft-Ebing as a sleep-inducer. Opium in

any form is not usually indicated, and, if given, should be very gradually withdrawn.

Alcohol in all forms should be absolutely prohibited from the onset of the treatment, unless there is a marked tendency to heart weakness and collapse; and even then it should be replaced as soon as possible by strychnine, caffeine, or other heart stimulants. All delirious patients should be carefully watched, and should be provided with an especial attendant to guard against injury to themselves and others, as well as to administer nourishment and medicine with regularity. If the patient cannot be induced to keep himself clothed, the room should be kept sufficiently warm (75° to 80° F.). In any case treated in a private house care should always be taken to see that the window-sash cannot be raised more than a few inches, so that any sudden attempt on the part of an individual, fleeing from imaginary dangers, to leap out of the window may be thwarted.

When the deliriant is physically strong, hot and cold baths given alternately often prove of great service in calming the excitement. Warm baths of short duration are preferable when the degree of enfeeblement is considerable.

The after-treatment mainly consists in absolute abstinence from alcohol, good but light nourishing food, tonics of quinine, strychnine, and iron, exercise, frequent warm baths, and an abundance of fluids with lithia or urotropin to eliminate the waste tissue products from the organism.

The *abortive form* of delirium tremens is of considerable frequency, though it is comparatively seldom seen in institutions for the insane. The clinical prodromata are in every way similar to those of the classic variety; there are the same symptoms of atonic dyspepsia, and many of the patients have taken no food for days during the debauch, but have kept on drinking until eventually tremor, mental anxiety, præcordial distress, profuse sweating, disturbed sleep, broken by frightful dreams, together with acceleration of the pulse and respiration, make themselves manifest. But while the general indications of an approaching breakdown of the nerve tonus are well developed, the psychical alteration does not proceed to the evolution of hallucinations during the waking state. The treatment is similar to that of the typical form of the disease, and watchfulness should always be exercised, as the milder cases may readily pass without warning into the severer types.

Pathology of Alcoholism

The pathology of acute alcoholic delirium in the human subject is rather indefinite. The vascular lesions are the most prominent, but some vacuolation of the cell body and cloudy swelling have been demonstrated. It is to workers in the field of experimental pathology that we owe whatever clearer insight into the degenerative lesions of the neurone induced by alcohol in its various forms has been obtained in recent years.

The first important experiments in this line are those by Mierzejewski and Jakimow. The latter poisoned dogs with large quantities of diluted alcohol (380 cubic centimetres in thirty hours). The lesions found were entirely confined to the cells of the gray substance, and consisted in a degenerative atrophic condition. The vessels were choked with blood corpuscles, but, with the methods of staining then in use, showed no further alteration.

Later, Vas, using aniline stains for the differentiation of the nerve elements in the brains of animals poisoned with alcohol, found changes in their receptivity for the dye and loss of the definite chromatin structure of the cell.

Delhio, in acute experimental alcoholism, using the Nissl method, also discovered changes in the chromatin structures of the cell, and an increased receptivity of the protoplasm for the dye.

Colella and Andriezen found certain alterations of an atrophic character in the dendrites of the nerve cell.

The writer, in 1896, studied the brains of rabbits poisoned during a period of about three weeks by daily quantities of ethyl alcohol equivalent to 1,500 cubic centimetres of ordinary whisky for a man weighing 150 pounds.* Clinically, the most striking feature was the great wasting, the animal losing considerably over one half of its original weight in three weeks, and this despite the most careful feeding.

For the nerve cells of the cortex, the Nissl method showed, in somewhat indefinite detail, beginning chromatolysis of the protoplasm, and minor alterations in the nuclei of the cells; but by the silver-phospho-molybdate method definite lesions of the dendrites could be demonstrated, at a point beyond that at which they were rendered visible when the aniline colours were employed. These morbid changes consisted in varicose swelling of the branches, and

* This material was kindly furnished by Dr. J. Friedenwald.

subsequent atrophy with loss of the gemmulæ. The bodies of the cells showed few indications of disease, and the axones and collaterals none; accordingly, the damage to the nerve cell may be regarded as being to a certain extent of a reparable nature. The neuroglia, especially that variety possessing thick arms and tentacles extending to the sheaths of neighbouring vessels, exhibited swellings of the protoplasmic extensions and bodies; this lesion appeared to be everywhere prevalent.

The lesions in the sheaths of the blood-vessels of the cortex were extremely well defined. The nuclei of the endothelial cells were universally swollen, in places fragmented, and showed alterations in the capacity for receiving the aniline dye. The cell protoplasm was also distinctly undergoing retrogressive changes. The walls of the intermediary vessels looked as if they had been subjected to a severe strain, their naturally even contours being distorted, and many irregular bulgings appearing in their outlines. The changes in the muscularis of the arteries were not less interesting. Nuclei were now and then absent from areas of the middle coat of the vessel, and in those that remained certain abnormalities were noticeable. It was, however, in the muscular protoplasm that the lesions were most marked, and there were indubitable indications that the cells were undergoing a retrogressive process. The cell substance was no longer clearly stained, but looked turbid or hyaline in character. The protoplasm, too, was considerably swollen, and its receptivity to the dye was below normal. The Virchow-Robin lymph space was entirely obliterated, and in those portions where the tumefaction was most pronounced, there was almost complete closure of the His lymph space, the outer lamina of the vessel being pressed closely against the limiting membrane of the perivascular sheath. Changes in the adventitia were not so pronounced as in the inner coats, although in some places, in the former, considerable numbers of leucocytes were included, while in others they were packed between it and the outer wall of the lymph space. These elements were swollen and necrotic.

The contents of the perivascular spaces, where the internal pressure had not been sufficient to obliterate them, afforded an instructive picture. Besides the leucocytes in all stages of disintegration, such a space would contain numbers of large protoplasmic bodies, and quantities of detritus, finely granular in character, which apparently had not been derived from the broken-down leucocytes.

In the capillaries as well as in the intermediary vessels changes similar to those in the larger arteries were demonstrable. The cells showed the same departures from the normal in staining, and here and there in the lumen were plugs of white blood-corpuscles, which from their closely packed appearance must have entirely stopped the circulation of the blood in the vessel before death. The part of the lumen beyond the plug was entirely devoid of contents.

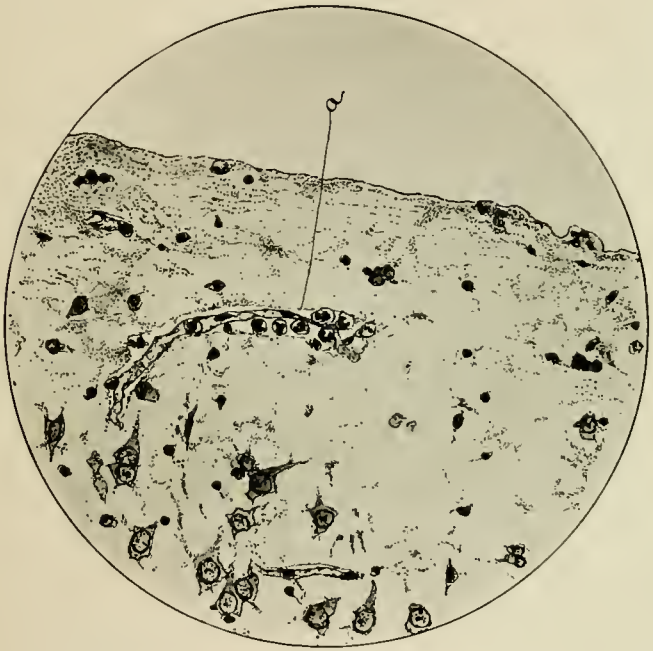

FIG. 24.—ACUTE EXPERIMENTAL ALCOHOLISM. Polynuclear leucocytes in the perivascular space surrounding a small intermediary vessel, and compressing its walls. At the point marked *a* the lumen of the vessel is seen to be obliterated. Drawn from a microphotograph by Dr. A. G. Hoen. × 280.

The changes in the coats of the veins were similar to those seen in the arteries, but here aggregations of dying polynuclear leucocytes were more frequent, and were by far the most striking feature both of their contents and of their surroundings. So vast were the collections in the perivenous spaces that in some few cases the whole channel was filled, while backward pressure from the plugs and compression of the vessel from the outside had attained to such a degree that in a number of instances the walls of the veins had ruptured, and red corpuscles intermingled with the white completely

filled the space. All the leucocytes within and without the vessel showed more or less evidence of degeneration, which in some of these cells extended to erosion and complete disintegration. It would thus appear that, at some period antedating the death of the animals, collections of leucocytes had formed in the smaller vessels and veins, and a slowly increasing backward pressure had been exerted upon the arteries; and that the abnormal pressure, while not sufficient, it is true, to occasion complete stasis, nevertheless, when acting in combination with the poisonous effects of the alcohol carried with the nutrient fluids, had caused degeneration of the cellular elements of the vessel walls; and that finally, as a result of the vascular lesions, those of the nerve elements and neuroglia had followed.

Certain more recent investigations, as those of Marinesco and van Gieson (personal communication), have not dealt with the blood-vessels, but have confirmed the views that chromatolysis, principally in the peripheral form, takes place in the nerve cell body as a result of the deleterious influence of alcohol.

THE ALCOHOLIC PSYCHOSES

Continued inebriety is sometimes the cause of types of insanity of a less specific nature than those just reviewed. Thus, in the clinic, cases of melancholia and of mania are met with, in which the disease does not follow the ordinary course of the primary psychoses, and in which the alienation is attributable to the abuse of alcoholic liquors. The melancholias are distinguished by their sudden inception, the depth of the mental reduction, and the short duration, followed by complete restitution; the manias by their equally sudden appearance, the deep disturbance of consciousness, and sudden restitution.

The Alcoholic Melancholia

There are rarely any prodromal symptoms beyond headache and a tendency to sleeplessness. Suddenly numerous hallucinations come on; visions of death, of torture, imprisonment, of murder committed before the patient's eyes; shrieks fill the air, complaints of his ill conduct, threatening voices, telling him that he is infected with some loathsome disease, that he is a thief, a child murderer, or is to be poisoned, are heard. More rarely there are visions of animals, devils, witches, phantoms, as in the acute delirium. With

the hallucinations come a fear of all things and of every one around, præcordial anxiety, neuralgic pains of great intensity due to the disturbed metabolism in the peripheral nerves, and suicidal thoughts.

Albuminuria is quite frequent, and when present helps to distinguish this form from the primary types of melancholia. The reflexes are sometimes lowered, sometimes a little exalted, more often normal.

The duration of the disease seldom exceeds eight or ten days, and on recovery the patient's remembrance of the period of the hallucinatory delirium is not clear, but dream-like. Not infrequently a residue of the sense deceptions remains, to be evolved at a later date into a delirium of persecution.

Fig. 25.—Facial Expression in Chronic Alcoholism. The patient had been an army officer and a fairly successful merchant. He became an alcoholic, and had periods of suicidal mental disturbance as a result of the excesses *in vino*. The attacks increased in severity as he grew older. From a photograph kindly loaned.

Alcoholic Mania

The outbreak of alcoholic mania is sudden, often coming on in the night season as the result of an overpowering sense deception of mortal fear or of imminent danger. While in this state the individual is highly dangerous to those who chance to be in his immediate neighbourhood, and numerous unmotived murders have been committed by such individuals, who on recovering have not the slightest recollection of any event that has occurred during this period of excitement. The chronic alcoholic is a constant menace to his family and to society at large.

A case eminently illustrative of this fact recently came to my notice. Two men, a harmless and industrious cook and an alcoholic, were sleeping in one bedroom. In the middle of the night the alcoholic became suddenly frenzied, seized a heavy boot, and dashed out the brains of his companion. When found, he was wildly excited, confused, and ready for another outbreak of brutal

violence. Hallucinations could not be determined. At the end of three days the frenzy abated, the man became coherent, but denied all knowledge of the murder of his comrade, and remained irritable and impulsive.

The premonitory symptoms of an attack are found in increasing irritability, morbid impulses, especially toward sexual excitement, disturbed sleep, and general alteration of the mien and character, with increased inclination to hard drinking.

The excitement is usually characterized by extreme violence, resembling the blind, reckless fury of the paralytic, though in the latter the mental reduction is more pronounced and longer continued. The excitement is also distinguished from that of the primary forms of mania by the absence of even temporary self-control and by the impulsive egotism, as well as the extraordinarily passionate and destructive disposition of the patient, who does not hesitate at indecent assaults even upon members of his own family. At the height of the excitement an intense degree of mental confusion, disturbance of the innate consciousness and motiveless impulsive acts, tremor of the facial and hand muscles and severe articulatory disturbance are to be noted.

The organic nature of the disease is evidenced by the tremor, occasional facial paresis, myotic or unequal pupils, the speech disturbance, and by marked alterations of the deep and cutaneous reflexes, which are usually exaggerated.

To add to its similarity with general paralysis, there are frequently delusions of pre-eminent self-importance, though these are of a more fixed and abiding nature. The patient becomes God, Christ, a saviour of the world, or a prince among men, and expects to be treated by his fellows in accordance with his delusive concepts. Opposition induces scenes of frenzy, screaming, angry outbreaks, destruction of clothing or of the furniture of the room. The delusions are evoked principally by antecedent hallucinations similar in a measure to those of the acute alcoholic deliriant, and consist mainly of religious fantasies. Paradise opens its gates, angels or devils throng around in innumerable crowds, and the maniac converses with them and receives audible replies. Through the height of the excitement sleep is entirely in abeyance. Remissions of an abortive form take place at infrequent intervals, only to be cut short by the continuance of the delirium, and a return to the destruction of bed-clothing and furniture, the agitation continuing until exhaustion is complete. The patients injure themselves, strike

their heads against the walls, bruise their bodies, break bones, all without the least apparent indication of discomfort or physical pain.

The disease runs a course of from one or two days to several weeks, according to the gravity of the case. The remissions gradually become longer, the excitement is less intense, sleep more frequent and refreshing. Physical weakness is now apparent, and the patient slowly returns to a more natural mental condition, the delusions persisting over a considerable period, and a degree of mental weakness remaining permanently.

A very considerable number of cases do not follow this favourable course. In some the motor and mental excitement increases to a point of great intensity, and is succeeded by a muttering delirium, with symptoms of collapse in which the patient dies.

In other examples the affection runs a chronic course. Dementia succeeds the mania, spells of screaming, tearing the clothing, and weeping, follow periods of explosive violence. The delusions become less and less definite, the nutrition sinks, the pulse becomes slow, the arterial tension is lowered, and the temperature subnormal. Irregularities in the muscular innervation appear, pareses, sweating of one side of the face or body, inequalities in the pupils, and ataxia of the lips and extremities are noted; prominent above all is the progressive weakmindedness.

Death occurs after the lapse of months, from diarrhœa, pneumonia, or a progressive decline of the vital powers with decubitus.

The *prognosis* in chronic alcoholic mania should be guarded. Not more than forty per cent return to anything approaching mental health, numbers die in the stage of collapse, and still more recover only a small part of their mental endowments.

The *treatment* consists mainly in prolonged baths, with cold applications to the head, the hourly administration of nourishment, principally milk and egg albumen diluted with soda or carbonated mineral water. Digitalis and strychnine may be used to combat the increasing heart weakness; hypodermic injections of ergotine and morphine to allay the cerebral congestion. The patient should be kept in bed, as far as possible, in a room with a fairly high temperature. In the stage of collapse quinine and strychnine are indicated, or the use even of alcoholic stimulants may be advisable. The bodily warmth should be looked after, hot-water bags applied to the feet and back, and, if necessary, the temperature of the room should be raised.

The *pathology* is similar to that of all examples of chronic alcoholism. Cases that have come to the section table show intense congestion of the meninges and brain substance, varicosity of the veins, a cloudy and gelatinous pia non-adherent to the cortex, general œdema of the brain, atrophy of the convolutions, and dilatation of the ventricles. The arteries are often distended and do not collapse; they show a patchy or diffuse arteriosclerosis or atheroma. The localized endarteritis of the terminal branches of the cortical and other cerebral arteries is an especially striking feature in the pathological examination of the brains of those who have died from chronic alcoholism. The condition may be present without the slightest indication of arteriosclerosis in the radial and temporal arteries, or even when no pronounced arterial degeneration in the aorta or in the larger cerebral vessels can be demonstrated at the autopsy. Sclerosis of the white matter around the edges of the ventricles is quite frequent. The ventricular ependyma is usually granular. Microscopic examination shows venous stasis, filling of the perivascular channels with transuded blood-corpuscles, granular detritus in the lymph channels, and the general evidence of antecedent congestion followed by retrogressive metamorphosis in the nerve elements.

Alcoholic Persecutory Insanity

The suspicious or persecutory delirium of the alcoholic may arise either after a short stage of incubation or by a process of gradual evolution.

The first form is much more frequent. After the continued abuse of alcohol there comes a time when headache, disturbed sleep, and circulatory irregularities become marked. Suddenly hallucinations, more commonly of hearing than of sight, come on. The patient hears mocking or threatening voices that mainly refer to the reproductive faculties. They tell the man that he is impotent, that he is a sexual pervert, that his penis is withering away, that he is a seducer, or that his wife is unfaithful to him. Other voices pour into his ears the most revolting language, or declare that he is hypnotized or being acted upon by electric or magnetic currents. Enemies follow him with taunts and scoffs; they try to poison him through the medium of his food, his drink, or tobacco. Hallucinations of smell and taste are fairly frequent, and are not seldom intermingled with delusions. Secret tubes are run through the walls of his bedroom, through which are conveyed noxious and poisonous

vapours to steal away his mind and render him insane. By means of wires under the flooring or in the ceiling, unseen foes influence him or shock him with electric currents, to the utter destruction of his stomach and the ruin of his digestion.

The sexual delusions arising from the cutaneous anæsthesias and paræsthesias are the most common, and next in frequency come those in which the subject believes himself to be in imminent dan-

Fig. 26.—Alcoholic Persecutory Insanity. This patient was addicted to the abuse of alcohol from his earliest youth. After each debauch there were periods of total loss of memory for current events lasting for days, sometimes for weeks. In his fortieth year, while on a journey, he began drinking heavily, and soon all idea of his personality vanished. In this irresponsible state he wandered as a tramp over two thousand miles, and landed four times in jails and asylums. In the stage of restitution to normal mentality he was greatly annoyed by voices that poured into his ears the most revolting language: that he was a pæderast; that "his private parts were to be cut off"; that he was to be "hung up by the testicles until dead," or, if this did not finish him, that he "was to be burned alive." There were also persecutory ideas of being poisoned. The characteristic tremor of the small muscles of the tongue and fingers, slightly exaggerated reflexes, nocturnal and diurnal muscular cramps, and local anæsthesias of the skin were present. The man after a four months' sojourn in the asylum eventually lost his hallucinations and delusions, and was discharged from supervision in a but slightly demented condition.

ger of his life from the persecution of enemies. These inimical persons are usually unseen, and act upon the patient from a distance by means of electricity or diabolical machines invented for the purpose of tormenting him. As a result of the imagined persecution, states of fear and anxiety are frequent, and the individual

seeks the protection of friends, the police, or voluntarily enters an institution.

Egotistical delusions are sometimes coupled with the persecutory delirium. On account of his immense riches the alcoholic is annoyed by his enemies; attempts are made to poison him to obtain his wealth; secret societies employ agents to follow him and destroy his powerful influence against them.

Occasionally delusions take the form of an imagined access to political power. The individual feels that legally he is President of the United States, governor of a State, or mayor of a city, but is prevented by inimical agencies from exercising his official functions.

The course in these cases of persecutory delirium varies. A proportion, after the total withdrawal of the causative agent, return to health within a comparatively short time. Others become weak-minded, retaining feeble impressions of former delusions. Still others keep their hallucinations and sequent delusions, and the disease runs a protracted course, the patients becoming more and more demented as time goes on, although a partial restitution may exceptionally occur after the lapse of several years.

The variety of alcoholic persecutory delirium arising by gradual evolution shows practically the same indications as that characterized by a sudden onset. The aural hallucinations at first take the form of noises in the ears, whistling sounds, the whir of machinery. Gradually from these, owing to the perverted mental state, arise actual voices, which become clearer and clearer to the sufferer as the mental deterioration proceeds. These voices call to him, mock him, harass him in the day and haunt him at night. They tell him he is to be poisoned, or incarcerated in prison, that his wife is unfaithful, that his children are changelings who have been foisted upon him in their childhood. In this form also sexual perversions predominate; signs are made by persons in a crowd that he is a pæderast, an onanist, that he is impotent. As the mental enfeeblement progresses, hallucinations of sight make their appearance and visions of all kinds are seen, although those of a sexual type predominate.

The hallucinations and delusions foster irritability and roughness of manner and action; the individual is ready to take offence even without provocation. Delusions that family and friends are hostile to him possess him. He turns upon his supposed tormentors and seeks to injure or destroy them; indeed, the individual afflicted with this form of alcoholism is one of the most dangerous of the

insane. Finally, the false conception of the notice he attracts begets the delusion that he is a person of importance. The constant espionage, the attendant voices, all foster these ideas, which are aggravated tenfold by the ever-present defects of memory. He is kept from his rights, from his civil station, from his position in the government, and as a result he is querulous, irritable, furious on the slightest opposition. In many cases there is disturbed sleep, frightful nightmares, and nightly appearances of visions.

Nearly all cases show the characteristic signs of alcoholic degeneration, facial tremor, partial paresis, anæsthesias, general muscular tremor, forgetfulness, and permanent loss of memory.

The symptom-complex is so similar to that of paranoia that the condition is known as *alcoholic pseudo-paranoia*.

The course is progressive, the mental deterioration precluding any hope of recovery. The treatment necessarily consists of isolation in an asylum—at least for a time, until a terminal dementia ensues—and the total withdrawal of alcohol.

Alcoholic Amnesia

While forgetfulness is characteristic of all forms of chronic alcoholism, the loss of memory may be so prominent as to constitute an especial form of the disease.

Patients affected with the more pronounced types of amnesia have usually been hard drinkers, particularly in the early hours of the day, and have the characteristic morning nausea, with tremor and anæsthesias, but comparatively seldom the intense irritability associated with chronic alcoholism. This difference is probably determined by the more profoundly disorganizing effect of the poison upon the nerve cell, as the examples, especially those occurring in early life, are frequently in subjects of hereditary instability. Hallucinations and delusions do not assume the prominence they have in delirium tremens or alcoholic persecutory insanity; indeed, in many cases they are entirely absent.

The characteristic sign of this type of the malady is the instantaneous forgetfulness of events that have only just transpired. Thus names or the simplest sentences, repeated over and over again to the patient, are totally forgotten either instantly or after the lapse of a few moments, nor does there exist any possibility of their recall in the future. Every degree of amnesia is found, from the severer type above delineated to an incomplete retention of the most prominent features of a conversation.

This forgetfulness of names, dates, the order of work, even of meal-times, renders the patient unfit to follow the daily pursuits of ordinary life. This incapability may exist for the simplest procedures. I have, for instance, ordered a patient afflicted with alcoholic amnesia to bring me a glass of water from the hydrant. He would start off with perfect willingness, would perhaps reach the door, and then return for further orders, with the acknowledgment that he had forgotten for what purpose he had been sent. The scene has been repeated eight or nine times in succession, the patient sometimes very nearly succeeding, at other times hardly reaching the doorway before abandoning the attempt.

The memory for past events, those dating back to the earlier childhood or manhood, is fortunately not affected to this almost incredible extent. Intelligent conversations can be maintained just so long as the memory of the subject has been well grounded; events long past are recalled with a fair degree of minuteness, old familiar airs are sung correctly, the school days are remembered in detail, the flow of language is good. Just as long as the individual's recollection of the long past is involved all goes well; but try him on the events of yesterday and everything is an utter blank. He cannot tell you whether he has eaten, slept, or received letters, or, in fact, what he has or has not done; the current events of daily life are a sealed book to him. The correlation of past intellectual impressions and the correctness of associated language place these instances of chronic alcoholism beyond the pale of the aphasias, ataxic or motor; nor is there present word-blindness, for the individual can read correctly; nor word-deafness, for he can hear and comprehend perfectly, though the after-feature of memory loss is instantaneous.

The patients afflicted with this form of amnesia retain their full consciousness, recognise their mental enfeeblement, and strive against it to the best of their ability and with almost painful earnestness.

The *prognosis* is far from hopeless provided there is absolute withdrawal of the inciting cause, and strict attention is paid to ordinary hygienic measures. I have seen patients with the most profound amnesia, amounting to absolute forgetfulness of every daily event, recover in the course of several years sufficiently to become useful members of the community. It is necessary to re-educate them, to have them follow a daily routine of work, until each duty becomes automatic and refixed in the consciousness by continual stimulation. Simple tasks are given at first, and by de-

grees those more complicated, until quite a stock of useful knowledge is gained. Young patients recover much more readily than those in middle life; indeed, the older the person the less the chance for permanent recovery.

Alcoholic Dementia

In the course of time a dementia follows all forms of chronic alcoholism, but in individuals with invalid brains the enfeeblement may assume a progressive type, with but slight motor implication. It is more frequent in the early years of adolescence and in the retrogressive period of life than in the third and fourth decennaries.

In a considerable number of instances in young persons between the ages of eighteen and twenty-five years, the sons of alcoholics, or of parents having a long history of family neuroses, I have seen the very moderate indulgence in alcoholic liquors produce an enfeeblement of the intellectual faculties, progressive in character, that ended in complete abolition of the reasoning power. Such patients are reduced to the level of the brute, since they retain only their animal instincts and somatic functions.

In the healthy individual with a stable nervous organism, it is noteworthy that when the use of alcohol is begun at a moderately advanced age the mental deterioration is much more rapid than when the habit is formed in early adult life. The trembling delirium and forms of persecutory insanity are then frequent. But even more common is a chronic progressive dementia, the first symptom being loss of memory, which is followed later by inconsequential motor phenomena, and finally by a progressive weak-mindedness passing into absolute obliviousness. The prognosis in both forms is absolutely unfavourable. The process may be retarded by the withdrawal of the drug, but the already existing enfeeblement is permanent.

Alcoholic Pseudo-paresis

By alcoholic pseudo-paresis we understand the occurrence in a chronic drinker of a symptom-complex which bears a certain resemblance to that of true dementia paralytica, but with which it has really nothing in common. Two forms are distinguished. In the *first*, to the customary mental enfeeblement, hebetude, remnants of former hallucinations or delusions, especially those of marital infidelity, the tremor, general neuro-muscular debility, and anæsthesias and paræsthesias, are now superadded the ataxia of the para-

lytic, with speech defect, constant headache, and frequent apoplectiform and epileptiform convulsions. The speech defect consists in an ataxic rather than a stuttering utterance. The *diagnosis* is usually not difficult when there is a history of repeated excesses *in vino*.

The *prognosis* is relatively much more favourable than in true paresis, inasmuch as in place of the progressive downfall a partial restitution may be looked for in the course of a few weeks. This partial recovery, it is true, may be delayed for months, but never for years.

In the *second* form, the true pseudo-paralysis of the alcoholic, if an apparently paradoxical term may be permitted, the similitude between the two affections is much more striking, and the diagnosis becomes correspondingly difficult.

The signs of disturbance of the neuro-muscular apparatus, labial ataxia, tremor, or epileptiform attacks are absent or ill defined, but, instead, we meet with a true expansive delirium, delusions of vast wealth, of the ownership of the world, factories, houses, banks, horses, or whatever may have been formerly connected with the pleasures or the business of the individual. Sexual delusions are also frequent. The organs of generation have grown larger in size, the procreative powers are wonderfully increased, the patient is possessed of a hundred wives, the most beautiful in the land; or his mind is filled with numerous other grotesque imaginings, daily changing in character.

These expansive conceptions continue only for a few weeks or one or two months, when they are cut short by the advancing partial dementia; but in this state of feeble-mindedness the patient remains, and does not pass by the descending course of the progressive paretic to complete mental annihilation.

Tiling has recently called attention to the frequent occurrence of neuritis in the first type of pseudo-paresis, the neuritis and amnesia together constituting the principal features of the malady. It is certain, however, that in the second there are many examples in which there is no evidence of accompanying neuritis to characterize the affection.

Pupillary disturbances are by no means so frequent in the alcoholic form as in true paresis, although the light reflex is sometimes absent, and slowness of reaction to accommodation and convergence may occur. On the other hand, pupillary inequalities are not uncommon.

The state of the deep reflexes depends upon the nature of the pathological changes. When there is neuritis of the peripheral nerves they are lowered or absent; when the neuro-muscular signs are lacking the reflexes are normal or too readily elicited.

Alcoholic Epilepsy

Alcoholic excesses not only aggravate the ordinary forms of epilepsy, but may by themselves give rise to attacks. This is particularly noticeable in the children of alcoholics, who have themselves acquired the drinking habit at an early age. A striking instance is related by Bourneville and Rellay of a child who learned to take stimulants, in the drinking-house of his grandfather, at the age of four years. The same year the epileptic seizures began, and death occurred in the eleventh year, the boy having become wholly demented. The case well illustrates the instability of the nervous organism and proneness to degeneration in childhood, as well as the influence of deleterious drugs upon it.

As high as eight or ten per cent of alcoholics have eventually epileptic seizures, the inception being ordinarily immediately after a hard debauch.

The attacks may be incomplete, with spasms of single muscles, or of one half of the body with partial loss of consciousness, accompanied by very active symptoms of cerebral congestion. At other times the convulsion is complete, the spasms being universal and severe, the loss of consciousness profound; the tongue may be bitten, or the patient may hurt himself severely. Stuporous states are prone to follow the severer attacks, and are usually more protracted than in the idiopathic epilepsy. Epileptiform convulsions may also occur as the equivalent of an attack of delirium tremens; the psychical disturbance is then deeper than that ordinarily seen. In other cases the delirium may be ushered in by an epileptic seizure.

The *prognosis* is unfavourable even with complete withdrawal of the stimulant, and repeated seizures are liable to bring about a speedily fatal issue, an intense congestion with general œdema of the brain being found at the autopsy.

The *treatment* should be mainly hygienic. The withdrawal of the alcohol is imperative; bromide of potassium should be exhibited in fairly large doses, and where there is defect in the circulation during the intervals between the attacks, digitalis or adonis vernalis in small doses is indicated.

Closely allied to the epilepsies are the states of dual conscious-

ness, automatism, and somnambulism that are fairly frequent in alcoholism. These forms are interesting mainly from the standpoint of the responsibility of the individual for acts and deeds committed while in the state of second consciousness.

Transient automatism, where the person performs various perfectly co-ordinated actions while in a state of apparent consciousness, but with a complete lack of remembrance for all that has transpired in the meanwhile, is on the whole rather frequent (Francotte, Crothers). Instances in which this state persists for days or weeks are very rare, although two such patients have come to our clinic, the condition in the one lasting six weeks, in the other five months. To all intents and purposes these persons were capable of performing the ordinary transactions of daily life, and conducted themselves for the most part in a reasonable manner. Both returned to their normal condition, and to a remembrance of current events, after hystero-epileptiform manifestations.

The *urine* in chronic alcoholism has not been investigated in a sufficiently large number of instances to afford statistical results of much value. A majority of the cases I have had examined showed the presence of a trace, rarely more, of albumin, with casts and an excess of uric acid and urea.

An analysis of the urine of 17 consecutive cases of chronic alcoholism showed albumin to be present in 11, absent in 6 examples. In but one case was there more than a trace. Hyaline casts were found in 7 cases, hyaline and epithelial together in 2, hyaline and granular together in 3, granular casts alone in 1 case, mucous cylindroids with hyaline casts in 3 cases—a total of 12 out of the 17 cases in which casts of some variety were discovered.

Urea was above the normal in 11, below in 6 cases. Uric acid deposits, crystalline and amorphous urates, were seen in 10 examples. The earthy phosphates were increased in 6, diminished in 2, present in normal amount in 9 cases. The alkaline phosphates were normal in 15, diminished in 2 examples. Glucose or an excess of indican were never found in any case. Calcium oxalate crystals were noted in 4 cases. The specific gravity ranged from 1,032 down to 1,009, averaging 1,019.

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CHRONIC OPIUM INTOXICATION

Second only in importance to alcohol, among the chemical poisons that produce a chronic intoxication showing psychical features, stands opium with its derivatives, especially the combination of its most potent alkaloid with sulphuric acid.

Opium as a source of pleasurable excitement, or as affording a means by its narcotizing influence of relieving the tedium of life, has long been used among the Eastern nations. Indeed, Homer himself is accredited with having used the juice of the poppy. Until recent times, partly by reason of its expensiveness, the drug has not been a favourite with the Caucasian races, though even among the Anglo-Saxons there have been notable exceptions to this rule, De Quincey and Coleridge being among the instances of celebrated English writers who have been among its votaries.

But with the progress of chemical science, which permitted the extraction of the active principle of the crude drug, the habit in its worst form, the hypodermic abuse of morphine, has made alarming strides, and seems to be growing more and more widespread, especially among the cultured classes. Morphinism is, indeed, a disease of luxury; the drug is still relatively expensive, and the means of using it successfully are obtainable only by those who have a certain amount of money at their command. Crothers, some years ago, estimated that in this country there were at least one hundred thousand persons who abused the drug, and there is no reason to suppose that the number has decreased since his statement was made; on the contrary, it must be admitted that the practice is growing constantly in frequency.

While the notorious intolerance of the present generation to pain is largely responsible for the increase, a toothache or a neuralgia being sufficient cause or excuse for the sufferer to fly to morphine or some other narcotic for relief, it is nevertheless true that medical men are largely responsible for the prevalence of the morphine habit. It is no exceptional instance to find a physician

not only administering morphine for the relief of any and every pain, but even placing the syringe and a prescription for the drug, renewable at will, in the hands of his patient with instructions how to use it. Such a practice can only be condemned in the strongest terms; it not only prostitutes the healing art, but is a social crime of the worst and most reprehensible character.

The medical man himself is the most frequent victim of the habit, and this is more frequently noticeable in the country districts than in the large towns. Hirt estimates that one half of the morphine *habitués* are to be found among physicians. Another class with whom the evil is growing is among the professional nurses. The long-continued vigils, and the consequent insomnia when the opportunity for rest at last arrives, induces physical languor; the means of relief is at hand, and it is but one step from thought to action.

Causes.—In the mentally robust the most common cause of morphinism is the continued use of the drug for the relief of pain, neuralgias, sciatica, repeated migraines, tabetic pains, rheumatism, hepatic or renal colic, dysmenorrhœa, and a host of other somatic troubles; then, when the pain has ceased, the habit is continued for the pleasurable excitement and feeling of temporary happiness induced by it. It is very fortunate that not every one is influenced in this manner; in many persons opium produces a sensation of discomfort, nausea, fulness in the head, even colicky pains with gaseous distention of the abdomen, that effectually deter the individual from its continued use, even should he be inclined again to try its effects, and thus makes him unwilling to resort to it except in the rarest emergencies.

In another class of cases the patients are of a neuropathic disposition, and have the same craving for morphine as a stimulant that others have for alcohol, ether, or essence of ginger. The neurasthenic, the hysterical, the hypochondriac, the periodical melancholiac or drunkard, all turn to opium for that sense of well-being only attainable while they are under the influence of some pernicious anodyne.

Still another class of morphinists is met with, which belong rather to the first than the second division. Persons who have become a prey to grief or despondency after failures in business, or from remorse after crimes, as well as those who are sleepless or overworked, are too apt to seek the haven of rest and rare sense of mental relief only to be found in the extract of the poppy.

Dosage.—The toleration for the drug among chronic opium takers is surprising. Doses of 20, 40, or 60 grains of morphine sulphate are not uncommon, and De Quincey reached a daily allowance of from 8,000 to 10,000 drops of laudanum.

Degenerative Effects.—These are far less pronounced and much slower than with alcohol. Opium apparently has but slight tendency to induce arterial degenerations, except in those instances in which it is combined with alcoholic liquors; while the listlessness and mental inertia, caused by the chronic poisoning, and the cachexia may be recovered from in persons of a previously sound mental constitution. The abuse of opium does not, as a rule, materially shorten life, except when the amounts are excessive, or some other drug even more harmful, such as cocaine or alcohol, is taken at the same time. The children of the opium inebriate, provided the abuse of the drug has not gone over several generations, are usually not degenerates. In India, where the opium habit is widespread, and is continued from one generation to another, the children of such parents eventually reach a plane of lowered mental activity, and the population of opium-eating districts contains a larger proportion of idiots and imbeciles than is found in others in which the habit is not prevalent.

The *symptoms* may be divided into two groups: (1) the indications of intoxication from the immediate effects of the drug, and (2) those which result from its withdrawal.

1. **Intoxication.**—Many persons of fair nervous equilibrium may go on for months and years taking opium habitually without showing indications of psychical disturbance further than a gradually increasing disposition to mental feebleness, an incapacity for continued thought, an absence of productive power, and the somatic indications to be presently considered. With others of less stable organization the symptoms of the pathological alteration of the nerve centres come on more quickly, and attain a more profound level.

In the beginning, when a dose of opium has been taken, very shortly afterward there ensues a period of stimulation of the brain centres; ideas come with a rapidity and freshness before unattainable, the arteries contract, the pulse is slightly slowed, and the respiration deepens. Soon there follows a feeling of torporous well-being; the person becomes drowsy and falls into a fitful sleep, characterized by the occurrence at intervals of pleasant hallucinatory dreams. The total period during which the effects of the drug

last is about ten or twelve hours, after which the individual experiences the so-called abstinence symptoms, *malaise*, dryness of the mucous membranes, slight headache, pyrrhosis, nausea, and incapacity for active mental or physical exertion. A repetition of the dose, however, immediately drives away these disagreeable sensations, and herein to a large extent lies the temptation to the abuse.

In those who have once become habituated to morphine, in addition to these temporary symptoms, there may be, during the stage of drowsiness, hallucinations of vision and attacks of anxiety. The sleep of the opium *habitué* is never profound, but is broken by the recurring visions which in the dream state are constantly changing. The majority of these are agreeable; pleasant landscapes or mountain scenes alternate with visions of the faces of acquaintances and friends, or the delights of Paradise unfold themselves to the eye. On the other hand, the hallucinations may be of a disagreeable nature; innumerable faces float before the eye of the imagination, until the brain is overwhelmed and appalled by the magnitude of the throng. One of the most characteristic features of the opium visions is the more or less complete annihilation of space as well as of time. As De Quincey expresses it, "Space swelled and was amplified to an extent of unutterable infinity"; and again in one of his dreams, "The mountains are raised to more than Alpine heights." Time is annihilated or increased to an eternity. The events of a lifetime are rehearsed in the actual fraction of a minute, and events unremembered in the conscious state are recalled in their most intimate details. On the other hand, the impressions created on the mental retina may be so prolonged, that an incident, read from a book, is enacted and reconstructed by the play of the imagination so as to take up an apparent lifetime.

The permanent effect upon the faculties in those instances in which the abuse of the drug has been long continued or the amount taken excessive, more especially if the victim be of a labile temperament, is shown in pronounced moral obliquities, and in the resort to any means, no matter how unscrupulous, even actual forgery and theft, to obtain the drug. The idea of any personal responsibility falls to the lowest ebb; thought, action, and even the most imperative duties, are shunned. While the largest numbers of these unfortunates are not insane in the stricter sense of the word, there is always present a certain degree of ethical obliquity, irritability, peevishness, and moroseness. It is never safe to believe the word of an opium eater; he will prevaricate with or without reason, his

disposition is uncertain and treacherous, his conscience is obtunded, he is dissolute, and has tendencies to morbid impulses. Fortunately, in so far as regards the generative functions, the effect of opium is exactly the reverse of that of alcohol, in that it diminishes the sexual activity, so that finally there is actual impotence both in man and woman. In the male, with the loss of desire, disappearance of the spermatozoa in the semen may be noted.

The *somatic* indications of chronic opium intoxication are well marked and characteristic. The secretions are all markedly diminished; the skin becomes yellow, foul, and parchment-like in appearance; the nails are brittle, the hair turns white and falls out, and

Fig. 27.—Photograph of a Chronic Opium Eater, showing the characteristic cachexia and wrinkling of the skin. The amount consumed averaged eighty grains of the crude drug a day.

the teeth loosen. Cutaneous eruptions are frequent. Profuse sweats by day and night annoy the patient and tend to induce congestion of the internal organs, sometimes resulting in bronchitis and pneumonia. In well-advanced cases there occurs a profound anæmia, the opium cachexia, a distinguishing sign of the habit. This cachexia may go on for a long time without inducing very grave symptoms, and in one case, that has been under observation for eighteen years, it is now hardly more marked than in the beginning.

The disturbances in the motor sphere are equally as definite as those of the secretory functions. The pupils are narrowed to pin-point size and are non-reactive to light. Unequal contraction of the pupils is now and then met, but is more probably owing to a constitutional peculiarity of the iris than to the effect of the drug. Tremor is frequently noticeable, especially during the act of writing, and the general muscular tone is lowered. With the lessening of the normal excitability of the central and peripheral nervous system there is slowing or actual decrease in the cutaneous and deep reflexes. Still, when these are absent or markedly diminished, locomotor ataxia or neuritis should always be suspected, provided that an opiate has not been taken for some days. The gait is not infrequently ataxic, affording another similarity in symptomatology to the organic diseases. Opium also diminishes the peristaltic action of the intestines, inducing constipation with its attendant evils, gastric acidity, loss of appetite, slow digestion, a foul tongue, and a general lowering of the nutrition. The activity of the muscular coat of the bladder is also palsied, whence results incontinence, or difficulty in the passage of urine. The flow, however, is rather increased than diminished. Albuminuria has been attributed to the effects of opium upon the system, but this has never been proved beyond doubt. Disturbances in the innervation of the heart are usual; attacks of false angina pectoris and pericardial anxiety occasioning transient states of distress, that are alarming not only to the patient but also to the onlookers. Obstinate sleeplessness is encountered in the end stages of chronic morphinism.

2. **Deprivation Symptoms.**—These begin usually within ten to fifteen hours after the omission of the accustomed dose. Among the more prominent are intense muscular weakness, with complete inability to retain the erect position, diarrhœa with obstinate cramps, profuse sweating, tremor, anxiety, and other general indications of collapse. The individuals clamour for opium to relieve their distress, and when given, it immediately allays the symptoms and the sufferer is restored to his previous condition. If the withdrawal be prolonged for several days, grave mental phenomena may arise. As in every other form of collapse, the prominent mental indications are those of an hallucinatory delirium, with visions of insects and small animals upon the walls and bed-clothes, frightful faces at the windows and doors, shrieks, murders committed before the patient's eyes, and other harrowing sights. As happens in alcoholic delirium, here also tremor of the muscles is present, and respiratory and circulatory

disturbances with impending coma may necessitate the administration of morphine anew.

When the withdrawal is being effected more gradually, the alarming symptoms are less severe and dangerous to life. There is general weakness with an ataxic gait, disturbances in the accommodation of the ciliary muscles, paræsthesias of all kinds, neuralgias, hemicrania, nausea, vomiting, profuse sweating, colicky pains, derangements of the vaso-motor nerves (lowered arterial tension) and of the respiratory system, with anxiety and a sense of impending death. The mental disturbances accompanying the somatic abstinence symptoms are sleeplessness, intense depression, constant restlessness, loss of memory, and an irresistible craving for the drug, which can only be relieved by its readministration. If the withdrawal be final, the general debility usually lasts for months, and, instead of decreasing, may result in death from a progressive marasmus.

Prognosis.—The chronic opium habit of former times, and as it now exists in the Orient, must be looked upon as far less dangerous to life than the morphinism produced by hypodermic injection, which at the present time is mainly in vogue. With this method sudden death is by no means infrequent, either as a result of too great a quantity taken at a single dose or in consequence of attempts to break off the abuse of the drug too suddenly and substitute therefor heart-weakening agents—cocaine, chloroform, antipyrine, or other of the coal-tar derivatives.

Comparatively few morphine *habitués* are ever broken of their slavery to the alkaloid, and many that recover under treatment relapse in the course of a few months. Especially difficult to treat are those patients who have superadded cocaine or alcohol to the original habit, the combinations inducing new trains of symptoms even more difficult to combat than those from morphine alone.

Diagnosis.—This is usually not very difficult, as the majority of the patients themselves apply for a means of relief from the habit. In those in whom the vice is suspected but denied, the characteristic indications of pupillary myosis, the parchment-like skin, and the cachexia, combined with forgetfulness, mental torpor, and the inclination to mendacity, are usually sufficient to warrant more than a suspicion as to their origin. With the morphine *habitué* the presence of numerous glistening white scars about the thighs and arms will complete the diagnosis. In cases of denial or doubt, the abstinence indications, to be obtained only under most careful supervi-

sion, as the morphinist exhausts every means to secretly obtain the alkaloid, will serve to make the truth clear. The secretions, especially the urine, contain morphine which has been eliminated, but except in the hands of the experienced chemist the determination of its presence is most difficult. Even Erlenmeyer's method of evaporating the urine and injecting the concentrated residue into a small animal with the expectation of producing the characteristic intoxication, is not without objection on the score of uncertainty.

Prophylaxis.—The increasing frequency of the morphine habit would suggest the legal restriction of the sale of the drug, even to physicians, as the best means to prevent its abuse. Large doses are very rarely required for the relief of any physical pain, and the preveution of the sale in quantities of drams and ounces by the retail apothecaries would in a large measure tend to restrict the habit. Furthermore, the selling of hypodermic syringes and needles, except to members of the medical profession, should also be rigidly prohibited. More especially is it the duty of the physician to beware of the reckless ordering of anodynes, and to see that, where its temporary use is imperative, morphine is not given for any length of time, and that no facilities are afforded the patient of continuing its employment after the emergency has passed.

The therapeutic *treatment* of the chronic morphinist may be attempted by either the rapid or the slow methodical withdrawal of the narcotic under suitable precautions. Erlenmeyer recommends complete discontinuance of the drug within a period of from three to eight days. Hirt prefers the sudden and absolute withdrawal, the patient to be kept under the influence of sulfonal, trional, or some other hypnotic (except chloral) in heavy doses for forty-eight hours, to prevent the usual maniacal attack and collapse symptoms succeeding deprivation.

Probably the most rational method, and the one least liable to induce absolute collapse and fatal results, is that of Burkhard and Krafft-Ebing. Nor does it necessitate the sending of the patient to a sanitarium, though the intense craving of the sufferers for the drug, and the facilities for obtaining it in their own homes, are necessarily far greater than in an institution. By this mode of treatment the amount of morphine is daily reduced a little until the quantity is determined under which life is moderately endurable. This is usually about one half or one third of what he has been previously taking. After being continued at this dose for ten to fourteen days the morphine is absolutely withdrawn, and the sul-

phate, hydrochlorate, or phosphate (Schmidt) of codeine, given hypodermically, is substituted for it. While the withdrawal is being carried out, absolute rest in bed is to be insisted upon; and nourishment—milk, egg-nogs, brandy punches, with vegetables and fruits—should be systematically administered. Baths at a moderate temperature are often very soothing and comforting. Under favourable circumstances the quantity of codeine is gradually lowered, and finally injections of water are substituted. Sudden withdrawal of the codeine induces similar though less severe abstinence symptoms than with morphine.

Through the entire course the condition of the patient must be carefully watched, so that the first indications of any collapse symptoms may be noted and the quantity of the narcotic at once increased. The heart's action must be supported, when necessary, by wine, and sometimes by digitalis or spartein. Effervescent draughts of alkaline solutions mitigate the nausea and acidity of the stomach, and render the food more palatable. Gentian, nux vomica, cinchona, and other bitter tonics are all helpful. Fairly large doses of capsicum are useful in the treatment of the stomach catarrh. For the sleeplessness, the bromides, trional, methylal, and sulfonal may be administered; chloral is not in place, the cardiac weakness prohibiting its use. Food should be administered after the injections of codeine or distilled water, the mental sense of comfort being at that time at its maximum. Not more than ten per cent of all cases permanently recover; the remainder relapse within a few months.

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CHRONIC COCAINE INTOXICATION

The habit of taking cocaine to induce a temporary intoxication dates back only a very few years, and the form of insanity following its repeated abuse owes its first description to Erlenmeyer, in 1886. Few cases of uncomplicated chronic cocainism, with attendant psychical disturbance, are to be met with either in the literature or in practice; almost invariably we find it combined with the morphine habit, to which it has been added during some attempt to break off from the latter drug. Cocaine, usually in the form of the hydrochlorate, was first used by physicians as a means to overcome the deprivation symptoms of opium, and afterward came into the hands of the laity for the same purpose. The effect of its prolonged use upon the human organism is far more deleterious than the opium habit, and when the two are combined, psychical and physical degradation are rapid and profound.

Fortunately the use of the drug in this way is to some extent dying out, particularly since its employment in the treatment of morphinism has been discontinued by the medical profession. The chief victims of the practice are physicians, druggists, and those of a strongly marked neuropathic disposition.

Symptoms.—Not every one who takes cocaine experiences with the intoxication symptoms a sensation of mental well-being—the euphoria of the Greeks. In many, the first considerable dose almost instantly produces a toxic effect before any noticeable mental exhilaration is experienced. Once the habit is acquired, the individual must rapidly increase the quantity, and in this fact lies the danger of the production of mental disturbance, since the alkaloid acts directly upon the nerve cells, and the quantities of the poison administered are frequently sufficient to overwhelm their normal functions.

The susceptibility to the poisonous effects of the alkaloid varies widely in different individuals. In some a dose of a grain or two will cause dyspnœa, increased frequency of the heart's action, and indications of collapse, while in others no perceptible effect is pro-

duced. The lethal dose varies from nine to about twenty grains, but the latter quantity has been often exceeded by those addicted to the habit. Unlike that of morphine, the effect of cocaine is very transient, hence the dose has to be repeated frequently to keep up the desired degree of intoxication. One of the remarkable properties of the drug is that the poisonous results do not always subside with the withdrawal of the cocaine, but may persist for weeks and months thereafter. Indeed, it is not infrequent for the abstinence symptoms to begin ten days or two weeks after the patient has entirely ceased its use.

The administration of a considerable quantity of cocaine to a person is followed, in a variable length of time, either by exaltation or by symptoms of collapse. Paralysis of the voluntary muscular system, weakness about the joints, fainting attacks deepening to coma, tremor, vertigo, dyspnœa, rapidity and feebleness or extreme slowness of the heart's action, cyanosis, anæsthesia of the tongue, and sensations of burning in the neck; later, delirium, hallucinations, cramps, even epileptiform convulsions and opisthotonus; finally, general lowering of the cutaneous sensibility with paræsthesias, paralytic enfeeblement of the extremities, and tottering gait, may be enumerated among the clinical indications of an excessive dose of the poison. On the side of the special senses, besides those symptoms already mentioned, are noises in the ears as of the roaring of the sea, disturbance of sight to complete amaurosis, and hallucinations of smell. The pupils are at first widely dilated, but later contract and may be non-reactive to stimuli. Death may occur during the state of collapse from paralysis of the respiratory and heart centres in the medulla. In the cases that recover, symptoms of nervous irritability, verging on hysteria, may last for days, perhaps weeks. Ordinarily, however, the amount taken at a single time is insufficient to produce such severe results, and the restitution is complete within a period of a few hours.

Under the influence of a moderate dose, following the decrease in the blood pressure, comes a sensation of intoxication with mental exaltation, a pleasant corporeal warmth with intellectual facility and well-being. The person becomes lively, excitable, and feels strong and capable. Very soon the euphoria passes away and is followed by a stage of depression, with loss of muscular energy and palpitation of the heart. If the dose be frequently repeated there ensues incapacity for mental exercise, with more or less pronounced loss of memory. The victim is now unable to carry on his business trans-

actions or to bring to a conclusion his newly formed plans; he is constantly toiling but never completing work; letters are written in wearisome length, but something always remains to be added and they are never finished; work of all kinds is commenced, but the man is constantly changing from one thing to another, and no serious result is attained. Even in conversation, this facility and inconstancy are pronounced.

Under the deleterious influence of the continued use of cocaine, especially when it is superadded to the morphine habit, the gravest somatic indications may arise. The bodily weight sinks rapidly, even one fifth to one third of the whole being lost within a few weeks. The skin hangs in folds and has a dirty yellow tint, the countenance assumes a distressed look, muscular weakness and tremor become profound.

As happens in other states of inanition, the reflexes become exalted, cramps make their appearance, there is muscular unrest with tremor, particularly noticeable in the tongue. The symptoms of collapse increase; there is a growing tendency to fainting attacks, with irregularity in the cardiac action, accompanied by profuse sweating, and dilatation of the pupils. Sleep is much disturbed.

The power of digestion does not seem to be greatly influenced by the action of the drug, as it does not set up gastric catarrh. The patients usually retain their appetite and powers of assimilation, but, the waste being greater than the supply, rapid emaciation results.

Sometimes from the direct poisonous influence of the alkaloid, sometimes from the continued denutrition of the entire body, the person habituated to cocaine acquires an indubitable insanity, which assumes the customary type of a hallucinatory psychosis. Usually after a short prodromal period of motor unrest, anxiety, mistrust of family or companions, and increasing irritability are noted. Hallucinations, which may involve all the special senses, quickly follow. Those of hearing are the most frequent. Obscene language and scolding voices are overheard; vile words are shouted at the sufferers; they hear noises made by thieves in the midnight watches; they are threatened with injury; their most secret thoughts are blazoned forth to the edification of the populace; they are made exhibitions of to the delight of their enemies. The roar of machinery, the clanging of bells, wailings, loud screams, and shrieks of murder are somewhat less frequent. Hallucinations of sight customarily accompany those of hearing. The bed-clothing, the walls,

or the furniture are covered with fleas, ants, roaches, mice; these penetrate into the ears, the nostrils, the mouth. Flies in countless myriads throng about them. In one case the patient, confined to bed by physical weakness, spent hours picking imaginary lice off the sheets and throwing them upon the floor.

Erlenmeyer calls attention to a symptom which has been mentioned as not uncommon in cocaine patients. They see projected on a white plane a large number of dark points and spots, which in the distorted imagination are thought to be lice, flies, or small animals. The multiple hallucinations he regards as an actual optical defect, and is of the opinion that we have to do here with a multiple disseminated scotoma. Since it is well known that cocaine, in common with many other nerve poisons, certainly can produce narrowing of the field of vision and irregular scotomata, the explanation of Erlenmeyer is well worthy of consideration.

Perversions of common sensibility are of great frequency and form one of the most characteristic indications of the disease. The one known as Magnan's sign, the sensation as if a foreign body were under the skin, especially under the tip of the finger or in the palm of the hand, is almost pathognomonic, and should be inquired for in cases of suspected but denied cocainism, as its preknowledge as a sign of the disease is hardly likely to be possessed by the lay patient. The paræsthesias are innumerable; thousands of insects crawl over the skin and through the flesh, or various other disagreeable sensations are complained of. Other frequent indications are quick muscular jerks, sensations of being pricked with needles and pins, or as if the limbs were wound around with cords. These evidences of disturbed sensation are frequently referred to electrical influences wielded by enemies, and together with the persecution of the unfriendly voices form the basis of a paranoia-like delirium. Soon the cocaine sufferer becomes dangerous to himself, his family, or the community. He may seize a pistol and attempt to kill his supposed persecutors, or under the influence of the hallucinations, he may commit suicide. Frequently, as with the true paranoiac, there are journeyings to and fro from city to city to avoid the tormentors; or constant changes of residence are made, with alteration of the dress and appearance for the same purpose.

The similarity in the clinical picture to that presented by the acute and chronic forms of alcoholic persecutory delirium is exceedingly striking, the only means of possible differentiation being in the peculiar sensorial hallucinations. To add to the resemblance

between the two affections, the cocainist is also troubled by an insane jealousy. Every movement of his wife is watched; letters received through the mail contain notes for assignations, every innocent word with male friends is misconstrued into a secret sexual meaning. His wife is untrue not with one alone, but with hosts of men; she has become a harlot, seeking the regard of every common workman or coachman. This jealousy frequently leads to scandalous scenes, or violence toward wife or acquaintances, so that finally incarceration in an asylum becomes necessary.

Except at the acme of the effect of the injection upon the person, actual consciousness is not greatly disturbed. There is some memory defect, and a cloudy idea of the actual causation of the mental indisposition, but this rarely proceeds to the extent that the individual falsifies faces and surroundings. The mood is always excitable, bitter toward family and friends; the patient is reticent to a degree, and indisposed to converse about his own troubles.

Deprivation symptoms are not nearly so severe as with morphine. Fainting attacks, dyspnœa and palpitation of the heart, mental depression and weakness of will-power, are the most prominent. Hallucinations and mental confusion disappear soon after the withdrawal of the drug, but the insanity in a more chronic form may persist for weeks and months afterward in the shape of persecutory ideas and insane jealousy.

The course of a case of cocaine insanity is usually rapid, running over a period of only a few weeks, especially when the dosage has been rapidly increased to produce the euphoria. Frequently toward the beginning of the psychosis there is obstinate sleeplessness, which the patient seeks to relieve by resorting to opium, sulfonal, or chloral.

Prognosis.—This is most gloomy. Even though the patient recover from one attack, he very frequently relapses into his evil habits. In the most favourable cases there ever remains an extraordinary weakness of the will power, with accentuated tendency to relieve the physical and psychical languor by substituting for the cocaine, alcohol, morphine, antipyrine, and other nervines in large quantities.

Differential Diagnosis.—The paranoia of the cocainist is differentiated from the true form by the multiplicity of the insane ideas, as well as by the want of a completely systematized delirium, although the contents of each separate delusion may be entirely similar. The constancy and persistence of a single systematized false idea with

the paranoiac is in contrast with the changing wealth of delusions encountered in the cocaine sufferer.

The alcoholic hallucinatory delirium may be distinguished from that of the cocainist by the peculiar nature of the skin hallucinations before referred to, the greater clouding of the consciousness, the stereotyped nature of the deceptions, and the absence of albuminuria in the cocaine sufferer. Again the maniacal character of the alcoholic delirium is of a milder type.

Treatment.—In acute cocaine poisoning, alcohol, digitalis, ammonia, or morphine are indicated to relieve the distressing symptoms. Persons addicted to the combined morphine-cocaine habit should be allowed their morphine, at least until the immediate effects of the cocaine have passed away.

In chronic cocaine insanity home treatment is rarely admissible, especially as there are nearly always dangerous tendencies. When the alkaloid has not been taken in daily allowances larger than ten to fifteen grains, it may be immediately withdrawn without actual danger to life, although a more gradual reduction is to be preferred. The administration of nourishing food, milk, peptonized meats, brandy and milk in combination, together with warm baths and cold applications to the head, should be resorted to. The most strenuous watching should obtain during the withdrawal, and alcohol, caffeine, or morphine be had recourse to when necessary. It should be remembered that collapse indications may follow many days after all apparent danger from this source has ceased, and that a cure of the immediate poisoning cannot be hoped for until several weeks have passed. Even less than the morphinist are the cocaine debauchees to be trusted, inasmuch as their moral rectitude and will-power have always suffered severely. Inability to sleep should be combatted by the bromides, with codeine and hyoscyamus, trional, methylal, or sulfonal, with baths or the pack. Chloral is contraindicated.

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RARER FORMS OF INTOXICATION

Besides those nerve poisons whose symptoms have been already detailed, there is a long series of drugs or chemical toxines, almost too numerous to mention, that may occasion temporary or lasting insanity. Salicylic acid, nicotine, antipyrine, chloral, atropine, hyoscyamine, quinine, iodoform, cannabis indica, ergot, colchicum, santonine, stramonium, zinziber, lead, mercury, arsenic, ether, carbon dioxide, the essential oils, the various poisons engendered in the putrefaction of meat, the peculiar alkaloid of the common toadstool, muscarine, illuminating gas, and carbonic-oxide gas may be enumerated.

The clinical manifestation evoked by nearly all the several poisons is an hallucinatory delirium, with a varying degree of mental confusion and motor agitation, with or without febrile disturbance. The type of mental affection borders more frequently on the maniacal than the melancholic form.

The outbreak of the delirium may be either sudden, or after a prodromal period of hours or days, depending upon the intensity or the chronic nature of the poisoning. After the local application of atropine, or the internal administration of salicylates, a delirium may begin within a few hours; but, on the other hand, it may be delayed for days, and only show itself after the drug has been withdrawn or when its constitutional effects are waning. Much depends upon the nervous stability of the person, and the individual susceptibility to the poison, which is most variable.

In the instances that show a slow development, there are usually to be noted some change of character, irritability, sleeplessness, and the evolution of delirious fancies. In the more sudden seizures the brain is overwhelmed by the rapid ingress into the circulation of a large amount of the toxine, acting directly upon the vitality of both vascular and neural tissues and giving rise to various disturbances and altered metabolism.

The *duration* of these intoxication deliria may be only a few hours; in other cases, after the immediate effect of the irritant has

passed away, they may progress and run a course of weeks and months; or, again, they may become chronic and permanent, ending in a secondary dementia. The usual course is from three or four to ten or twelve days, after which restitution may be looked for in those persons who have not particularly unstable nervous systems.

Very little is known of the period of elimination of any poison from the system. The mydriatic effect of atropine in considerable doses, either internally or applied to the cornea, lasts for ten or twelve days, and accordingly it is quite possible that other chemical poisons, whose effects we cannot so distinctly observe, may persist for an equally long period. The abstinence symptoms of chronic cocaine intoxication, for example, only begin ten or fourteen days after the withdrawal of the drug, so that it is presumable that there is retained within the system a quantity sufficient to keep up a certain degree of stimulation for that period.

The hallucinatory delirium in these toxic insanities is not necessarily constant during the whole period of the illness; there may be times of partial or complete clearness, lasting from a few moments to hours, after which the obtunding of the faculties begins anew. As a rule, an unbroken delirium is of grave moment for the life of the patient, and argues a severe intoxication. A partial recollection of the contents of the delirium, which may be pleasurable, persecutory, or characterized by hallucinations of animals or faces in hordes, even of the affairs belonging to the daily life of the patient, may remain after recovery. An hallucinatory delirium, deepening as the days pass to somnolence and coma, is of evil augury.

The sense deceptions most frequently fade little by little as the restitution toward integrity, physical and mental, progresses, until finally they completely disappear. At times recovery is quite sudden, but these, in common with every other case of quickly subsiding mental disturbance, have a tendency to relapse.

In the cases that tend to become chronic, delusions of persecution, of being bewitched, of being possessed by the devil, more rarely of the annihilation of self and the world, supplant the tormenting hallucinations, and continue in a modified form until the mental faculties become weakened and apathy to everything succeeds.

A clear *diagnosis* in these cases depends upon a foreknowledge of the poison taken into the body, either from internal administration or external application. In certain instances in which there

have been attempts at self-destruction, the diagnosis is most difficult. Frequently no direct history can be obtained from the friends, and the patient himself is unable to give any information. A minute physical examination should always be made as a routine practice. A wound covered by an iodoform dressing, widely dilated pupils non-reactive to light, the lead line on the gums, the odour of the breath from ether or ginger, and the cyanosed condition of the extremities in chronic phenacetine or antipyrine poisoning, may give valuable information, and serve as a guide to a correct treatment of the case.

The *pathological anatomy* in these chronic poisonings has not been sufficiently studied. In the cases that die at an early stage a varying degree of congestion of the cerebral tissues, especially of the cortex, accompanied by hyperæmia and tortuosity of the pial vessels, is found. Only rarely are hæmorrhages discovered, except such as have occurred immediately before the exitus. The results of the experimental ricin poisoning work published by the writer several years ago throw some light on the state of the cortical vessels and cells under these conditions. The action of ricin is very closely allied to that of the so-called toxalbumins, and acts upon the organism in a perfectly definite manner, the amount of destruction of the nerve elements being proportionate to the dose and duration of the poisoning. In the cortex of the animals examined, there were many places, in the finer vessels, at which the endothelial nuclei were swollen, received the stain badly or not at all, and were occasionally necrotic and fragmented. The perivascular channels contained considerable amounts of a finely granular detritus that did not absorb any dye except eosin, and this only in sufficient quantities to give it a pale rose tint. This detritus was found around all the medium-sized and larger blood-vessels, and the amount of it in places had been sufficient to retard the lymph currents. All evidence of the presence of thrombi in the smaller vessels was absent, and the numbers of white blood-corpuscles within the blood-vessels and perivascular spaces was inconsiderable, in contrast with what is found in the lesions of acute alcoholism. Within the capillaries were single rows of red blood-corpuscles very closely packed together, and everywhere was proof of ante-mortem hyperæmia. In every region examined there was evidence of past turgescence and congestion of the smaller arteries and veins.

The nerve cells of the cortex and ganglia were found to be in every stage of degeneration according to the severity of the poison-

ing. In the milder forms, the protoplasmic branches of the cell were covered with moniliform swellings, while the adherent gemmulæ had partly fallen, and some of them were to be seen lying free in the adjacent tissue (Fig. 11). With greater severity of the process the tumefactions increased rapidly in numbers, the dendrites began to atrophy, until finally the nerve body was shorn of its extensions, reduced to a stump, and showed in itself a process of disintegration. The axone was observed to be the portion of the cell most resistant to the influence of the toxine (Fig. 11).

The action of the drug upon the nerve elements can be explained in two ways. First, its direct influence upon the protoplasm of the cell, after having been taken up into the blood stream, occasions disturbed cellular metabolism; and, secondly, the nutrition of the cell is directly influenced by the alteration of the blood supply, by reason of the changes in the walls of the smaller blood-vessels, which conduce to and augment the operation of the poison. Overwhelming destruction of the cellular protoplasm, rendering the neuroglia-lymphatic apparatus, which is similarly tumefied and disorganized, unequal to cope with and remove the detritus of the cells, may also become an important factor, since the more abundant the products of dead tissues that are left in close proximity to the living ones, the more rapid, presumably, is the destruction of the surviving elements.

The question of regeneration of the nerve cells in the human being after a severe mineral or toxalbumin poisoning is of the first importance from a clinical standpoint. Many cases, we know, never recover their full mental capacity after a severe toxæmia, but remain in a state of more or less mild dementia. We are, accordingly, led to suppose that in such examples there is only a partial regeneration of the neurones, and that the remaining defect entails the mental deterioration. Other instances more nearly recover their full integrity, although it may be only after the lapse of many months, during which it is possible that a reconstructive process in vessel and cell may have been progressing.

Therapy.—This aims essentially at treating the condition causing the intoxication. Lead should be combated by the internal use of the iodides, warm baths, iron salts with iodine, and the administration of large quantities of Apollinaris, Bedford, or other mineral waters. With many of the other chemical poisons—quinine, the salicylates, iodoform, and others—it is usually sufficient to withdraw the irritating agent and supply mild diuretics and diaphoretics. Under these measures recovery is attained usually within a

short period, except in such patients as are strongly predisposed to insanity. Meat and fish poisons are to be treated by thorough flushing of the intestinal canal with saline purges, the use of cardiac stimulants, and substances which increase elimination through the kidneys and the cutaneous organs. Rarely is the patient seen sufficiently early for an emetic, as apomorphine or zinc sulphate, to be of service. When there is considerable febrile disturbance attending the delirium, an ice-cap to the head and warm baths (at 95° to 98° F.) are of great benefit. When the delirium lasts over several days, an injection of morphine at night, or the administration of sulfonal or chloral, may be indicated to procure a sufficiently prolonged period of rest to enable the shattered faculties to recover their equilibrium, after which the patient awakens lucid, or at least quieter.

The nourishment should be carefully looked after in all cases, and especially where there is great physical prostration, the hourly administration of stimulants (brandy or whisky), alone or with food, may be of vital necessity. Strychnine and digitalis may at times be urgently needed to prevent heart failure from the intense overwhelming of the vital powers from the effects of the poison taken. In instances in which the delirium rises to a maniacal degree, it is of absolute necessity to keep the patients quiet in bed in order to prevent exhaustion of the remaining vital forces. This may be effected either by securing the constant presence of one or more nurses, or by means of an improved bed-sheet, which, while allowing some freedom of the limbs, effectually prevents the patient from rising from bed. When no other apparatus is at hand, the careful pinning of a heavy cotton sheet to the edges of the mattress with large safety pins and carrying a stout band over the shoulders of the sufferer will serve effectually until more appropriate means can be obtained. Hyoseine hydrobromate may be used in exceptional cases, but only when the patient is robust.

It is possible in this place to detail somewhat *in extenso* only a few of the more frequent forms of chemical poisoning followed by insanity.

Iodoform.—The poisoning may follow the external application of the drug to wounds, or its internal administration for intestinal hæmorrhage and hepatic affections. The psychosis does not ordinarily follow a single administration or application, but is wont to appear only after its use has been continued for ten or twelve days.

The prodromal symptoms of the approaching nerve storm are irritability and disquiet, followed by mental cloudiness, and soon afterward by hallucinations. The patients do not recognise their surroundings; they are oblivious to the lapse of time, emotional, complaining, and difficult to keep in bed. With the mental manifestations there is increased frequency of the pulse, 112 to 120, and cyanosis, with slight elevation of the bodily temperature. The urine shows the characteristic iodine reaction, and not infrequently contains a small quantity of albumin. It is usual in severe cases for the hallucinatory delirium to persist for from four to seven days after stoppage of the cause of irritation, and until the urine is quite free from iodine.

Quinine.—It is not uncommon to meet with individuals of neurotic temperament who are peculiarly susceptible to the effect of the salts of quinine. A comparatively small dose will render them slightly delirious for a short time, after which they return to their usual condition. Actual insanity following the administration of quinine in overdoses is comparatively rare. In one patient seen by me, a man of forty-nine years, who had never before been insane, one dram of the sulphate taken daily for a period of a month had induced an active hallucinatory delirium lasting three days, from which he rapidly recovered on the withdrawal of the drug. In another example, a young woman of low mental grade, to whom ten grains of quinine had been given every three hours during the daytime over a period of two weeks for a malarial infection, the drug produced at the end of that time an absolute mental collapse, resembling in all respects an acute dementia. The passive apathy, which was accompanied by indications of severe physical prostration, lasted nearly three weeks after the withdrawal of the medicine, but soon after she was restored to her former mental state, and never relapsed.

Lead.—This form of intoxication is more frequent than any of the others. Plumbic poisoning may be contracted from very numerous sources: from drinking water which has passed through lead pipes or has been kept in cisterns, from working in the metal or its compounds in the arts (white-lead workers, painters, plumbers, type-founders, potters), also from food stuffs kept in glazed pottery ware, from orpiment used to colour cake, from hair dyes and cosmetics, and from the continued medicinal administration of plumbic salts.

In lead poisoning, before the implication of the higher centres,

some of the more common indications of nervous disturbance—tremor, colic, wrist-drop, peroneal paralysis, cramps and pains in the limbs, disturbance of the general nutrition, and anæmia—are usually noted. The onset of the cerebral symptoms may be acute, but is more commonly immediately preceded by insomnia, restlessness, noises in the head, and giddiness. Then follows a period of active delirium, with much motor excitement and hallucinations of sight and hearing. Tremor may be well marked, and convulsions may occur at any period of the delirium. Following the active excitement are somnolence and coma, which resembles that of an acute syphilitic dementia, in so far that the patient may be roused for a moment from the stupor, may answer a question, though hesitatingly and with marked tremulous movements of the articulatory muscles, and immediately lapse into a deep sleep. As in the specific trouble, there may be optic neuritis, with slowly reacting and unequal pupils. Complete amaurosis without ophthalmoscopic changes may also occur (Gowers). A high temperature, the occurrence of frequent convulsions, of optic neuritis, and considerable quantities of albumin in the urine, are unfavourable indications.

The outcome in many cases of cerebral plumbic encephalopathy is unfavourable, even after the lead has been eliminated from the system by appropriate treatment. Many of the patients pass into a state of chronic insanity, with failure of the mental powers and a progressively increasing muscular weakness, resembling in some ways the progressive paralysis of the insane in its demented form. The excited form of paresis, with its attendant ambitious delusions and progressive mental decline, is said to rarely follow plumbic intoxication (von Monakow). In cases of suspected plumbic pseudo-paresis the characteristic narrow bluish-black line on the gums close to the teeth, especially at the projections of the gums between the teeth, should be carefully looked for, and colicky pains, local paralysis, muscular spasms, pains in the limbs, even hemiplegias and convulsions, should suggest not so much a general paresis as the possibility that the patient is suffering from chronic lead intoxication. The salts of lead tend to induce sclerotic changes in the arteries, more frequently in the renal organs than in the brain, with non-excretion of urates, and storage of waste tissue products. Albumin is of quite frequent occurrence in the urine of individuals poisoned with lead. The metal is very slowly excreted from the organism, and traces of it may be detected in the urine and fecal

matter for months or years after the use of the contaminated water, or other source of conveyance into the system, has been stopped.

Antipyrine.—The aniline antipyretics in recent years have come into extensive use among the laity for the relief of pain in neuralgias and to induce sleep. When taken in overdoses, or when continued for too long a time, they have been known to give rise to an acute insanity, similar in type to the usual collapse forms. Large doses of drugs of the coal-tar series produce loss of appetite, marked acceleration or diminution of the pulse rate, cyanosis and extreme coldness of the extremities, an acute influenza and ringing in the ears, sometimes with gastro-intestinal symptoms, and a diffused itchy eruption. If the administration is continued, difficulty of thought with confusion and a tendency to active hallucinations succeeds, and complete restitution to mental integrity is slow. Antipyrine destroys the red blood-cells rapidly, and the slowness in the return to mental vigour is probably owing to this fact. Belladonna and alcoholic stimulants are indicated to combat the acute prostration.

Salicylic Acid and its Derivatives.—Comparatively few cases of hallucinatory insanity following the administration of salicylates are recorded, probably because the majority of these mental disturbances have occurred in the course of febrile affections, and the delirium has been attributed rather to the fever than to the drug. I have seen a number of patients, to whom the medicament had been given for acute rheumatism, develop an hallucinatory insanity during the course of treatment, which promptly subsided when the salicylate of sodium was withdrawn. The principal symptoms noticed were ringing in the ears, vertigo, active hallucinations, in the form of the appearance of the fiend, of sombre sights and similar visual deceptions with mental confusion, followed in the course of some days by persecutory ideas and depression. None of the cases were of long duration.

Belladonna.—The susceptibility of different persons to this drug varies greatly. Some will show great congestion of the integument, dilated pupils, congested conjunctivæ, and dry throat, with mental distress, after the single administration of a quarter of a grain of the extract, while in others it takes doses of several grains, repeated at intervals of a few hours, to induce any constitutional effect. Even the application of atropine to the conjunctivæ for any length of time may induce acute insanity, as in the following instance: A frail young girl of twenty-two years had been ordered atropine drops to produce mydriasis for an ophthalmoscopic examination. She sud-

denly developed indications of collapse, with hallucinations of sight and hearing, the insanity lasting nearly three weeks, several days after the last vestige of the effect of the atropine had disappeared from the eyes. Five years have elapsed since the attack, but there has been no repetition of the mental disturbance.

The mental symptoms of belladonna poisoning are of a more active character than that usually seen from any substances used in the medicinal treatment of disease, alcohol excepted. The delirium is very intense, the hallucinations are pronounced, and the motor agitation is considerable, the patients singing, shouting, wandering hither and thither, and being difficult to restrain. The hallucinations are manifold. Troops of people pass before the eyes, the bedclothing is covered with insects and small animals, which annoy the patient, who attempts to pick them off and cast them away. Visions of flames and flashes of lightning occur and startle the sufferer, who shrinks visibly. Aural are less frequent than visual hallucinations.

The depth of the mental reduction is variable, but is always marked. The patients no longer recognise their surroundings, or the faces of attendants and relatives; they are unable to answer questions coherently, and their entire time is absorbed in attending to the hallucinatory visions. The physical phenomena are striking. The pulse is at first full and bounding, the countenance congested, the pupils are widely dilated, the throat is dry, the lips are parched. Later the congestive symptoms are followed by pallor, with weak, compressible pulse, and exhaustion. Opium, digitalis, and alcoholic stimulants are indicated after the first effect of the poisoning has passed. The duration of the active excitement in belladonna poisoning is not usually more than five or eight days, but may be prolonged over several weeks in those predisposed to insanity.

Ether.—In some of the large cities of America and Europe, in Ireland, and in eastern Prussia, the habit of ether drinking is in vogue, replacing alcohol. A daily allowance of ten ounces of ethyl-ether is not considered unusual. As the acute intoxication produced is of short duration, the dose has to be frequently repeated to keep up the desired effect, and in consequence the abuse of ether is more injurious than that of alcohol. The mental effects of the prolonged misuse of ether have not yet been fully studied, but it apparently induces a degradation of the general character similar in many ways to that from alcohol. The corporeal effects are cirrhotic degeneration of the liver and kidneys, atheromatosis of the

vessels, and fatty degeneration of the heart muscle and other organs (Sommer).

Carbon Disulphide Intoxication.—Delpech in France, and Hamke and Laudenheimer in Germany, have made the most complete study of this form of nervous disturbance following the continued respiration of air containing the fumes of carbon disulphide, which is used in the arts almost exclusively in the manufacture of India-rubber goods. Close, ill-ventilated rooms are largely responsible for the somatic and nervous phenomena. A partial tolerance seems to be quickly established by the majority of the caoutchouc workers, as mental disturbances are much more frequent during the first two months of employment in vulcanizing than afterward.

The presence of a few milligrammes of CS_2 per litre in the atmosphere of a room will soon occasion, in man, a severe disturbance of the sensorium, a feeling of intense anxiety, and incapacity for thought (Rosenblatt and Hertel); in animals it induces hyperæsthesia, increased muscular irritability with excitement, and, when the inhalation is continued, a depressed stuporous state (Koster). Laudenheimer found in the Leipsic caoutchouc workers that the fumes of the bisulphide occasioned severe catarrhal and other disturbances, bronchitis, and gastro-enteritis, with progressive lowering of the bodily weight. In fifty cases albuminuria was noted only twice, but the urine is characterized by a pale colour, low specific gravity, and a peculiar sweetish odour. The blood-cells are not perceptibly altered. Neuritis is quite frequent, especially with anæsthesia and loss of power in the domain of the ulnar and peroneal nerves, and in one instance wide-spread anæsthesia has been recorded (Bernhardt). Lowering of the general muscular strength, especially that of the inferior extremities, is one of the most constant symptoms. The deep reflexes are increased, or there may be a pseudo-tabetic condition (Stadelmann). Amblyopia, optic neuritis, retinitis, choroiditis, and unequal and slowly reacting pupils are not infrequently met with. Besides the more localized indications of nervous disturbance, some patients develop a train of neurasthenic-hypochondriacal symptoms, which are to be differentiated from those accompanying the functional disease by their acute origin, together with the peculiar weakness of the lower extremities.

The true psychical disturbances, according to the above-mentioned writers, may be divided into three groups: 1. Exalted forms, similar to a typical mania, with frequent short hypochondriacal periods, the symptom-complex consisting of pronounced motor mani-

festations, tremor, weakness of the musculature, and pupillary differences. 2. Melancholic forms, similar in type to a hallucinatory depressive insanity. 3. Stuporous forms, catatonic, or corresponding to the type of acute curable dementia, characterized by the wide dilatation and absence of reaction to light of the pupils. 4. A simple dementia, which occurs most commonly after a long-continued exposure to the gaseous poison.

The *prognosis* is largely dependent on the duration of the poisoning, its severity, and the constitutional robustness or frailty of the person affected. The outcome in the milder cases is almost always good. Nearly all the maniacal forms recover within a period of three months; those of the melancholic type are less favorable, the catatonic and demented varieties equally so, while a moderate proportion of the stuporous forms end in health. Loss of energy, weakness of memory, a tendency to start at sudden noises, and an apathetic, dreamy condition, may persist long after the acute symptoms have passed off.

The *treatment* indicated consists mainly in dietary and hygienic measures, with salines and diuretics to eliminate the poison from the system as rapidly as possible.

Illuminating and Carbonic-oxide Gas Poisoning.—The intentional or accidental inhalation of ordinary coal illuminating gas or carbonic oxide, when not immediately fatal, is somewhat frequently followed by an acute insanity of the hallucinatory-confusional maniacal type, lasting from a few hours to weeks, and not seldom running into a chronic form.

Inhalations of impure carburetted hydrogen or carbonic oxide are followed by great deterioration of the red elements of the blood, a condition that may be present for months and years after the poisoning, and which probably accounts for the persistence of the mental symptoms.

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GROUP II

INTOXICATION INSANITIES

SUB-GROUP (*b*). INSANITIES FOLLOWING BACTERIAL AND TOXALBUMIC POISONING

THE INSANITIES OF THE PUERPERAL PERIOD

a. Insanity of pregnancy.
b. Insanity of the post-partum period.
c. Insanity of the lactation period.

The insanities incidental to child-bearing are of sufficient importance to merit a separate description of the mental disorders belonging to each of the three periods—that of gestation, that immediately following parturition, and the lactational period.

Although the statement of numerous writers, that there is nothing peculiar or distinctive in the puerperal insanities, is in a measure true, since we find the same general causes in their evolution as in some other forms of mental derangement; nevertheless, in the case of the recently delivered woman especial disease-processes are at work, in a majority of instances, which give to the insanity arising at that time a different impress from the mass of the psychoses. Here a direct infection from the vaginal, uterine, or mammary regions, a retention of effete tissue products, and, more rarely, an auto-intoxication from the alimentary tract, are the most common immediate factors, these being often overshadowed and modified by instability of the brain.

Clinically, the several puerperal psychoses are separable into *those of gestation*, *those of parturition*, occurring within two months after labour, and the later post-partum or *lactational insanities*. Those of the second period are the only ones for which a distinctive form may be claimed, and that only in a certain number of instances, which, however, make up a predominating proportion of the entire number of examples.

Before the advent of modern methods of asepsis post-partum insanity was much more frequent than it is to-day, the medical

records of the mid-period of this century containing numerous papers on its etiology, symptomatology, and treatment; but in recent years the literature has become less and less abundant, though, unfortunately, it is still by no means scanty.

It is to Fürstner (in 1875) that we owe the first accurate description of the symptomatology of the disease, though Gundry in this country, in 1860, came very near to having the honour assigned to him, his delineation being lacking only in the neglect to take sufficient account of the confusional element in the disorder.

INSANITY OF PREGNANCY

In an assemblage of 691 cases of puerperal insanity collected from the literature, there were 65 which began during the period of pregnancy, or about 9.5 per cent of the total number, a proportion considerably larger than that furnished by the statistics of the Royal Edinburgh Asylum—1 per cent in 141 cases. The cases admitted to the local asylum in the last two years are too few to base any conclusions upon them, but they show a still larger proportion, 4 among 15 cases of all forms, a percentage of 26.6. Of these four cases, one occurred at eighteen, one at twenty-seven, one at twenty-eight, and one at forty-three years. Two were in the second, one in the ninth, and one in the first pregnancy.

Symptoms.—The nutritional disturbances to which all women are subjected during pregnancy allow few of them to escape at least some alteration of the disposition. When slight, these changes are manifested principally in the form of capriciousness, abnormal appetites and cravings, tendencies toward brooding over possible ill results of the pregnancy to themselves, or some slight degree of mental exaltation, in which the imagination is more particularly disturbed. On the whole, the insanity of pregnancy is one of the rare forms of mental disturbance, Nature apparently treating the pregnant woman with more consideration at this than at other times, even though there be a strong taint of ancestral insanity traceable in her history.

The actual mental disturbances may be placed under the two usual classifications of the psychoses, *depression* and *exaltation*.

(*a*) Depression is considered to be the more frequent of the two forms, and is shown, mainly on the somatic side, in digestive disturbances, as regards the mental faculties by apathy not usually amounting to stupor, loss of interest in husband, family, and surroundings, weariness of life, delusions of having committed un-

pardonable sins, of being unworthy to live, and the thousand-and-one deceptions of the melancholiac. All these patients are more or less prone to commit suicide, and should be watched closely to prevent accident.

Melancholic tendencies are distinctly more frequent in the later months of pregnancy, the impending event no doubt exerting an unfavourable influence. In the cases that begin in the earlier periods of pregnancy the disturbance may last only a short time, the patient soon returning to her normal state. Less frequently it may continue during the entire period, but after delivery there is usually a restitution to health within a few days or weeks, the disease rarely persisting and assuming the aspect of the chronic delusional form of insanity.

Except for the circumstance that the woman is pregnant at the time, the condition differs in no way from the ordinary types of melancholia. Periodical forms of melancholia may simulate the insanity of gestation, and should be remembered in making a diagnosis. Conception has been known to occur during a long-continued attack of ordinary melancholia, but this is exceptional, and of course the alienation then has no connection with the puerperal state.

(*b*) So far as any clinical symptoms are concerned, the mania of pregnancy is not separable from an ordinary attack of mild or simple pathological excitement. After a prodromal period of restlessness and insomnia, there are loquaciousness and motor agitation with or without hallucinations and delusions, according to the mildness or severity of the attack. Delusions of a persecutory nature are the most common, and aural hallucinations are more frequent than visual. Delusions appertain to change in the personality or to the genital organs of the patient. Albuminuria, so far as I have been able to ascertain, is not more frequent in these than in other maniacal types, but hyaline casts are often demonstrable in the urine.

The cases that begin in the early months are considered to be more favourable in their outcome than those appearing in the latter half of pregnancy. In either event the amount of inherited brain stability has a good deal of influence, and much depends upon the surroundings of the patient. But, provided there be no renal lesion, there is no real reason why a case of mania beginning at a late period of pregnancy should not be as favourable in the final result as one which has come on in the earlier months.

Fully one half of these mental disorders are recovered from permanently either during the gestation, or within a week or two after delivery; in the other half the patients become quieter after confinement, but retain their false conceptions about themselves or the outer world. A few dement rapidly and completely, become quiet and degraded, and are eventually cut off by a pneumonia or some other infectious trouble. The prognosis is naturally worse when there exists a chronic renal lesion, leading to the retention within the system of the waste tissue products—products allied to urea in chemical composition, but of less complexity.

Treatment.—The treatment of both forms of the insanity of pregnancy is mainly hygienic. Exercise, baths, diet, fresh air in abundance, are mainly to be relied upon. Sedatives, especially morphine, should be avoided from their tendency to lock up the secretions and aggravate the already impoverished condition of the blood. Syphilis should be looked for, and when present should be combated by the proper remedies. Renal lesions of any description always lend an unfavourable cast to the mental disorder.

INSANITY OF THE POST-PARTUM PERIOD

The first six weeks after delivery are set apart by the majority of writers as the time requisite for the involution of the uterus, although two months might be allowed with greater propriety for the return of the generative apparatus to its natural state. It is chiefly during the first two weeks of this epoch, when the vessels of the placental site are still open, before tears and lacerations of the perinæum and vaginal structures have healed, when the breasts are assuming their physiological functions and there is tumefaction of the glands, sometimes with the formation of fissures of the nipples from stretching of the tissues, that the liability to the so-called puerperal mania is at its height.

Pathogenesis.—Post-partum insanities are to be separated into three divisions, according to the nature of the direct causes producing the derangement, the first and second groups including about eighty per cent of the total number of cases. The inciting factors that follow labour are: (*a*) Infection from some portion of the genital tract, in rarer instances from the mammæ or from other sources. (*b*) The accumulation within the organism of certain chemical products of incomplete tissue metamorphosis allied to the urates, possibly the carbamate of ammonium, inducing indirect or direct

irritation of the nervous system. (*c*) Direct lability of the nervous system, the shock of delivery and the mental apprehension incident thereto being the immediate oversetting factors. To this last class of cases belong those that become maniacal either during or immediately after delivery, or at a period when an infection can almost certainly be excluded, and which usually run their course without febrile reaction. A few of these are psychoses from ether or chloroform. Some of the cases of recurrent puerperal insanity, which come on in certain patients after each labour and run a rapid and favourable course, undoubtedly belong to the periodic insanities; these may have either maniacal or melancholic aspects.

(*a*) The first may be looked upon as the distinctive form of puerperal insanity, having an especial symptomatology apart from the rest; it resembles in many points of its inception an ordinary febrile delirium, and, indeed, is not distinguishable from it except by its course. As in other varieties of febrile insanity, it is the unsteady brain that falls an early sacrifice to the elevation of the bodily temperature, and to the stress of toxic influences upon the cortical cell. Here, just as is seen in febricula in children, the hereditarily unstable are delirious with a fever that those with a healthy ancestry resist without apparent strain. Hansen, Idanof, and nearly all the more recent writers who have dealt with the lying-in psychoses, lay the greatest emphasis upon infection as the most frequent cause of this form of insanity; and although they produce no bacteriological evidence to support their conclusions, the post-mortem results in the few recorded cases would seem to be sufficiently definite by themselves. In looking over the literature I had been unable to find any cases in which a distinctive form of organism had been isolated from the blood or uterine cavity of the patient during life; but I obtained from the maternity department of the Johns Hopkins Hospital (Prof. Whitridge Williams) the unpublished records of two cases of puerperal insanity (maniacal-hallucinatory form) in which cultures, taken with all necessary precautions from the interior of the uterus, showed a growth of the streptococcus pyogenes. To these I can add a third case of the same form of puerperal excitement, of my own observation, in which cultures obtained from the blood of the patient, on two occasions during life, as well as those from the vaginal secretion, developed florid growths of streptococci. Clouston's post-mortem case was in all probability also a streptococcus infection. Death in this instance took place on the sixth day. At the examination a thin layer of

pus was found upon the peritoneal surface of the uterus; there was also a small abscess in the right ovary; the mucous membrane of the uterus was thickened and covered with a yellowish purulent material, while the uterine wall contained deposits of pus all through it, and one of the uterine veins, for four inches in its course toward the vena cava, had its lumen filled with thick grumous matter. It is quite probable that organisms other than the streptococcus may be factors in the causation of the disease, but the three instances above cited would seem to indicate that this, at least, is among the most common. Undoubtedly the placental site is the favourite primary seat of the infection, especially in those instances that begin within the first week or ten days after delivery. The open vessels, the opportunities for infection of the interior of the uterus afforded by digital exploration before or during labour, the ready transplantation of any infectious material through the uterine veins into the general circulation, would induce one rather to wonder that infection and febrile insanity are not more frequent sequences of parturition. Secondary sources of contagion can readily be determined in the bruised and torn tissues, a laceration of the perinæum extending into the bowel, for instance, permitting the influx of fæces, perhaps the colon and other bacilli with them, into the genital passages, now in a condition much less resistant to infection than under ordinary circumstances.

Infection from the mammæ is unusual in the first days of parturition, but the glands should be examined for abscesses, fissures, etc., in those cases of post-partum insanity that begin with hallucinatory-confusional symptoms some weeks after labour, and in which none of the more ordinary sources of the disturbance can be found. Confusional delirium concomitant with the development of acute miliary tuberculosis has also been observed in a few instances.

Besides disturbed mentalization, there are other diseases of the nervous system following the puerperium that are usually attributed to infection. Möbius, Lunz, Bernhardt, Eulenberg, and others, have described a polyneuritis following labour within a few days. Orton and Luckinger have recorded examples of transient motor aphasia occurring in the first ten days of the puerperium, unaccountable on the ground of an embolism, that were probably the direct result of thrombosis of septic origin. Not in every case of the hallucinatory-confusional form of puerperal insanity do we find during life the direct evidences of an infectious process, and, as before remarked, autopsies hitherto have been few in number. Some of the most

severe septic processes run their course with but slight elevation of temperature, and when the patient is highly excited and unmanageable it is well-nigh impossible to make an accurate examination of the pelvic contents. Again, in the rapid cases it is a well-known fact that the more virulent the poison and the more intense the systemic implication, the less indicative are the local signs.

Extensive loss of blood, such as may occur from placenta prævia or from accidents during labour, may also be a cause of hallucinatory-confusional insanity in the puerperium, just as profound anæmia from hæmorrhage at operation, or from some other cause, is an evoker of a similar type of acute derangement. Such cases are usually afebrile, or have a minimal rise of temperature, and except from the history might clinically be indistinguishable from the distinctive form of lying-in insanity. In the records may also be found cases of typical hallucinatory-confusional insanity following the puerperium, in which the autopsy disclosed the fact that the patient was suffering from a miliary tuberculosis. Again, should labour occur during pneumonia, or during the course of a severe cachexia from malarial poisoning, or from the effects of any very exhausting disease, we might well have a collapse delirium with the clinical expression of hallucinatory-confusional insanity.

(*b*) It is well known that during the gravid period there are disturbances in the general nutrition of the pregnant woman even in the most physiological cases. A proportion of these alterations are no doubt due to increase in the abdominal pressure and a consequent tendency to obstipation or diarrhœa, to the diversion of the blood-flow from other organs to the growing uterus, and various exhausting drains upon the maternal system. All of these, together with an unusual strain thrown upon the kidneys by the rapid tissue metabolism going on in the uterus, may induce, in certain instances, especially in women that are not physically strong, the accumulation of toxic substances within the body, that irritate the nervous system, at the supreme moment of delivery, to a pathological reaction in the form of an eclampsia, a psychosis, or both. We know that pregnant women are particularly liable to have albuminurias, glycosurias, lactosurias, and other evidences of altered chemical metabolism and excretory changes; and it is not difficult to suppose that some of these anabolic products, as well as others belonging to the uric-acid series, induce hyperexcitability of the nervous system. Some of the albuminurias and glycosurias are transient, others continue through the later stages of pregnancy, and help to induce,

either during or after delivery, convulsions or psychoses, which rapidly disappear in a majority of examples as soon as the system returns to a normal condition. Mental disturbances in an acute or chronic form from renal lesion in the non-pregnant are far from infrequent, and assume practically the same type of insanity—hallucinatory-confusional excitement. It is not, therefore, surprising that, when the additional causes of irritation belonging to pregnancy are laid upon the maternal system, these disturbances should be more frequent than in uncomplicated instances.

But leaving out of account, for the moment, the toxines evolved in the albuminurias and glycosurias of pregnancy, the hydræmic condition of the blood ordinarily present is sufficient, with an ill-balanced brain, to superinduce irritation of the brain cortex from deficient nutrition of the cells, such as is often seen in anæmia from other causes. But with poverty of the blood we may always expect the incomplete excretion of urates and ammonium carbamate, the latter representing a transition form from a lower product of tissue metabolism toward the urea series. Thus, when to various toxines nerve-poisonous substances of the ammonium series are superadded, the combination of irritating agents may easily produce an overwhelming of the mental faculties—a collapse delirium. Olshausen, who has given especial attention to the subject of the psychoses after eclampsia, found that in a material of 200 cases, 11 were followed by mental disturbance, and that among 515 eclamptics whose histories were recorded in the literature, 31 had an acute psychosis following the convulsions.

Furthermore, auto-intoxication from the intestinal canal should be thought of in the acute psychoses of the puerperium, especially in neglected cases that have had bad or improper food. Certainly there is no reason why an auto-intoxication should not occur at this period as well as at others.

The practice, particularly prevalent among the lower classes, of giving considerable quantities of alcoholic stimulants to the parturient woman, especially after the end of the first stage of labour, should be borne in mind as supplying a probable factor in the causation of some cases of acute puerperal insanity. Alcohol is not well borne by many persons, especially those of inferior mental capacity, and the delirium that succeeds is difficult to differentiate from other kinds of hallucinatory insanity.

The insanities from these various forms of poisoning are short, sharp, and usually recovered from within a few days. The eclamp-

tic cases follow a similar course; in the majority the mental disturbance begins either after the awakening from coma or on the following day, and quickly recedes, two weeks being, as a rule, the limit of its duration, while a few end within three or four days.

In a certain proportion of infectious cases, especially when there is high temperature and rapid pulse, with abdominal tenderness and the other indications of the presence of a septic process, it is difficult to decide whether one is dealing with an actual fever delirium or the beginning of a psychosis; it is only when the fever and other acute indications have subsided, while the disturbance of the mental functions still continues, that we can make our diagnosis. The distinction between the delirium of fever and the long-continued delirium of a toxic psychosis is unimportant, as the one often insensibly merges into the other. In both, the symptoms are due to irritation or inanition of the brain cell, the high temperature, and the presence of a poison in the blood plasma.

(*c*) Although the two forms, the infectious and the toxic, probably comprise more than one half of all the insanities of the childbed period (70 per cent, Idanof, 80 per cent, Hansen), there still remain a considerable proportion of the total number of cases in which these agents cannot be traced, and to which it is difficult to assign a definite etiology. In Hoppe's 100 cases of puerperal insanity, 63 showed the ordinary acute hallucinatory confusion, 11 melancholia, 11 periodical insanity, 7 mental disturbance with prominent indications of hysteria, 5 hallucinatory paranoia, 1 epileptic insanity, and 2 dementia paralytica; according to these figures, at least 25 per cent, excluding acute hallucinatory forms, were cases with inherited brain defect. In Idanof's 53 cases, 56 per cent had a well-defined hereditary predisposition.

Next to the hallucinatory-confusional insanity the melancholias represent the most frequent of the parturient psychoses, and of these a certain proportion must also depend to some extent upon an hereditary predisposition, though I have excluded them in summarizing Hoppe's tabulation. The ordinary immediate causes of melancholia are constitutional predisposition conjoined with anæmic conditions, cachexias, anxiety, fear of death, and similar incidental causes. The period of gravidity offers an unexampled opportunity for the exhibition of all these; later, when there is superadded the pain and mental distress of labour, the labile brain soon succumbs. Similar conditions apply to the few cases of a more purely maniacal form, hysterical excitement now overpassing the ordinary limit.

Probably no small proportion of the cases that pass for puerperal psychoses really represent nothing more than the excitement of a periodical insanity, superinduced by the strain of parturition upon a susceptible nervous system; to this category belong the mental disturbances that recur almost without exception at the end of every pregnancy. Two of Hoppe's, an equal number of Hausen's cases of the non-infectious type, and one of my own, were instances of post-epileptic mania, with much mental confusion, simulating in some respects the hallucinatory-confusional form, though finally distinguishable from it by a different clinical course.

In the English statistics quite a number of the cases of excitement following the puerperium have been determined to belong to general paralysis of the insane, in which pregnancy had taken place in the first stage, and the attack of maniacal excitement, customary at the beginning of the second stage, had followed delivery, its advent possibly being precocious, and induced directly by the cerebral congestion attending the pangs of labour. Two of Hoppe's patients and five of Hoche's were general paralytics. Moral causes should also claim some recognition in the etiology, as many cases of puerperal insanity begin with primiparæ (forty-five per cent, Shdanow, thirty-four per cent, McLeod), and there is always a larger proportion of cases of insanity among unmarried than married women.

Statistics as to Frequency.—The records giving the frequency of puerperal insanities are mainly derived from the poorer classes, and from lying-in hospitals. In the years 1878–'82 there were 3,500,000 births in England and Wales, and during the same period 1,794 patients suffering from puerperal insanity were committed to English asylums, or about one in 1,950 parturient women (McLeod). This proportion is, of course, far too low, as a considerable number of these patients are kept at home and do not enter the doors of asylums. The various foreign monographs bearing upon the subject give widely different figures, according to the experiences of the several observers. Thus Reid gives one case of insanity in 397 deliveries, Rigden one in 1,200 deliveries, Menzies one in 700, McLeod one in 398, and Hansen one in 386—an average of one in 616 deliveries when all these tables are taken into consideration.

Among the general insane admitted to asylums the proportion of puerperal cases varies also within wide limits. Clouston, at the Royal Edinburgh Asylum, to which all classes are admitted, found 141 cases (5 per cent puerperal, 4 per cent lactational, 1 per cent

gestational) among 1,549 insane women, while at the Carlisle Pauper Asylum there were 75 cases among 431 insane females, equivalent to 17.4 per cent of the total admissions; and of the 75, 68 per cent were post-partum cases in the strict sense. Hoche, of Hamburg, in 2,454 insane women found 211 puerperal psychoses, equivalent to 8.6 per cent of the total number, and of these, 24 were insanities of pregnancy, 98 belonged to the period of confinement, and 89 to the lactational period. In the United States, Gundry, in 1860, among 11,762 insane women found 1,050 suffering from an insanity which had begun at some time during the puerperal period, a proportion of 8.92 per cent of all insane females. The statistics of New York State hospitals from October 1, 1888, to September 1, 1895, show that there were admitted to the several institutions 427 cases of puerperal insanity (child-bed, 286; pregnancy, 80; lactational, 61) among 8,791 insane women, a proportion of 4.85 per cent, or only a little more than one half of the number found in asylums in 1860. These figures certainly show, as has already been stated, that the puerperal insanities are on the decrease, owing to better aseptic conditions at the time of delivery, and better hygienic surroundings.

Results.—Hoche found that 40 per cent of the patients in his collection recovered, 30 per cent remained insane, and 30 per cent improved; McLeod, that 77.3 per cent were cured and 9 per cent died; Clouston, that 55 per cent of post-parturient cases recovered, 27 per cent improved, and 8.33 per cent died; Menzies, among the same class of cases, found a percentage of 43.3 per cent of recoveries, 46.6 per cent became chronic, and 10 per cent died; Lewis (post-partum), 80 per cent recovered, 5.7 per cent became chronic, and 8.5 per cent died; Hoppe (post-partum), 65 per cent recovered, 6 per cent died.

Duration.—The large majority of post-partum cases that progress favourably recover from within three to six months; a considerable proportion, especially of the periodical cases, within a few weeks. The insanities of lactation and pregnancy vary greatly in their duration, averaging from six to nine months. In Hoppe's 100 cases the duration of the hallucinatory-confusional forms averaged 9.4, that of the melancholias 13, that of the hysterical psychoses 19.6 months. McLeod found that in 814 cases of all forms, 34 per cent were well in three months, 76 per cent within six months, and 87 per cent within the first nine months. In 10 recent child-bed cases, personally observed, there were 50 per cent of recoveries, 40 per cent

remained insane, and 10 per cent died; in 4 cases of the insanity of pregnancy, 2 recovered after delivery and 2 became permanently insane, while of two cases of lactational insanity, one died and one proved incurable.

Relapses in all forms of puerperal insanity are frequent after apparent recovery, even although the disturbance may have lasted only a few days; in these relapsing cases the prognosis is very unfavourable. This recurrence is particularly noticeable among the women of the poorer classes who suckle their children on being returned to their homes. Slowly recovering cases, with intermissions of partial lucidity, give a better prognosis for complete return to normal conditions than those in which the psychosis passes away rapidly.

Symptomatology.—The clinical picture varies a good deal, according to the nature of the special form of mental affection of the puerperal woman, and according to the time of its inception.

The symptomatology of cases occurring during pregnancy differs in no wise from that of ordinary types of melancholia, mania, or periodic insanity, the melancholic being depressed, apathetic, showing mental inhibition with or without delusions, while in the excited forms the patient is loquacious, incoherent, with delusions mainly of a persecutory nature, and more or less motor excitement according to the character of the case. A good many of such patients are simply irritable, loquacious, sleepless, and restless, without well-defined delusions, and, in fact, present the phases of a simple mania.

A somewhat different picture is seen in the insanities of the post-partum period. These fall into two natural divisions: (1) the smaller class, in which there is a grave inherited tendency toward insanity, with a melancholic, hysterical, periodic, epileptic, or paretic symptomatology, the especial indications of which will be found under the appropriate headings, and need not concern us in this place; and (2) a much larger group due to septic intoxication from the genital tract or the alimentary canal, or resulting from the storing up in the system of waste tissue products. Cases of the former class may begin at any time after parturition, before the end of the period of uterine involution, that is, within two months after delivery, but are more frequent after the end of the second week, while instances of the second group develop much more commonly within the first ten days after delivery than in the later weeks. This is readily to be explained by the fact that tissue lesions (of the

placental site, etc.), through which infectious material must pass to reach the general circulation, are more open in the first days after childbirth than afterward, when the mouths of the veins are closed and healing is progressing. Again, it is to be remembered that immediately after delivery the bodily vigour is at its lowest, and in many cases there has been a greater or less degree of exhaustion from loss of blood.

As already mentioned, it is to Fürstner that we owe the first accurate clinical description of the insanities belonging to the childbed period. The condition is not peculiar, in the strict sense of the word, to the puerperal woman, since it can occur just as well after severe hæmorrhage, in the inanition psychoses, during diabetes and acute and chronic albuminuria, in typhoid and pneumonic fevers, and in other less common forms of disease; it constitutes, symptomatically, the connecting link between the delirium of fever, or starvation, and the true insanities, the one insensibly merging into the other. Indeed, no distinct line of demarcation can be drawn. The condition of motor unrest, of hallucinations and delusions of the brain obtunded by fever and a systemic poison, we call *delirium* when it lasts only as long as does the febrile movement; we term it *insanity* when it persists after the indications of the somatic disease have disappeared. The mental disturbances due to fever, severe loss of blood, and pronounced inanition, are similar in character and cannot be definitely distinguished the one from the other without a knowledge on the part of the physician of the immediate nature of the somatic malady. All of them exhibit the hallucinatory-confusional motor and mental types of excitement, and later continued agitation, delusions, stupor, or melancholic indications.

The prodromal symptoms of the approaching nerve storm are not very definite. The patient, who in the majority of cases has been feverish for a few hours or days (the temperature ranging from 101° to 104° F., or even higher, in severe cases), becomes slightly irritable, manifests dislike to child or nurse, and is restless. The eyes become bright, the expression denotes uneasiness. Soon hallucinations are manifest, principally those of the sense of sight; ghastly faces appear at the windows, or the horrible forms of men who seek to murder her or her offspring. In somewhat less frequent instances the voices of those about her change; she hears whisperings that she or her infant is to be slain, and in a frenzied moment she catches up the child and rushes through the door or

window to escape the impending danger; or she strikes the nurse or relative watching over her, whom she no longer recognises, and may even attempt to strangle them with her naked hands, or kill them with the readiest weapon obtainable. By no means all cases of parturient insanity show these suicidal or homicidal tendencies, but such occur with sufficient frequency as to render it the duty of the physician to warn the household in any case of child-bed psychosis.

The attempts at suicide are the antithesis of those of the melancholiac. The latter are premeditated, and are gradually evolved from the insistent ideas of unworthiness. In the puerperal woman they are the direct consequence of frightful hallucinations, and are entirely unpremeditated. Even the most transient attacks of insanity in the child-bed period may be accompanied by hallucinations and mental confusion, during which the patient is entirely irresponsible; and in instances of infanticide, within a few days after labour, it is often most difficult to decide whether the act was performed knowingly, or unwittingly in the condition of clouded consciousness. Too often the case is one of *mali principii malus finis*.

The hallucinations are usually remittent, especially at first; soon to these is added a mental confusion, that perverts and changes the *ego* of the patient, and together with the hallucinations alters her whole surroundings with respect to self. Accompanying them is a lively motor agitation. The excitement now often becomes intense, the patient incessantly moving about, tearing the bed-linen or injuring herself in attempts to escape from restraint, the mental obscuration preventing any forethought or the retention of any capability of being reasoned with or persuaded to remain quietly in bed. With the motor activity there is none of the loquaciousness of the true maniac; on the contrary, speech is often reduced to disjointed, unconnected words, and when spoken to, the woman either pays no attention, or stares at the person addressing her in a blind, uncomprehending way. She is absolutely sleepless, occupied entirely with her hallucinations, rejects food, or takes it in a mechanical manner, and is regardless of her person or of the ordinary decencies. Erotic tendencies are manifested in some cases.

By this time the lochia have ceased or are reduced in amount; in the latter case they are often fetid; the milk secretion, if present, soon fails; the heart's action is laboured and tumultuous, the pulse quick and compressible, ordinarily from 110 to 120, but some-

times much higher. The tongue, at first slightly coated, becomes dry and brownish, while the teeth are often covered with sordes. The general nutrition is evidently failing, yet despite this the motor unrest continues, broken occasionally by more quiet moments. The breath is very foul, and the whole body may exude an ill-smelling odour. Quite often there is a persistent diarrhœa, or obstinate constipation may be present.

Within a few days—usually four or five—the character of the disease undergoes an alteration, and the patient enters the second stage. The effects of the toxine, from whatever source derived, are now at their height; the patient becomes duller, more stupid, even mute, or there is the constant repetition of single words or syllables. As a consequence of the dulling of the senses the hallucinations dominate the entire picture, and at times drive the sufferer into frenzied states, so that when left unguarded for a moment she may throw herself out of the window, or make other attempts directed against her own life. During the periods of motor excitement there is a heightened perception of what is going on around, and succeeding them may be some minutes of partial lucidity.

In these severer forms the return to normal mental clearness, if such is to be the result, is a gradual one. The hallucinations slowly subside, and are not replaced by delusions, the physical condition of the patient improves, food is taken in larger quantities, the intervals of lucidity become more and more prolonged, and the patient gradually regains her normal mental state.

In occasional instances in the second stage, instead of becoming frenzied, the patients are depressed, and continue in this state with intervals of lucidity until they eventually recover from the hallucinations and delusions. These depressive forms are less frequent than those of excitement, and the progress toward eventual recovery is slower. The depression and mutism are apparently the direct result of delusions evoked by vivid hallucinations of fear and of impending personal danger, though it is extremely difficult to obtain from patients any coherent account of this period of the disease, since, owing to the profound degree of mental confusion, their remembrance is extremely limited. Psychical pain is not a feature of the depressed form, as it is in the melancholiac, the dejection being due rather to toxic mental obtundity. These patients offer no active resistance when they are fed through the stomach tube.

In the cases that result unfavourably, instead of a return to the mental equilibrium, the hallucinations continue in less vivid forms,

and delusions, principally those of a persecutory type, sometimes of an erotic nature, manifest themselves, and continue as the prominent feature of the disease. The patient now gains in weight, digestion resumes its activity, and there is a return to physical health. The mental faculties, however, remain stationary, the apperceptions nearly always showing a certain degree of dulling; sometimes there is actual dementia. Finally, in any event, the woman becomes completely demented after the lapse of months or years.

The gradual progression of symptoms to an acme is not without exceptions, since many of the cases are cut short in the first stage—that of active hallucinations—the disease aborting, with a complete return, within a few days, to mental health. These latter examples of the disease are the more frequent after eclampsia, or other disorders accompanied by auto-intoxication from storage in the system of waste products of the ammonium series, from auto-infections from the intestinal canal, and after acute alcoholic poisoning in those unaccustomed to its use and possessed of an unstable brain.

Death in post-partum insanity is usually from one of two causes: profound sepsis, or exhaustion from motor excitement.

In the first case, the patient, after passing through the hallucinatory-confusional stage, with or without much motor excitement, becomes progressively stuporous, then comatose. There is now ordinarily some distention of the abdomen, with tenderness, not always confined to the locality of the uterus, fetid lochia, and slowed or tumultuous heart action. Muscular twitchings may also be present, accompanied by low muttering delirium, without any marked rise of temperature.

In the other form the motor agitation, instead of subsiding, increases to actual frenzy, the patient being in incessant motion; disjointed words are constantly enunciated, and there is absolute sleeplessness. Food is refused; even water when placed in the mouth is spat out, and on account of the extreme degree of muscular unrest it is difficult to feed such patients through the tube or by enemata. The decline in bodily weight is rapid, and death results from exhaustion. Acute miliary tuberculosis should always be considered in these cases, as in several instances this diagnosis has been confirmed at the autopsy. Endometritis, placental retention, metrophlebitis, diffuse peritonitis, purulent salpingitis, parametritis, and endocarditis pneumonica have all been noted in the septic form.

After what has already been written, it is hardly necessary to return to the other forms of mental disease that occur in the child-bed period. It is sufficient here to recapitulate that the periodic insanities, the vesanias accompanying epilepsy, hysterical insanity, paretic dementia, and hallucinatory paranoia may all be found in the lying-in room, and that their course and treatment differ in no wise from those of the same diseases occurring at other times.

THE INSANITY OF THE LACTATIONAL PERIOD

All cases of insanity beginning later than the second month after parturition are indifferently designated lactational insanities, irrespective of their past or immediate cause. The distinctive lactation psychosis is essentially an inanition insanity, and is also characterized by the cardinal symptoms of visual and aural hallucinations, confusion, followed by excitement or depression, with delusions, and in rare cases with stupor. The hallucinatory maniacal form is the more frequent.

Causes.—The natural exhaustion following labour, perhaps accompanied by hæmorrhage, the changes incidental to the involution of the uterus, the activity of the mammary glands, which causes a new strain upon the general system for the supply of nourishment to the child, the loss of rest incidental to frequent nursing and protracted suckling, are the most common etiological factors in the induction of this form of mental disturbance. The combination of all these produces rapid cataboiic changes in the tissues, loss of weight, and more or less profound anæmia from the drain upon the albuminous constituents of the mother's blood, particularly in the later months of lactation. These causes alone are quite sufficient in physically weak and insufficiently fed mothers to induce the psychical upset. Hereditary tissue instability must also be a factor of no inconsiderable prominence. The insanity of the period of lactation is far more frequent among mothers from the poorer classes that have insufficient or poor food, or suffer from lack of attention, than among those having all that is requisite as regards aliment, lodging, and nursing.

In rather infrequent instances absorption into the general circulation of the products of pus-formation, from abscess of the breasts, is the immediate exciting cause. The symptoms then approach those of the febrile-delirium type, and the course of the disease is governed by the mildness or severity of the blood poisoning.

Acute diseases, such as erysipelas or rheumatism, occurring during the period of lactation, *cæteris paribus*, always fall with more stress upon the brain tissues than at other times, when the more robust condition of the system is better capable of withstanding them.

Symptoms.—When seen by the physician the patient is usually anæmic, thin, with the skin yellowish and dirty in colour, and suffering from anorexia and sleeplessness. For weeks, perhaps months, she has shown loss of memory, decline of the faculty of attention, a progressive pallor, digestive disturbances, the evolution of morbid fancies, and a change of disposition toward her infant and the household. If she continues to nurse her child she becomes more and more anæmic, and eventually develops hallucinations, aural, visual, or mixed, with increasing obtuseness and confusion of thought. Whispered voices constantly annoy her; she hears the ominous murmur made by a crowd of men who are coming to slay her or her child; strange visions flit before her eyes; appalling spectacles are beheld; her children are killed before her. Under the influence of these terrifying hallucinations she may attempt suicide, take the life of her infant, or, under a false conception of the identity of those around her, may violently assault husband, mother, or nurse. Periods of quiet may follow the more active manifestations of the disease, to be succeeded by recurring agitation, irritability, various delusions that her husband is unfaithful to her, that she is being poisoned, or others of a persecutory type. Distrust, suspicion, and terror, all prevail at the same time in the obtunded brain, and sequent stuporous conditions are by no means infrequent.

Excitement is more common than depression in lactational cases (states of depression, 40 per cent, Schmidt; 20 per cent, Krafft-Ebing; 34 per cent, Lewis). True melancholia is rather infrequent, psychical pain not being a prominent feature of the depressive form. Again, the patients do not usually comprehend what is passing around them, and the condition is rather one approaching stupor than true melancholia, since it is often very difficult to arouse them to any degree of attention and comprehension of questions, and any answers obtained are incoherent and irrelative.

Progressive paralysis, periodic and recurrent insanity, or epileptic psychoses, may occur during the lactational period.

The bodily temperature should be ascertained in every case, to differentiate between the ordinary exhaustion insanity and that due to febrile and septic processes.

Prognosis.—This is fairly favourable when there is no heavy burden of alcoholism or ancestral insanity. Although we have a smaller proportion of complete recoveries than among the post-partum cases, a greater number of patients retaining their delusions and remaining among the chronic insane, the fatalities are fewer. Not more than one half the entire number may be counted upon to return completely to mental health. The later the insanity occurs in lactation the less favourable the prognosis, because, owing to long continuance of the pernicious influences, the vitality has been reduced to a low ebb. The duration of the psychosis averages from eight to nine months. Dementia finally results in all instances that do not return to health, though the degree of reduction may be quite variable.

Treatment of the Puerperal Insanities

1. **Post-partum Cases.**—The therapy of these cases is widely different, according as we have to deal with reaction to a nerve poison (sepsis, auto-intoxication from retention of ammonium and uric-acid products, or those of the intestinal canal), loss of blood, or one of the ordinary forms of insanity complicating the lying-in period. In some instances the clinical thermometer is of the greatest importance, inasmuch as it is sometimes possible, from the height of the temperature, to determine whether the cause is septi-cæmia or something else, but even this aid occasionally fails us. Where there is uterine or pelvic tenderness, even suppressed or fetid lochia, no delay should be made in washing out the cavity of the uterus with antiseptic douches of bichloride of mercury, or weak carbolic-acid solutions, with abundance of hot water. Abscesses in the vagina and mammæ should be searched for, and when found should be evacuated. Recto-vaginal and vesico-vaginal tears should be cleansed, closed, and treated in the best manner the condition of the patient admits. Recto-vaginal openings are a dangerous source of infection to the parturient woman, as the streptococcus and colon bacillus may readily gain entrance from the bowel into the genital tract, and in the crushed condition of the vaginal and perineal tissues, after protracted labours, may be the cause of serious physical and subsequent mental damage.

The medical treatment of these puerperal cases is mainly tonic and nutritive. The administration of food claims the first place. Milk and white of egg, or plain milk, eggs beaten up in milk, and animal broths, should be given by the mouth, and supplemented by

occasional clysters of panereas or predigested milk. If resistance to the administration of nourishment is made, enforced feeding must at once be resorted to, either by the spoon or stomach-tube, as it is imperative to keep up the strength in every way possible. Quinine has the first place among drugs, as it not only helps as a tonic, but also has some influence upon toxic organisms. Twenty to thirty grains a day should not be exceeded, as larger doses have a tendency to increase the agitation. Iron is not admissible in the earlier periods of the disease, as it also increases the excitement. Spirituous liquors should not, as a rule, be given while the febrile movement lasts, although in weak subjects they may sometimes prove necessary as a food in combination with milk; even then only small amounts should be used. Hypnotics are often required to induce rest. Where there is much motor agitation and unrest, hyoscine hydrobromate in small doses ($\frac{1}{100}$ to $\frac{1}{80}$ gr.) may be advantageously administered, provided the patient is fairly strong, and is possessed of a good heart. Morphine should not be given, but if opium in any form is required, the liquor opii may be administered. As a pure hypnotic, chloral is the best, perhaps combined with the bromides. Warm baths and hot sponge baths are soothing at night, tending to induce quiet and sleep. When the patient is recovering, the various sirups of the phosphates, the albuminate of iron, the peptomanganate of iron, the tincture of the chloride of iron, bone-marrow, phosphate of quinine, and nux vomica, with suitable foods, are required. If circumstances admit, a trip to a seaside or mountain resort, under the care of an efficient nurse, is most advisable, and no patient should be returned to the care of house and children until several months have elapsed after apparent recovery, relapses being only too frequent, the patients then showing a strong tendency toward the chronic forms of insanity.

The insanity following severe loss of blood and shock during the puerperium should be combated by the administration of food, bone-marrow, malt, beer, quinine, and in the later stages iron preparations. Quiet and rest should be induced by sponge baths, bromides, and as a last resort by chloral. In the auto-intoxications of the albuminuric, elimination of the waste products should be attempted by salines, diuretics, and diaphoretics, though no severe drugs like jaborandi should be used, the weakened condition of the woman not warranting their employment. Digitalis with acetate of potassium, sometimes the infusion of adonis vernalis, markedly increases the urinary secretion. Digitalis is best given in the form

of the infusion, but large doses should not be employed. When intoxication from fermentation in the digestive tract is suspected, a saline, or pil. hydrarg., followed by salol, can do no harm, and may be of great benefit.

2. **Lactational Insanity.**—The first requisite here is to check the drain upon the system by stopping the nursing; then order a liberal but unirritating diet, principally milk, eggs, wheat foods with malt, and, if they can be taken, the iron-containing vegetables, such as spinach. Much meat is to be avoided in the early stages of the psychosis. Nearly all lactational cases have some digestive trouble which should be combated by the administration of suitable remedies, salines, perhaps calomel or blue mass, followed by a mineral water; or, where there is actual indigestion, the essence of pepsin and pancreatin may help to tide over the breach. Clysters of peptonized milk or sweet-bread will occasionally prove very useful. Later, combinations of iron with arsenic, the albuminates of iron and manganese, the phosphates of iron, quinine, and strychnine, are very beneficial. Avoid spirits whenever practicable, and rely rather upon sponging and warm baths than upon hypnotics. In the cases in which some drug must be employed to produce sleep, chloral gives the best results unless the heart is weak. The tumefaction of the breasts, that frequently results from the withdrawal of the infant, may be successfully combated by the application of atropine in glycerine, or belladonna ointment. The internal administration of atropine in any quantity has often a tendency to evoke hallucinations, even though they were not previously present. Sufferers from parturition or lactational insanities do better when confined to bed, and when not allowed to exhaust themselves by purposeless movements; later, however, when the acute symptoms have passed, they should be sent into the open country to seek diversion and pure air. Drives in an open carriage are generally the best method of taking exercise, since too long walks are apt to overtire the debilitated patient. What has been said concerning the return home of parturient cases applies with equal or greater force to the lactational forms.

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DELIRIUM ACUTUM

This very rare affection resembles in many respects an intense febrile delirium. It is characterized by the clinical expression of fever, delirium, great motor excitement, and rapid exhaustion, ending frequently in death.

It is very doubtful whether delirium acutum, otherwise known as typhomania (Bell), acute delirious mania, delirium grave, and acute paralysis (Reger), is an entity or only a symptom-complex. Clouston speaks of it as a phase of severe primary mania; Kraepelin does not believe that it exists; according to Lewis, "it represents the most profound maniacal reduction which we meet with." With the few cases it has been my fortune to see, some diagnosis other than delirium acutum, principally post-febrile or meningitic delirium, would have been equally justifiable. In one very striking instance, in which during life there were no physical indications of a definite somatic disease, the necropsy showed a deep-seated mass of lobar pneumonia undergoing resolution, while in the brain and the meninges there were the customary hyperæmia of the blood-vessels, lymphatic engorgement, and œdema. Indeed, instances of the disease have been recorded after a host of infections troubles, pneumonia, typhoid and typhus fevers, in phthisis (Holsti), after dysentery (Snchanow), diarrhœa (Smith), measles, acute rheumatism, influenza, after the puerperal state, in cancer of the stomach, as well as other conditions. It is also extremely probable that a not inconsiderable number of the examples of delirium acutum belong to the fulminating form of general paralysis, occasionally, perhaps, complicated by an infection to which these debilitated patients are especially liable. Delirium acutum has also been noted after an attack of severe delirium tremens, a condition also favourable to the inception of an infectious process.

Ceni has found, in a series of experiments, that the blood of insane individuals suffering from intense motor unrest, or that of animals whose muscular system has been severely exhausted by the continuous application of faradism, forms a favourable culture

medium for the growth of bacteria; indeed, in the blood of insane patients the presence of pyogenic organisms was frequently determined.

The various researches on the bacterial origin of delirium acutum are by no means in accord with one another, nor, indeed, could this be expected, inasmuch as the inciting sources of the disease are so manifold. The work on these lines has so far come mainly from the Italian school, and is recorded chiefly in the writings of Bianchi and Piccinino, and Ceni. The former observers obtained from the blood of patients with acute delirium a certain organism having the form of a bacillus, also various forms of cocci, usually the streptococcus pyogenes and staphylococcus aureus, these cocci being present in large numbers. Bianchi regards this bacillus as peculiar to the affection, having found it not only in the blood, but also at autopsy in the subarachnoid and ventricular fluids. Ceni in two cases found in the blood and cerebro-spinal fluid not the bacillus described by Bianchi, but only staphylococci, and argues that the bacillus is certainly not the only cause of acute delirium; in fact, he believes that the micro-organisms are only of secondary importance. Sir Batty Tuke (personal communication) found in an example of the disease a long, rather thick bacillus, with numerous spores. In the studies of other authors it is noted that the blood cultures remained sterile, but it must be remembered that in any investigation for bacteria in the blood a great deal depends upon the time at which the culture is made, as examinations made at too late a date after the inception of the disease are ordinarily negative.

In a malady for the development of which so very many causes may apparently be responsible, it is difficult to believe that a single organism is the sole immediate inciting factor. The clinical likeness between this affection and the severe types of puerperal insanity argues that, in all probability, cocci—the pneumococcus or streptococcus—may produce as severe and exhausting a delirium with motor agitation as any other form of bacterial infection.

Pathogenesis.—Besides the infectious diseases, quite a number of causes are mentioned by the various authors as provocative agents. Among these are perturbation of mind, unhappy love affairs, excessive mental strain, poverty, drunkenness, insufficient nourishment, dystocia and its corporeal weakening influences, the menopause, insolation, trauma, and numerous other neuro-physical depleting influences. The acceptation of a number of these would presuppose an already present instability of the nerve tissues that admits of the

residuum of mental equilibrium being readily overturned by the presence of any irritating and debilitating poison, whether it be engendered within the body or received by it from external sources. Not a few instances of delirium acutum arise in the course of chronic insanities; then the paralytic symptoms are unusually prominent, and the course of the malady is almost always fatal.

The cases of apparent delirium acutum occurring at the beginning of the second stage of paresis do not always end fatally, although they may attain the severest form of a typhomania with considerable elevation of temperature, and may go on for weeks. In those patients that die there is constantly found at autopsy an acute perienceph alitis with much plastic exudate upon the surface of the pia mater.

Age.—Although no period of adult life from seventeen to sixty-five is exempt, the majority of the cases occur between twenty-five and forty-five years. In Christensen's series of 33 cases, only one was below twenty-five and two were over sixty-five years, while 21 were between twenty-five and forty-five years. All of Krafft-Ebing's 45 examples were between the ages of twenty-seven and forty-seven years.

Sex.—Females are apparently more subject to the malady than males. Christensen had 23 women and 10 men, and Krafft-Ebing 22 men and 23 women. Spitzka and other writers also give statistics showing a preponderance of cases in the female sex.

Duration.—The virulence of the disease process is attested by the fact that few of the patients survive more than three weeks, the average duration being not longer than ten days. The disease is fatal in at least seventy-five per cent of all cases, inability to induce the patients to partake of sufficient nourishment hastening the end.

Frequency.—Delirium acutum is fortunately one of the rarest of the psychoses. Christensen had thirty-three instances in eighteen hundred admissions to the Aarhus Institution, and our local asylum has had only three cases in nine hundred and sixty admissions. Examples of the disease are comparatively more frequent in private practice than in asylums.

Clinical Symptoms.—These are essentially similar to those of the severer types of post-febrile collapse delirium, and not a few of the recorded cases, as that of Ball, have followed six or eight weeks after a typhoid or other fever. In certain instances there has been no other ascertainable cause than a fright, bad treatment, or mental over-exertion.

In the prodromal stage the most striking symptoms are the complete sleeplessness, with alteration of the general character and mien; then follows clouding of consciousness to mental confusion, depression and incapacity for thought, pain with a feeling of fulness in the head, and other congestive phenomena. Soon vivid hallucinations begin, while the physical phenomena become intensified, and the nutrition rapidly sinks. Then commences the second stage of intense maniacal delirium.

The inception of the first stage is rarely sudden, and although instances are recorded in which the patient has become suddenly maniacal on awaking from sleep (Blandford), it is not difficult to conceive that in these cases the earlier indications had been overlooked. The *malaise*, headache, and an intense bursting sensation in the head are fairly constant, and suggest strongly a beginning meningitis, the similarity being rendered still more striking by the spastic narrowing, or more rarely the inequality of the pupils. The sufferer now presents the appearance of one drunk with wine; he staggers about the room, and though perhaps melancholic at first, soon becomes joyous, dancing, shouting, and indulging in an expansive hallucinatory imagery. The maniacal symptoms soon increase to a veritable frenzy, the delirium becoming wild and aggressive. Under the influence of fearful delusions the patients dash themselves against the window or against the wall, bruising and otherwise injuring their bodies. More rarely the attendants and nurses are attacked. The hallucinations are usually of the persecutory type; the victims are pursued by detectives, satanic fiends struggle to overcome them, enemies try to poison them, ferocious animals leap upon them. Paræsthesias of the integument are also noticed. The skin is covered by vermin, or worms crawl through the flesh. Among the more bizarre appearances are the visions of flames and flashes of fire and blood before the eyes, that accompany the active congestive phenomena.

At the acme of the disturbance, owing to the increased mental confusion, the delirium changes; single words or single syllables are repeated over and over again, these utterances being now and then interspersed with loud screams and whistling sounds. Even in the midst of the wildest excitement the deliriant mutters of annihilation, of the end of all things, of death. All is destroyed utterly, and he is buried under the ruins.

The face up to this stage has shown a well-marked congestion, and even taken on a purplish colour. The muscular movements

are uncertain, massive, and aimless; the patient stamps with his feet, burrows with his head into the pillows, puffs out the lips, breathes stertorously and with ever-increasing frequency. Added to the ordinary muscular agitation there may be grinding of the teeth, irregular spasms of the facial and eye muscles with squinting, or spasm of the masseters with tonic and clonic contractions of the muscles of the extremities. Partial pareses of the monoplegic order have been noted in a few instances.

Speech is disturbed to a considerable degree. It is stuttering, ataxic, or nasal, according as the extreme dryness of the mouth and nose, muscular insufficiency, or ataxia predominate.

The deep reflexes are usually augmented, sometimes to a remarkable degree, the wave of excitement passing from one half of the body over to the other with increasing intensity. Somewhat rarely general convulsive movements may be excited by an attempt to elicit the reflexes. The general hypertonicity of the reflex system leads to difficulties in deglutition, food and drink being regurgitated and expectorated.

As a result of the violent movements and the rejection of food, nutrition rapidly sinks, and the countenance, before vividly congested, now becomes pale, anxious, and sunken.

The lips and tongue soon become dry and cracked, sordes cover the teeth, the tongue is heavily furred with a brownish fungoid growth, and salivation is frequent.

The temperature is almost always above the normal, varying from 101° F. or more. The degree of fever is not necessarily constant, but may vary from day to day in irregular fashion. The pulse is small, weak, ranging from 100 to 130. Death is frequently due to hypostatic congestion of the lungs.

As the disease progresses, the motor indications continue, while the patient becomes progressively more stuporous, then comatose. Decubitus is rapid; patches of ecchymosis form on the skin. The bowels are obstinately constipated, the urine, passed in small quantity, is high coloured, and often contains albumin and casts (Krafft-Ebing, Mendel).

The final stage is in coma, in which the sufferings of the victim end. In the place of the violent motor excitement there ensue ataxia and pareses of the extremities, with irregular spasmodic movements, accompanied sometimes by an intense tremor. The delirium, before violent, now becomes muttering, the spastic pupils gradually relax, the heart-beats increase in frequency and lessen in

power, the skin becomes cyanotic, hypostatic engorgement of the lungs comes on and eventually ends life. Death may occur long before this stage from collapse of the vital powers following the prolonged excitement and inanition, or with indications of bulbar paralysis.

Most peculiar in the course of the disease are the remissions and intervals of lucidity, which may endure for hours, and lead to false conclusions as to the prognosis. These remissions are fairly constant, and occur at all periods of the disease, even to the final stage. The delirium subsides, the hallucinations are recognised as false, the mind clears, and the motor symptoms disappear. But soon an exacerbation, coming on with headache, manifests itself, and the picture of paralytic delirium begins anew.

Differential Diagnosis.—With the exception of the delirium of pyrexia no other mental malady is accompanied by the same temperature range as delirium acutum, and indeed the distinction between the two cannot always be closely drawn. The diagnosis from cases of severe typical mania, the disease with which it is most often confused, is readily made. In mania there is no considerable rise of temperature or acceleration of the heart-beat, and instead of the hallucinatory-confusional delirium, there is loquacity, a ready flow of ideas in place of inhibition or monosyllabic repetition, nor is there increasing stupor. Death in acute mania is extremely rare; in acute delirium it is very frequent. The differentiation between the confusional form of mania and delirium acutum is more difficult, but here again the rise of temperature in acute delirium is highly suggestive, and the characteristic progress of confusional mania, obtundity alternating with prolonged periods of loquacious excitement, completes the diagnosis.

To distinguish it from meningitis, especially of the brain convexity, is exceedingly difficult unless the remissions in acute delirium be present. The early beginning of stupor, rigidity of the neck, opisthotonus, strabismus, hyperæsthesias, and repeated clonic convulsions, perhaps with well-marked paralysis, should warn one of the probable presence of a meningitis.

The galloping form of paresis also may be mistaken for delirium grave, and the points of distinction are not always obvious. Careful search should be made in suspected cases for a history of progressive change in the mental disposition of the patient, extending over a period of months before the inception of the maniacal hallucinatory frenzy. The intermingling of delusions of wealth, power,

strong erotic notions, with hallucinations of fire, bloody scenes, and a general persecutory delirium, should lead us to withhold a diagnosis of delirium acutum until the ordinary period for the exitus in the latter disease has passed. The frequent loss of the reflexes in parcsis should not be overlooked. The temperature in fulminating parcsis has, too, a more constant character than in delirium acutum, and seldom rises so high. Death in the early stage of paretic dementia, either from collapse, exhaustion, or the occurrence of a deglutition pneumonia, is very frequent. Remissions in paresis do not occur with the same regularity as in the pure delirium acutum.

In every case of suspected acute delirium care should be taken to ascertain whether the patient has passed recently through a fever, or has been subjected to unusual exposure. The physical indications of pneumonia and typhoid fever may be masked in a violent frenzy, accompanied by hallucinations and mental confusion, and such a possibility should always be remembered before pronouncing the diagnosis.

Prognosis.—As mentioned in an earlier part of the chapter, nearly seventy-five per cent of all patients suffering from acute delirium die either during the acme of the excitement or in the succeeding collapse stage. Cases that begin after alcoholic excesses, and those exhibiting eye symptoms, are said to be particularly fatal; and, as a rule, the more acute the inception and the more stormy the excitement, the more unfavourable the prognosis. In those that do recover, the restoration to health is very slow, and is interrupted by slight exacerbations. A simple maniacal excitement passing into a chronic state may follow the more active process. In the infrequent cases that do not terminate fatally there often remains a grave degree of intellectual defect.

Pathology.—Both the gross and microscopic pathology are comparatively uniform in all cases. The vessels of the brain and meninges are tortuous, varicose, and distended with blood. The active congestion extends into the basal ganglia, and even to the cord. The cortex is dotted with numerous diffuse punctiform hæmorrhages; it is markedly œdematous, and sharply differentiated from the white matter. So marked is the œdema that the whole brain, after the calvarium is removed, wells out of the skull cavity. The pia is also œdematous, and along the edges of the blood-vessels coming out of the brain the lymph channels can be distinguished as broad, whitish lines. In various portions of the cortex there may

occur local areas of encephalitis (Semidaloff), which may extend into the medullary substance.

The microscopic examination shows all the veins and arteries to be packed with blood-corpuscles, while in the lymph sheaths are dense aggregations of transuded white cells, preventing the return of the serous fluids toward the heart. Red corpuscles are somewhat frequently intermingled with the leucocytes, marking the intense degree of hyperæmia. A plasmatic exudate is also found in the spaces. The nuclei of the cells of the blood-vessel walls are enlarged, and have apparently increased in numbers (Popoff). Around the vessels are found foci of acute encephalitis and necrotic tissue. The nerve cells are markedly altered, being ordinarily in a condition of cloudy swelling, with reduction of the Nissl granula to fine dust, while unusually distinct dendrites extend for long distances from the cell body. Some show vacuoles, others pigmentary degeneration, and shrinkage of the cell body. In many cells there are indications of nuclear degeneration, the nucleus being enlarged with infolding of the membrane. The pericellular spaces are sometimes filled by a coagulated exudate, which appears to compress the cells. The neuroglia cells and their nuclei are increased, and newly formed round cells are found along the margin of the blood-vessels.

The organs of vegetative life show equally pronounced changes. The lungs exhibit either hypostatic congestion or foci of lobular pneumonia. The heart muscle is relaxed, pale, and shows fatty degeneration of the muscular fibrillæ. The blood is dark and fluid. The muscular system also participates in the alteration, showing hyaline or waxy degeneration of the striated fibres.

The condition of hæmorrhagic encephalitis which has been found in nearly all closely observed recent cases (Bianchi and Piccinini, Semidaloff and Weydenkammer, Popoff, Suchanow, and others) warrants the placing of the disease among the numerous varieties of infectious hæmorrhagic encephalitis recently described by Strümpell, Wernicke, Friedmann, and others. Similar appearances, though to a less degree, are occasionally seen after fatal delirium following the chemical intoxication-psychoses, the collapse delirium of fever, and more rarely alcoholic delirium.

It should not be forgotten that a considerable number of fatal atypical examples of the disease depart in their anatomical characteristics from the above description, and correspond closely in the pathological findings to galloping paresis, having the indications of a more chronic process in the meninges and arteries of the cortex—

the periarteritis with diffuse round-celled proliferation predominating. The several lesions, more particularly the transudation of white blood corpuscles into the lymph spaces and the cellular proliferation in the adventitial meshes, would readily account for the prolonged motor excitement seen in some cases of paresis and in delirium acutum.

Treatment.—Ergotin injections have been recommended in the highest terms by Guicciardi, Solinetti, and Krafft-Ebing. Besides these, applications of ice to the head, with protracted full or half baths at a moderately elevated temperature, lessen the congestion and delirium. The alimentary canal should be cleared with a saline purge or croton oil. It is of the most vital importance to keep up the physical strength by the administration of nourishment in the most concentrated forms, as peptonized beef or broths. Methodical feeding by the stomach-tube has to be resorted to when necessary. Brandy in steadily increasing doses should be given when there are indications of physical weakness, and in the later stages the application of artificial warmth by means of water-bags and hot blankets should be employed. Injections of morphine in small amounts lessen the muscular jactitations, but the drug does not have the same beneficial influence as in acute meningitis.

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FEBRILE DELIRIA AND PSYCHOSES

Initial delirium.
Febrile delirium.
Post-febrile psychoses.

The disturbances of the mental equilibrium during and after febrile affections are far more commonly seen in private practice or in hospitals than in asylums, though even in the last the proportion is not inconsiderable, 442 cases of febrile insanity among 19,237 insane having been received into the New York State asylums between 1888 and 1895, equal to about 2.3 per cent of all admissions.

Psychoses are not confined to any single kind of febrile movement, but may follow or accompany any of the zymotic diseases, infectious or inflammatory processes. In order of frequency, typhoid, influenza, pneumonia, and scarlet fever belong to the first rank, and these are followed by measles, variola, erysipelas, typhus, rheumatism, diphtheria, multiple neuritis, meningitis, infection by pathogenic cocci, malaria, cholera, anthrax (Palawski), phthisis, the febrile movements accompanying acute catarrhal states of the nasal and post-nasal mucous membranes, besides other more rare conditions.

The loss of balance of the mental functions may begin at one of three periods in the course of the disease:

1. It may precede the febrile movement (initial delirium).
2. It may begin during the acme of the fever (febrile delirium).
3. It may appear after the subsidence of the febrile movement (post-febrile exhaustion psychoses).

The first form is rather rare, and has been studied only in palustral intoxication, in typhoid and pneumonic fevers. An initial delirium may recur over and over again at the commencement of the paroxysms of ague and quickly subside, or may pass over, as in typhoid, into the ordinary acme delirium, and continue throughout the course of the disease.

The second form is the ordinary delirium of the pyrexia, beginning from the second to the sixth or eighth day of the temperature

elevation, and continuing, with or without intermission, until its subsidence. It may persist without remission after the decadence, and pass into a more chronic form of days' or weeks' duration.

The last type is the true post-febrile exhaustion insanity, having a determining cause connected, it is true, with the somatic disturbances that precede it, but owing its immediate pathogenesis to a somewhat different basis from the other forms.

In the first two varieties of febrile delirium there can be little doubt that the presence of certain toxalbumins resulting from the chemical action of the specific micro-organisms, together with the high temperature combined with nutritional and circulatory disturbances of the brain, the hyperæmia from increased rapidity of the heart's action and consequent increase of oxidation of the albuminous elements, with insufficient compensation in the food supply, and later the decrease in the force of the circulation with various stagnations and venous hyperæmias, are sufficient, when the process is severe, to bring about that disorganization of the mental functions known as delirium. When to these exciting causes is added a constitutional brain instability (for the transmission from an ascendant of a lowered quality of neural vitality is always productive of a readily disturbed mental equilibrium), the upset of the equipoise may be produced more readily and may be more severe than in individuals in whom the stability of the nerve cell is on a better primary foundation. Thus, in some weakly organized individuals delirium may begin at a temperature range of 100°, while others may retain almost complete clearness of the faculties at a fever heat of 108° F. In addition to a constitutional predisposition to instability, a previous traumatism, insolation, physical debility, or some antecedent nervous disease, particularly of childhood, are also among the causative factors in the evolution of a readily provoked delirium.

It is nevertheless true that many persons who show a passive or active delirium during the course of an acute zymotic affection have none of these hereditary or acquired tendencies. In such instances the oversetting of the mental functions is due to the virulence of the bacterial toxalbumins, combined with high fever and deprivation of a sufficient nutrient supply to the cerebrum.

The post-febrile psychoses, although many of them are similar in symptomatology, stand etiologically upon a somewhat different ground. The height of the fever has now passed and the stage of depression has been reached, the poison produced by the specific

bacterium has been counteracted by tissue resistance or by the development of an antitoxin, and, so far as the acute somatic disease is concerned, the patient is on the road to recovery, though only a beginning has as yet been made. But, after prodromal symptoms of a few hours, he becomes excited, confused, or depressed, as the case may turn, and evolves an undoubted alienation. These, among the most frequent examples of post-febrile insanity, are not referable to high temperature, or to the immediate effects of toxalbumic poisoning; moreover, the individual is frequently free from hereditary taint. The psychosis must therefore be regarded as resulting from an exhaustion of the brain centres, especially those of the cortex, induced by the preceding high temperature, nutritional disturbances, and the after-effect of the toxine upon the nerve cells and sheaths of the blood-vessels, while at the same time the overaction of the heart muscle during the fastigium has caused exhaustion of the vitality of that organ and sequent lowering of the circulation. We have, therefore, here a true collapse or inanition psychosis, with, as a rule, the clinical features of a hallucinatory confusional delirium, or, more rarely, of a stuporous type known as acute dementia.

Not every case of post-febrile insanity follows the above outlined course, for in a not inconsiderable proportion of examples the post-febrile phenomena are due to a prolongation of the fever delirium, which persists after the temperature has become normal. Such instances may naturally be referred to an overwhelming effect of the pyrexia and of the specific poison upon an unstable nervous system; and it is only natural that, the greater the pre-existing instability, the more readily will the balance be upset by even moderate quantities of the bacterial toxines and a medium degree of febrile elevation.

The paralyses that follow certain forms of infectious maladies—notably diphtheria—are instructive in showing that the after-effects of the poison are not lost within a few hours or days after the subsidence of the acute process, but that the impression is retained for a considerable time, as these neuritic affections follow the disappearance of the primary symptoms only after a period of days or weeks.

Febrile and post-febrile insanities are not new in the history of medicine; indeed, they seem to have been much more frequent in the days of Chomel, Sydenham, Esquirol, Pinel, and others of the older writers, than at the present time. The discovery of cinchona had its immediate influence upon the paludal psychoses, while the

introduction of hydrotherapeutic measures has materially decreased the number of cases of typhoid delirium and dementia. Similarly, all means that serve to lessen fever and shock from inanition tend to decrease the number of nervous disorders attendant thereon.

The theories that have been advanced by the writers at various periods of this century in regard to the genesis of post-febrile deliria are three in number: (*a*) the mechanical theory of the older authors, who held that the lessening of the quantity and quality of the nourishing blood induced anæmia with congestion and reflex irritation: that as a consequence an abnormal excitation was transmitted to the brain by the peripheral sensitive nerves, and at the end of a variable time the normal excitability of the corresponding brain region was exhausted (Jaccoud); (*b*) the infectious theory of Korsakow and others, who suppose an overwhelming of the functions of the nerve cells by the acute poisoning, which is undoubtedly a prominent factor in many cases; and (*c*) the inanition theory of Kraepelin, Mairet, and others. Undoubtedly the intoxication and inanition are the most important elements in the evolution of a febrile insanity.

Symptomatology.—The initial delirium of acute febrile diseases is ordinarily characterized by profound disturbance of the consciousness, confused hallucinations, with intense anxiety, and a tendency to violent outbreaks, which may exhibit themselves in assaults upon attendants owing to non-recognition or misinterpretation of acts done for the comfort or sustenance of the patient. Endeavours to escape from the impress of vivid hallucinations may lead to flight through windows, or injury to persons who may endeavour to restrain him, as the deep mental clouding precludes any attempt at reasoning with the deliriant.

The acme delirium presents an ever-varying degree of intensity. In general, the more severe the febrile access, the more profound the mental disturbance, though there are notable exceptions to this rule, and patients with a comparatively low temperature and slight somatic disturbance may show a severe and active delirium. In many febrile cases no delirium is present during the hours of daylight, but as night approaches, hallucinations and haziness of the perceptions begin, which last until the morning. Patients with delirium usually complain of discomfort and fulness in the head and sleeplessness as prodromal symptoms; then follow mental cloudiness and the development of simple hallucinations—moving figures, the china on the mantel grimacing, and other false percep-

tions. Should the condition become more serious, the grade of consciousness assumes a lower level. The clouding of the intellect deepens, hallucinations become more vivid and can no longer be corrected, and dream states are confused with reality.

The contents of the hallucinatory delirium are occasionally pleasant; loved ones appear to the deliriant; the scenes of youth are repeated with vividness. Not infrequently the subjects of the sense deceptions are connected with the occupation of the patient. At other times—and this is most frequent in the hallucinatory delirium—they are of an unpleasant nature. The persons are surrounded by grimacing faces; they are threatened by vague or terribly real figures of hideous men or animals; they believe themselves to be forcibly detained from attending to important business matters, and angels or devils beckon and speak to them. Auditory hallucinations, accordingly, mingle with those of visual origin. Music is heard, and the sufferers listen in rapt attention. The sound of bells, the noise of locomotive whistles annoy them; voices call them, and hallucinations, mingled with attendant delusions, change from hour to hour, or even from minute to minute. The patient is now restless to the highest degree, difficult to control in bed, and often requiring to be forcibly detained there. The most marked degree of delirium is shown by complete annihilation of reason, a confused, broken train of ideas, and entirely uncontrollable actions, dancing, shouting, whistling, singing, with furious attempts to escape from control. Should these severe symptoms continue for any length of time, a stage of collapse sets in; weakness of the muscular strength and uncertainty of movement become apparent, the intensity of the mental obtundity increases, the patient becomes stuporous, then comatose; there are loud mutterings of occasional words, picking at the bed-clothes, and muscular jactitations. In the course of time the coma increases, until the patient can with difficulty be aroused, and soon death occurs under indications of profound exhaustion.

The febrile delirium is not always continued, but may be interrupted by periods of imperfect or complete lucidity, from which the patient relapses after an interval of minutes or hours. This tendency to lucidity is much more marked during the day than in the night season, when the hallucinations always become more vivid and the restlessness more pronounced. In erysipelas, variola, scarlatina, and rheumatism the delirium has a tendency to be more active than in typhoid fever, paludal poisoning, or pneumonia, though there are very many exceptions to this statement, especially

in pneumonia of the so-called meningitic variety. Previous alcoholism has always a tendency to increase the severity of a febrile delirium.

Post-febrile Insanity.—Kraepelin, to whom belongs the credit of having written the most extensive and thorough work in this department of mental medicine, divides the various forms into three main classes. As these are clinically clearly distinguishable from one another, it is well to adhere to this classification, and not place all these cases under the group of "confusional insanities," as Wood has proposed. The three forms distinguished by Kraepelin are:

1. Collapse (exhaustion) delirium.
2. Acute hallucinatory confusion.
3. Acute dementia.

Combinations of the first two types are by no means infrequent, and delusional, excited, and depressed forms may succeed the more acute symptoms.

The *exhaustion delirium* of the defervescence, partly induced by heart weakness, with attendant venous congestions and œdematous conditions of the cerebrum, partly arising from plasmatic and lymphoid exudates following damage to the arterial sheaths, from the immediate effects and deleterious after-results of toxalbumins engendered in the course of the acute disease, is often accompanied by abnormal temperatures and great prostration. It is apt to be rather stormy in its onset, with the characteristic features of predominating confusion, dreamy hallucinations, rapidity in the change of thought from one subject to another, and fleeting alteration of the humour and mien. With it there is generally active motor excitement and entire sleeplessness.

After a period of disquietude and unrest, the patients lose a clear idea of their surroundings. They no longer recognise their attendants; the room seems altered; they are not in their beds, but in their offices, counting-rooms, or in strange places; the pictures on the walls, the curtains, the furniture, all appear changed. Actual hallucinations soon mingle with the altered perception of things; the figures on the mantel nod and make grimaces, black shadows appear in the corners of the room and beckon to them, the street noises are confused and heard as if they were voices, the thoughts wander and become more and more cloudy, and as they do so the visions become more and more frightful in character.

With the growing mental confusion and increasing auditory and visual false perceptions the patients become excited, the flow of

language is increased, words jumble upon one another, they sing, recite, or recount exploits, and a true expansive delirium is now and then met with. The active motor agitation renders it very difficult to keep the sufferers in bed; they seek to escape from surveillance, wander about the room, and talk of going to their places of business; they strip themselves, exhibit erotic fancies, and gesticulate, now with bold aggressive motions, now in beseeching supplication.

Answers to questions are no longer relevant, if given at all; the friends are unrecognised, the physician is greeted at one time as an enemy, at another as an intimate friend, and the patient is either witnessing the torments of hell or living amid the delights of paradise. Most frequently, however, the hallucinations are of a persecutory or painful nature, and quite often are occupational in character. The patient frequently refuses food, and resists bathing or necessary attention in a blind, senseless manner highly characteristic of the degree of mental confusion present. Sleep is in abeyance.

The physical indications of collapse delirium are important from a diagnostic standpoint should no history of the acute disease be at hand. The patients are always reduced greatly in flesh, and the skin hangs in folds about the neck and body. Despite the motor excitement, the physical weakness is apparent, the patient being insecure upon his feet, lurching from side to side with the gait of a drunken man. The bodily temperature is subnormal, the pulse small and weak, the heart-beat feeble, and often blue patches appear on the skin after the most trivial injury. The reflexes are usually slightly elevated.

The duration of collapse delirium may be only a few hours, or may be prolonged for ten days to two weeks; then, probably, coming from under the influence of a narcotic, or from the deep sleep produced by absolute physical exhaustion, the sick man awakes, weak, but with returning consciousness; he recognises the bedchamber, his friends, and only shows a mild loquaciousness and the continuance of some partial delusion which soon vanishes in returning health. Recollection of what has occurred during the delirium is never very clear, though partial remembrance of having been restrained, or of the forced administration of food, also in some cases vague ideas of the hallucinations and sensorial deceptions, are retained for some days, combined with an inclination to querulousness and moroseness, which only disappears in the course of weeks. Not

every patient who has suffered from inanition insanity recovers his full mental capacity immediately; many remain weak-minded for weeks and months thereafter, while some continue permanently in a state of apathetic dementia. Epileptic seizures occasionally begin during the period of convalescence, and denote a grave injury to the brain substance. This tendency to periodic convulsions is more frequent after typhoid than other fevers. Paretic dementia may also in rather rare instances follow an acute infectious disease.

The *prognosis* is favourable in at least 70 per cent of all cases of post-febrile insanity (84 per cent, Krafft-Ebing) that recover from the stage of exhaustion. The eventual outlook is more unfavourable in cases that develop albuminuria than in those that show no renal complication.

The *acute hallucinatory confusion* resembles in many respects the collapse delirium, but differs from it in the duration and eventual outcome. It is not peculiarly a post-febrile alienation, but may follow any disease tending to bodily exhaustion, as anæmia, the puerperium, loss of blood, or surgical operations attended by intense prostration.

The onset is most frequently acute, the prodromal stadium being only a few hours, and the symptoms rapidly reach an acme. When this is attained there is total confusion, intense clouding of all the senses, numerous hallucinations, and frequently, though not in every example, considerable motor excitement and sleeplessness. The patients are anxious, excited; they are apprehensive of a terrible end, are unable to collect their thoughts, and complain of dulness and incapacity for the simplest mental exertion. The hallucinations are of a painful nature; black figures appear at the windows and in the room, warnings of death are heard, the "death watch" calls from behind the bureau, wild animals run under the bed, witches torment with threatenings of punishment. Ideas of unworthiness and deep personal sin also prevail, the future life is lost, and God is no more.

The deportment of the patients naturally shows the deepest anxiety, but changes rapidly with the fleeting hallucinations and the delusions derived from them. Unmotived laughter interrupts the hours of depression. Some patients, calm even to apathy, suddenly break out into wild screaming, weeping, or recrimination. The physical nervous phenomena betoken the exhaustion of the nervous system. The deep reflexes are exalted, tremor is pronounced, there is rapid loss of vaso-motor innervation, an abnor-

mally slow pulse, variations from subnormal temperature to slight pyrexia, and a feeling of utter exhaustion and weakness.

Remissions with full lucidity are frequent, and may last from hours to days, after which the hallucinations and other phenomena are repeated. The height of the malady is attained in from ten days to two weeks; later the intervals of lucidity become more pronounced, though the patients in the periods of relapse continue to be excited and confused. The entire course averages from two to four months before entire mental clearness is attained. Some cases fall into a condition approaching acute dementia before recovering.

When convalescence begins, there is a gradual subsidence of the acute symptoms, the free intervals becoming longer than the relapses. The confusion first disappears, then the hallucinations, and lastly the motor agitation and physical depression with distrust and anxiety. Persecutory ideas and hallucinations may persist for months or even years after the return to bodily strength, and may eventually be succeeded by a mild dementia.

The *prognosis* is favourable in a majority of cases. If the hallucinatory excitement is very severe, death may ensue in a state of collapse, and self-destruction under the influence of hallucinations is not unknown. Very little clear remembrance is retained of the incidents occurring during the illness.

In the *diagnosis*, an attack of ordinary mania, idiopathic or periodical, alcoholic hallucinatory delirium, and hallucinatory paranoia, are to be considered.

In acute mental confusion the onset is more sudden and the acme is more quickly reached, while in mania there is a gradual beginning with a forestage of depression. In the hallucinatory confusion there is an anxious, frequently changing deportment; in mania the disposition is complaisant though changeable; with the confusional insanity come multitudinous hallucinations; in mania there is rapid flow of ideas but infrequent hallucinations; in hallucinatory confusion the sensorial perversions entirely control the ideas, and language is reduced to broken words when the clouding of the intellect is considerable. In paranoia hallucinatoria there is perfect recognition of surroundings and complete mental clearness on subjects other than those derived from the impress of the sense deceptions, which are systematically related. In acute alcoholism, the shorter course of the malady, and the presence of cutaneous and visceral deceptions, will serve as points of differentiation.

Acute Dementia.—Typhoid fever, more frequently than any other acute febrile condition, is followed by this type of alienation. Two forms are distinguished: the *excited* and the *stuporous*.

Some days, or even weeks, after apparent recovery from the febrile disease, sleeplessness with disquiet, irritability, talkativeness, and perhaps the advent of delusional ideas, are noticed, and then within a day or two there is profound confusion of mind and complete annihilation of every sense. The patients appear lost in a deep dream-like condition, from which they can be roused only with the greatest difficulty to reply to a simple question; or, perhaps, if an answer is attempted, the words are cut short before they are fully enunciated. They appear not to appreciate their surroundings, not to recognise their friends or relatives, and if any coherent words are uttered, they are complaints of their abject condition. Even more frequently there is absolute passivity; artificial feeding is not opposed, there is no resistance to enforced movements of the limbs, the facial expression is one of complete fatuity. If movements are made with the hands they are automatic, the clothing is picked at, a string is rolled between the thumb and finger for hours, or the hands are rubbed together. At varying intervals there are attacks of great unrest; in an automatic manner the patient jumps about, masturbates, or becomes suddenly violent.

The physical phenomena are striking. The temperature is subnormal, the pupils are widely dilated, reacting slowly or not at all to light, the reflexes are increased, and the bodily weight steadily diminishes.

In the *stuporous* form the tendency to motor agitation is gradually lost; the patients lie quietly and apathetically in bed, perfectly motionless for days; the urine and fæces are passed under them; they are absolutely without reaction to the strongest stimuli, and require careful and regular feeding. Probably the only sign of life to be observed is an occasional twitching of the muscles of mouth or eyelid. Everything about the person denotes mental and physical paralysis. Recovery from these conditions is very gradual, remembrance and a degree of mental capacity returning before the sufferer takes any apparent interest in his surroundings. With the gradual increase in the bodily weight convalescence is established and generally continues without relapse.

The *duration* is usually from six to eight months, but may be much longer if the stuporous condition is profound. As a rule, the *prognosis* is favorable, though there are a considerable num-

ber of instances in which there remains a marked degree of dementia.

Age in Febrile Psychoses.—No epoch of life is exempt from the occurrence of the febrile deliria and psychoses, though in youthful persons they are slightly more common than in those of advanced age. Men predominate in numbers over women, probably on account of their greater exposure to the effects of deleterious habits (alcohol, etc.), and to greater irregularity in their manner of living.

The *pathology* of these deliria and psychoses is incompletely known. The most constant discovery is the evidence of a past or present hyperæmia of the brain, usually diffuse, less frequently confined to the cortical regions. With the hyperæmia is found œdema of the encephalon, with cloudiness of the meninges, and sometimes, in protracted cases, adherence to the cranial bones. Congestion in all the viscera is also noted at many autopsies. Localized disease of the cerebral substance in the form of hæmorrhages, abscesses, or acute meningitis is infrequent. Collections of pus either in the meninges or in the brain tissues are the most frequent of these focal signs. Typhoid fever, the cerebral form of pneumonia, also cerebro-spinal meningitis, are more frequently followed by acute localized lesions of the cerebrum than the other infectious and contagious diseases. Hæmorrhage also occurs in the mucous surfaces of the intestines and bladder.

Under the microscope, sections of the brain from those dying of exhaustion after febrile delirium show distention and irregular widening of the capillaries; the lumina are packed with dense masses of red blood-corpuscles, while in the adventitial sheaths are numerous leucocytes and much granular and pigmented matter. The pericellular spaces also contain an unusual number of white blood cells. More rarely, beyond the extravascular space and within the nervous substance migrated lymphoid cells are to be seen. The disease-stress upon the brain seems to fall rather upon the arterial coats and lymphatic system, including the lymph neuroglia, than upon the nerve cells proper. The vessel sheaths are frequently found damaged to the extent of beginning hyaline changes, with alterations in the nuclei both of the muscular and intimal layers. These nuclei are non-receptive, or absorb too large quantities of the aniline dyes; their chromatin particles are indistinct, and the caryplasm is uniformly tinged.

General Treatment.—In the initial and in the acme delirium the treatment is the same as that of the primary disease. All the

ordinary means for keeping the fever-temperature within moderate limits should be employed. Cold bathing, cold packs, sponging with water and alcohol, more rarely the administration of quinine and the coal-tar antipyretics (which should always be given with great caution), all tend to lessen the delirium. In the initial delirium of malaria, quinine in repeated doses and best in liquid form, or hypodermically, should be used. The Brand treatment and its various modifications have proved very effectual in lessening or abating delirium in typhoid fever.

When the stage of decline of the fever is reached, every means to promote the general strength and support the heart's action should be used. The patients should be fed regularly with milk, eggs, nutritious broths, and soups. Alcohol at this stage usually lessens rather than increases the delirium, and for ill-nourished patients becomes an absolute necessity. I have seen half an ounce of brandy in milk, given at intervals of two or three hours, cause an entire subsidence of the delirium, which recurred as soon as the stimulant was withdrawn. Strychnine or tincture of nux vomica are useful adjuvants to alcohol, and, when the patient is vigorous, may be employed without the addition of alcoholic stimulants. With a delirious patient care should always be taken to have an efficient nurse at the bedside to prevent mishaps, since at any moment the patient is liable to get out of bed, or, under the influence of appalling hallucinations, may spring from the window, or run downstairs in his night-robes into the street. With cases that cannot be controlled at home, either by reason of their violence or from the impossibility to obtain efficient attendants, the best thing to be done is to place them under the influence of a narcotic, of which opium is the best, and transfer them to a convenient institution.

The administration of narcotics or hypnotics in febrile delirium is usually not advisable. Occasionally, however, instances are met with in which the patient is sleepless, restless, constantly attempting to get out of bed, and difficult to restrain in it, and in which the administration of a moderate dose of morphine with atropine hypodermically will induce the much-needed sleep, from which the patient awakes refreshed, the delirium having abated, and perhaps subsiding finally within a few hours.

In the treatment of the exhaustion psychoses and acute dementia two essentials are always to be kept prominently in view:

(*a*) Every possible means is to be used to increase the depleted nutrition of the patient. Here alcohol in combination with milk

and eggs occupies the first place, with animal broths, malt, and sugar in considerable quantities as adjuvants. Peptonized meats, colloped beef, raw meat, may also be given. The feeding should be systematic and enforced. If the patient refuses to take it from the spoon or glass, no time should be lost in resorting to the stomach tube, and that as often as necessary. Nutrient clysters may also be used as an adjuvant to stomach feeding, or when from any reason, as injury to the fauces, frequent feeding by the mouth is inadvisable. Alcohol is in these cases also *par excellence* the best sleeping potion. Under its influence the excited patient becomes quiet and falls asleep. Strychnine, black coffee or caffein citrate, quinine, and digitalis are indicated when there is excessive weakness. When there are indications of collapse, the subcutaneous injection of 200 or 300 cubic centimetres of warm salt solution into the flank may save life, while the elevation of the lower extremities above the level of the head also assists in restoring the circulation.

(*b*) The second indication is to keep the patient quiet and prevent him from injuring himself. This, in the majority of cases, can be accomplished by keeping him strictly in bed, under the care of at least two efficient nurses, and, if necessary, using mechanical means of restraint, of which the sheet is the most advisable. Very violent cases should be sent to an institution where a padded cell is obtainable.

The period of recovery should be carefully watched. The fat-forming foods, and tonics containing iron, strychnine, phosphorus, and quinine, should be administered. Warm baths and sponging add greatly to the comfort of the sufferer, while at the same time they promote the excretion of effete matters. Somatose and the glycerophosphates in combination usually assist in improving the nutrition, and do not derange the stomach as does cod-liver oil. Hydrocarbons and sugars should be freely allowed. All convalescents should be sent to a quiet country abode, where they may be free from external excitants, and for a time lead a purely vegetative life. No patient should be considered to be well until he has nearly regained his former weight.

The rational indications for the hygienic and medical treatment of the post-febrile insanities and stuporous states are essentially to restore the physical health as rapidly as possible by careful feeding, in which alcohol plays an important part. The patient should be kept in bed, carefully protected from cold by sufficient covering, and, if necessary, by the application of artificial warmth. When the

excitement is high, warm baths, sometimes prolonged over fifteen or twenty minutes, the patient being carefully watched during the immersion, are often very soothing; and the administration of mild hypnotics, trional, sulfonal, the bromides with codeine and hyoscyamus, is occasionally necessary. Enforced feeding—overfeeding when digestion will permit it—is a most essential part of the treatment, and it is often astonishing how much these exhausted patients manage to digest and assimilate. The employment of the tube may prove of especial service if there is danger of collapse and if nourishment is refused. Both during the acute symptoms and in the long period of convalescence, the milder preparations of iron and manganese, the vegetable tonics, and strychnine, are indicated. Under these measures the gain in weight in the course of a few weeks is often enormous.

On account of the tendency to relapse in these cases there should be no diminution of attention to the physical needs and general hygienic care until such patients are entirely well, which will not be for many weeks after apparent recovery. Quiet should be assured by sending them to farms or the seashore, where they may be protected from irritating influences, their faculties not stimulated too much by constrained conversation, and where they can take up some mechanical or manual work, attending to flowers, the vegetable garden, or other light labour. Massage may be useful as a passive exercise when outdoor life cannot be obtained.

The more common forms of the febrile psychoses deserve a somewhat detailed description.

Typhoid Fever.—Hospital statistics throw but little light upon the frequency of typhoid psychoses, since many of them are of the asthenic form, and only begin after convalescence has set in and the patient has been discharged from surveillance. Nevertheless it is undoubted that this form of fever more frequently than any other is responsible for disturbances of the mental equilibrium. Wille gives .81 per cent of typhoid cases as having post-febrile insanity. Probably under the cold-water treatment of the disease this is in excess of the present ratio, but both in private practice and in asylums post-typhoidal cases outnumber by three to one any of the other forms of post-febrile alienation.

Age is of but little moment as a predisposing cause of the psychosis, though, as a majority of typhoid cases occur in persons under thirty years of age, instances are naturally more frequent below than above that period of life. Sex has also little influence,

though more examples are found in males than females. Alcohol is unimportant as a factor, being well defined in only 1.3 per cent of cases (Kraepelin). Constitutional instability plays the most important *rôle*, the severest and most protracted cases I have studied having always been in the degenerate.

Febrile delirium is also more frequent in typhoid than in other fevers, nearly one third of all cases of the disease having delirium coming on during the initial stage and continuing through the stress of the disease, or arising in the stage of acme and only subsiding with the decline. It begins more frequently in the second week than at earlier or later periods (Bethe). Cerebral symptoms always complicate a disease and render the prognosis more unfavourable; hence there is always a higher percentage of deaths among the delirious than among other patients. The delirium usually subsides with the defervescence, but occasionally may continue long afterward, even more than a year, after which the patients usually dement and become quiet.

The most frequent form of delirium in typhoid fever is the quiet, muttering type, with picking at the bed-clothes, irregular muscular movements, and other indications of nervous exhaustion and irritation. A few patients present at the acme of the fever, even when no alcoholic stimulants have been given, not a muttering delirium, but one of a quiet, hallucinatory type; they talk to themselves of the ants, mice, or other small animals that run over the bed and worry them, they see shadows in the corners, complain that the hands of the clock on the mantel are pointed at them. But all their plaints are made in a quiet, passive manner. On being questioned, they show a considerable degree of mental confusion, reply at random to simple questions, complain of loud or angry voices annoying them, and then fall to casting the insects and animals off the counterpane. Most of the instances of this type are found in atypical examples of the fever, where it runs for weeks without any considerable temperature elevation.

More rare than the quiet, delirious cases are others that show indications of cerebral irritation approaching those of a meningitis. This form has been especially studied by Liebermeister. With a rather sudden lowering of the temperature to a nearly normal point, the patients become maniacal, or show melancholic symptoms with agitation; they remain in this condition for days, and then return to their former state, the alteration being accompanied by a return of the fever temperature. As albuminuria is rather infre-

quent in typhoid, this excited condition can hardly be referred to any existing uræmia, but rather to the exhausting effects of the tox-albumins of the typhoid bacillus, perhaps aggravated by some concomitant infection. The delirium in these cases is rather prone to recur and continue after the convalescence. Ordinary agitated delirium with vivid hallucinations is also noticed in some typhoid fever patients, but is not the rule.

The True Psychoses.—Speaking generally, it may be stated that the more profound the intoxication and the higher the temperature range, the more likely is the occurrence of a febrile delirium or a post-febrile psychosis. There are distinguishable quite a variety of these mental affections following typhoid.

As mentioned above, in certain instances the delirium outlasts the duration of the fever, but assumes a more quiet type, the patients muttering to themselves broken sentences dealing mainly with the events of earlier life or business affairs anteceding the attack. For the genesis of the delusions many of them return to the time of their childhood or early manhood, their fancies occasionally being mingled with ideas of a grandiose cast. The *prognosis* in the majority of cases is favourable, but a proportion of the patients in whom the post-febrile delirium continues for weeks either die from gradual inanition or become finally demented, although in the latter case they regain their physical health.

Other examples accord with the type of acute mental confusion, and these are the most numerous. The onset is within a few days after the beginning of convalescence, in the seventh or eighth week from the inception of the fever. Hallucinations of sight and hearing, with a varying degree of mental confusion, are the prominent symptoms. The hallucinatory delirium may assume a maniacal aspect with great motor agitation, or may have a melancholic, agitated character, the latter sometimes succeeding the former condition. A majority of the cases belonging to this form recover within the first six weeks; a few die of exhaustion following the excitement, especially when they have suffered from lack of attention in the first stages of the affection. The *prognosis* is unfavourable after a continuance of the symptoms for more than four months, especially when there has been a considerable gain in weight without corresponding mental improvement.

Another class, during the period of convalescence, develop an apathetic melancholia with delusional ideas, principally of persecution, of being lost, or of having committed the unpardonable sin.

Some of them also have hallucinations upon which the false ideas are based. The *prognosis* is not very favourable, numbers of them retaining their delusions over many months, and eventually becoming demented. The majority of these patients have either undergone a profound intoxication or are weaklings *ab initio*.

The last class is that of the *acute dementias*. The patients become stupid, apathetic, and sit or lie for hours in the same position; the pupils are widely dilated, and react sluggishly to light; they are difficult to arouse even for a moment, but show no indications of veritable depression, hallucinations, or delusions. Many of them have transient periods of excitement, followed by a stupor even more profound than before. The *prognosis* is fairly favourable, at least one half eventually recovering after the lapse of six or eight months, sometimes after a longer period.

Pneumonia.—An initial delirium is most infrequent in acute inflammation of the lung parenchyma, but it may begin as early as the second day, especially when there has been an antecedent history of protracted alcoholism. The symptomatic picture is usually one of a quiet, hallucinatory delirium. The patients retain to a certain extent their senses, speak logically and coherently for a time when addressed, and then wander off among a series of fever fancies mainly based on the hallucinations, which may be either auditory or visual, but are seldom connected with the other senses. Very often the delirium is of the professional type. One of my patients conversed with the clerks in his banking house, and gave orders to messengers; another imagined that he was on jury duty, and that every one else had been discharged from the panel, but that his coat, hat, and shoes had been taken away from him. Being impressed with this idea he spent his entire time in making futile attempts to rise from the bed to find them, so that he might go to his home.

In other cases the delirium is much more active; the patients cannot be restrained by ordinary means in bed, and have either to be kept there by mechanical devices or removed to an institution. The hallucinations are now very vivid; strange forms of terrifying aspect appear to the eye, animals disport themselves on the floor or on the bed, the surroundings are unrecognised, as well as the faces of the attendants, who are addressed by unfamiliar names. Lucid intermissions are fairly frequent, and argue a favourable ending.

The febrile delirium may pass without intermission into a post-febrile form, lasting some days, or more rarely weeks, and

the patient may then develop a more positively maniacal condition, with motor excitement and garrulity, the mind constantly flitting from one subject to another; he may also have grandiose and optimistic delusions, or perhaps those of a persecutory or sinful type. Sleeplessness, developed from the hallucinations and confusion, is often met with.

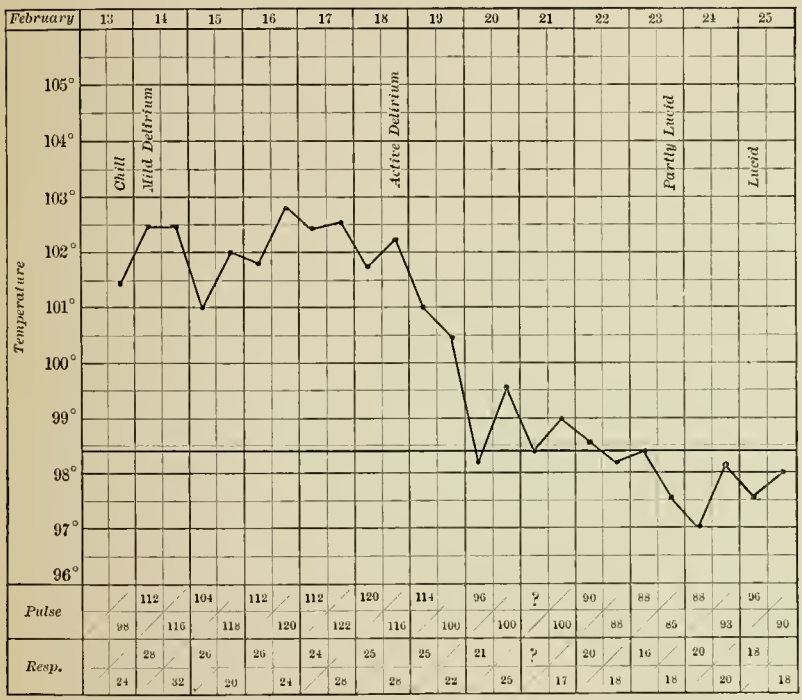

FIG. 28.—THE CHART OF A CASE OF PNEUMONIC DELIRIUM WITH ACTIVE MOTOR EXCITEMENT. The mental phenomena began almost immediately after the initial chill, and ran until a week after the crisis.

These post-pneumonic psychoses, therefore, belong mainly to the group of the collapse deliria, and are rarely of long duration, very seldom running into the weeks. Acute dementias do not often follow pulmonary inflammations except in instances in which there have been indications of severe cerebral irritation. The prognosis in post-pneumonic psychoses is more favourable than after typhoid fever, eighty to eighty-five per cent recovering (Kraepelin).

Malarial Psychoses.—In the days of Sydenham and Sauvages, when malaria was treated by emetics and blood-letting, the paludal

psychoses seem to have been of common occurrence. The first-named author plainly says that the mental disturbance was largely attributable to the method of treatment, and many of the cases seen by him became hopelessly insane. Such was the frequency of the palustral insanities that distinctive names were given to these affections, such as the *amentia a quartana*, this form of malarial fever apparently being regarded as the most frequent evoker of alienation. Under the widespread use of cinchona, and the cessation of the practice of venesection, these forms of psychoses have, in the temperate climates, almost disappeared, and articles on the subject in the English language are of extreme rarity. In the Southern States cases now and then come to record, but in the Middle States they are most infrequent. Among 19,000 insane persons admitted to New York State asylums, there were only seven in whom the condition was ascribed to malarial intoxication. Pasmanik, whose statistics are the most recent, found that among 5,412 malarial patients in Bulgaria, two per cent were attacked by some mental complication. He regards the psychoses not as the product of febrile temperature, but as induced by the infection and consequent weakening of the bodily strength. Children are somewhat less frequently the subjects of malarial mental disturbance than adults, and the form of affection assumed is a comatose rather than a delirious state. This statement I can substantiate, as all the cases of infantile malarial mental disturbance that I have observed have been stuporous, with indications of nervous irritation in the form of muscular twitchings and spasms.

The disturbance of the psychical equilibrium in paludal intoxication may occur at three periods: before the fever (initial delirium), at the height of the paroxysm, and as a post-febrile insanity. A malarial paroxysm may also be replaced by an attack of insanity of a febrile character with delirium and stuporous conditions, or at times with epileptiform cramps, which end in a deep sleep, and from which the patient arouses with, at most, a dim perception of events that have occurred during the paroxysm.

The febrile psychoses of malaria present little difference from those accompanying other acute diseases. Acute mental confusion with dream-like states, accompanied by intense congestion of the head, hallucinations, and acceleration of ideation, with ablation of attention, is the most frequent; it is usually of short duration, and differs in no way from an ordinary febrile delirium. The second form distinguished by the authors in reality only represents an

aggravation of that described above. The hallucinations are more vivid and terrifying, and under their influence there is a sudden and violent outbreak of maniacal excitement, all of these symptoms being concomitant with the febrile attack. Homicidal and suicidal impulses occur during the delirium, and the patients are most difficult to restrain. The duration is only a few hours, except when the mental vitality is of a low order. Recurrences of the delirium when the primary disease is untreated are common.

The post-febrile psychoses present a somewhat greater variety of clinical phenomena. The depressive form, mainly the melancholic agitation, or melancholia with stupor, is by far the most frequent, especially after tertian and quartan fevers. Hypochondriacal melancholia is also not uncommon. Maniacal forms are rarer, and show the ordinary symptoms of motor agitation and hallucinatory delirium. Both may be regarded as a collapse delirium resulting from the exhaustion induced by repeated paroxysms of the disease, and in some instances, where the type has been severe, they may possibly be induced by temporary plugging of the capillaries of the meninges and cortex by aggregations of the parasites, such as has been found in the vessels of the intestine; the thickening of the vessels and the melanin deposits indicating a more intense local disturbance in some places in the meninges than in others.

The *duration* is only a day or two, but may be prolonged to three months if the asthenia is pronounced.

The *treatment* should consist in rich and abundant alimentation; wine, tonics, and, above all, quinine in liquid form should be given. Morphine hypodermically is indicated during an initial or early febrile delirium. Pasmanik warns against the too free use of the cinchona alkaloid, as overdoses are apt to increase the excitement, and particularly to create a tendency to auditory hallucinations and prolong the affection.

Psychoses in Asiatic cholera, in variola, and in measles are so rarely seen that it is needless to treat of them here in detail. Cholera psychoses are entirely of the collapse form and are induced by the profuse alvine evacuations. Scarlatina is rather a frequent source of mental disturbance in infancy and youth, and psychoses following it are more protracted and incurable than after any other infectious disease.

Erysipelas.—Erysipelas of the head is occasionally accompanied or followed by mental disturbance, with hallucinations, confusion, and delirium of persecution. A calm delirium is, however, nearly

five times as frequently met as one of an active type (Roger). Grandiose ideas are rare. As to the frequency of erysipelas delirium, the statistics of the different writers vary within wide limits. Roger noted the condition in 8.4 per cent, and Biegleder in 10 per cent of their respective cases. The delirium may begin with the onset of the malady, at the acme, or, much more rarely, after the subsidence of the fever. Facial erysipelas is rather more commonly followed by delirium than when the disease affects the scalp. As might be expected, we are more apt to encounter mental disturbances with high temperatures than with a moderate degree of fever; but delirium can occur in mild and even in absolutely afebrile cases. Meningitis and albuminuria are the most usual complications, the latter being very frequent, but, as a rule, only slight and transient; it need not be regarded as of grave moment, unless accompanied by indications of acute nephritis. Except when there are symptoms of meningeal inflammation or of uræmia, the *prognosis* is favourable. The *treatment* does not differ from that of the original disease.

Influenza.—Following the epidemic of *la grippe* in 1891–'92, and the more recent one of 1898–'99, a variety of nervous disturbances were quite prevalent, mainly in persons of latent or pronounced psychopathic disposition. The majority of the forms assumed have been those of a general neurasthenia, of a severer or milder type, but there has also been quite an array of the true psychoses. The toxine of influenza seems to fall with especial stress upon the central nervous system, and besides has a most definite depleting effect upon the general physical powers, both of which influences act with greater force upon the hereditarily unstable than upon the sound individual. At the autopsies of cases dying from the influenza poison the central nervous system is always found much congested (Geill).

The most frequent form of psychoses after influenza is the acute hallucinatory confusion, at a later stage assuming the clinical picture of an agitated melancholia. Mixed hypochondriacal and neurasthenic forms are also noted. The duration is comparatively short, from two to six weeks, and the eventual outcome is favourable, unless the predisposition to insanity is great.

Stuporous states occur with less frequency than the above form, but are of longer duration, running their course, as a rule, in from eight to ten weeks. All the instances that have fallen under my personal observation have been fully restored to sanity. The

majority of cases are found between the twentieth and fiftieth years, very few in childhood or old age. The *treatment* consists of enforced alimentation, small quantities of alcohol, and tonics containing strychnine and quinine.

Multiple Neuritis.—The poisons of many infectious diseases, notably diphtheria, scarlet fever, and typhoid fever, sometimes occasion a diffuse neuritis, whose peripheral nature has been shown by the results of autopsies. Simultaneously with this neuritis an insanity may develop, which is to be referred to the effect of the poison upon the general nervous system. The mental aberration is shown under the usual type of hallucinatory confusion, more rarely simple confusion without sensorial implication. The psychosis is therefore a post-febrile one, with the addition of the symptoms of inflammation of the peripheral nerves. Korsakow has described a number of cases of somewhat similar character under the name *cerebropathia psychica toxæmica.*

Phthisis.—Tuberculous affections of the lungs are rarely accompanied by actual psychoses, but there are many instances in which there is developed in the course of the disease a hypochondriacal-melancholic or apathetic disposition, or the reverse, an undue elation without apparent reason, not rising even to the degree of a light mania. Blind would refer the mental symptoms in such instances to the effect of a brain intoxication from bacterial toxines.

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GROUP II

INTOXICATION INSANITIES

SUB-GROUP (*c*). INSANITIES FOLLOWING AUTOGENIC POISONING

THE AUTOGENIC INTOXICATIONS

There are a number of somatic diseases in the course of which, owing to the morbid processes entailed, are engendered substances that act upon nerve tissues as poisons, and cause such disturbances in the neuronic elements that storms of variable violence result. Among these maladies may be enumerated the various forms of Bright's disease, particularly the chronic contracting kidney, and diabetes mellitus. Closely allied to these are the various auto-intoxications from intestinal putrefaction with the formation of complex products of bacterial fermentation, or defective metabolism from alteration or entire absence of certain glandular secretions, conjoined with accumulation of the products of incomplete tissue metamorphosis from inactivity or disease of excretory organs.

In autotoxis, from whatever source, it is most difficult, often impossible, to find a line of demarcation between cause and effect, the importance of the primary disease being minimized in our efforts to attribute the mental disturbance to the toxines engendered. We are too liable to overlook the fact that such diseases as chronic nephritis or diabetes bring about a grave constitutional debility, a cachexia of a pronounced order, and that in other wasting diseases there occur the same forms of alienation as are found in the autochthonous series, namely, mental clouding, hallucinations, wild delirium, and stupor. Hereditary or acquired psychical lability is a factor that should not be forgotten, as the unstable show, to a profounder extent and with greater rapidity than those of more vigorous constitutions, the effect of a perverted blood-serum upon the neural tissues. Perhaps the clearest and most distinctive of all the autotoxic series is the post-operative myxœdema with disturbance of the mental functions. Even of this form, from a patho-

genic standpoint, there are two possible explanations. The thyroid gland may secrete a product which is useful in the metabolism of the body, so that its removal causes the nutritive disturbances that we recognise as *cachexia thyreopriva*. That this view is probably correct is shown by the fact that there is an improvement in the mental and physical condition of these patients when the glycerine extract of the thyroid gland, or its active principle, thyreoidin, is administered to them. The other explanation, that the gland extracts from the blood some deleterious product and renders it innocuous, has far less probability.

Another fairly definite form of autotoxis may be tested by anyone who cares to subject himself to an obstipation of five or six days' duration, and attempt during that period to keep up with his daily routine of work. Before the expiration of the time he will find himself nervous, excitable, sleepless, or excessively somnolent, and on the verge of many sense abnormalities.

The autogenic forms of mental maladies are of far more importance to the practitioner of internal medicine than to the asylum physician, as with certain exceptions, and these of inconsiderable importance, they are met with in the daily routine of private or hospital practice. Insanities in the end stages of chronic nephritis and of diabetes mellitus are by no means uncommon; acute nephritis is occasionally attended by alienation; gastro-intestinal affections, particularly coprostasis, swell the number, and cholæmia, exophthalmic goitre, gout, all add their quota to the army of the insane.

The form assumed by the mental disturbance in these several maladies varies greatly. Many individuals do not pass beyond the stage of a progressive alteration of character, irritability, morbid fancies, and sleeplessness, while others are abnormally depressed, excited, or stuporous. Not a few of the forms of pseudo-paretic dementia have their origin in a chronic auto-intoxication, the uræmic and diabetic types being the most frequent.

Of the several psychoses following what may be presumed to be states of autogenic poisoning, the hallucinatory-confusional and confusional-maniacal forms are most characteristic. Many of these patients find their way into institutions labelled, so to speak, with the diagnosis of an ordinary mania, whereas in reality the condition from which they are suffering differs widely from it in symptomatology and prognosis, while the treatment is essentially dissimilar. Patients suffering from simple mania do not have a confusional

element, but are active and talkative; their ideas flow freely, and while sometimes destructive and mischievous, they rarely pass to a lower plane of reduction than incoherence, which is mainly the result of a distorted and too rapid flow of ideas. Hallucinations in simple mania, if they are present at all, have never the variegated colouring that belong to the hallucinatory-confusional insanities, nor are pitiable states of extreme anxiety, alternating with outbursts of wild frenzy, characteristic of the simple affective form.

There are, accordingly, in the autotoxic insanities two elements that directly contribute to the genesis of the affection, especially in uræmia, disturbances of the glandular secretions, and diabetes: (1) inanition from the constitutional complaint, and (2) the presence of a complex nerve poison circulating with the blood, as a result of defective elimination or altered secretion. Probably in the majority of cases the two factors are combined, the degradation of the brain tissue being more profound therefrom, as is shown by the hallucinatory confusion deepening to actual stupor.

Uræmic Psychoses.—The retention in the blood of various tissue poisons which should be eliminated through the agency of the kidneys gives rise in the course of Bright's disease to a number of nervous phenomena, of which those referable to the brain are the most important. These manifestations of the presence in the body of poisonous materials occur in some form or other in the end stages of nearly all cases of chronic nephritis. Thus we frequently encounter headache, sleeplessness, an alteration of the disposition, and an inability to think and reason clearly, amounting to actual defect in intelligence. Retinitis is exceedingly common in advanced stages of Bright's disease, and hæmorrhages into the brain substance occur in no mean proportion of instances, Bamberger finding 29 among 357 cases. In chronic nephritis we may also meet with hemiplegias and monoplegias often of temporary duration, but occasionally ending fatally, although at the autopsy only the signs of a diffuse cerebral œdema may be found. Uræmic convulsions, followed by coma, often accompanied with paralysis, are among the most frequent indications of the beginning of the end with the nephritic.

To distinguish the coma of the nephritic patient from that following an ordinary epileptiform or apoplectiform attack is ofttimes a difficult matter. The character of the coma itself is sometimes, though not always, a guide. In uræmia it is usually not profound, and the patient shows intervals of partial consciousness, while after

the apoplexies and apopleetiform or epileptiform eonvulsions it is deeper, and the sufferer eannot even for a moment be awakened. Albuminuria with eonvulsions, especially where the urine shows granular tube-easts, and perhaps blood eells, is *prima facie* evidence of uræmia, bnt albumin is also oeeasionally fonnd after the convulsions sequent to an ordinary apoplexy, after epileptie seizures, and the apopleetiform and apopleetie attaeks of the paretic and syphilitie dement, as well as in kindred states. The eondition of the pupils, too, is not pathognomonie. In some eases of uræmia they are eontraeted even to pin-head size, and immobile; in others they are widely dilated, and irresponsive to light; or, again, they may be of normal sizc. Inequality of the pupils usually indieates some loealized irritative mischief in the brain, and is not often found in Brightie eoma. An examination of the fundus of the eye will, when there is retinitis in eombination with an albuminurie urine, give the neeessary diagnostie clinch. In uræmia, uncomplieated by loeal inflammation or a general infeetions eondition, such as may arise from a cystitis following retention of urine, there is persistent subnormal temperature. In apoplexies, eontinued epileptic convulsions, or eoma arising from increased intraeranial pressure from tumour, there is a normal temperature or pyrexia. Articulation cannot be made to serve as a guide in the differential diagnosis. When a person lies in uræmie eoma, and ean be roused sufficiently to utter articulate sounds, the speeeh, it is true, is thick, guttural, and laboured; bnt the same applies equally after gross lesion of the eerebrum; or aphasia may be present with both. The blood in uræmia invariably exhibits an excess of acid, often many times in exeess of the normal quantity (von Jakseh).

Delirium is a not infrequent symptom in the last stages of ehronie nephritis. It may be either quiet or aetive, the former form predominating; as a result of the attendant sensory deceptions inanimate objeets are taken for animals, or a strange nurse is addressed as an intimate friend. Broken sentenees, often single words, are repeated over and over again in a monotonous voice, as if the sounds eatehing the patient's obtnnded sense of hearing were repeated antomatieally. The condition is, therefore, a variety of the so-called "low mnttering delirium."

The forms of actual psychoses attendant upon uræmia vary, not only with the nature of the renal trouble but also with the individual suseeptibility of the patients to the non-excreted toxines.

Insanity has been recorded not only in the later stages of chronic Bright's disease, but also in the acute forms. In the chronic disease it may also appear under the guise of a toxæmia, with weakness of memory, defective intelligence, mental confusion with motor agitation, and alterations of the reflexes, so as to constitute a clinical picture not unlike that of the demented form of paresis, a *pseudo-paresis uræmica*, and be exceedingly difficult to differentiate from the true malady. The uræmic psychoses are more frequent with the contracted than with the large white kidney, and the amount of albumin in the urine may be so slight as to escape detection except by the most delicate tests, especially when the specimen examined is taken from the morning urine, and not from the whole quantity passed during the entire day. The hyaline and granular casts, being few, may also escape detection if only a perfunctory examination be made. The presence of a very sclerotic kidney is not inconsistent with the appearance of fair health on the part of the patient, and the cause of the autotoxic symptoms may remain a profound mystery until revealed at the autopsy table. When there is diffused sclerosis of the superficial arteries, renal changes should always be suspected. The presence of a confusional insanity nearly always indicates a toxæmia from some source, and it behooves the physician to make frequent and accurate examinations of the urinary secretion in all suspicious cases, in order to avoid unfortunate mistakes in diagnosis; otherwise he may be deceived into giving a favourable prognosis, when a fatal termination of the psycho-physical malady will certainly take place in a few weeks or months. The presence of the slightest clouding of the urine, even with the ferrocyanide-acetic-acid test, should render one suspicious; and when, in addition, a few granular and hyaline casts are found, the prognosis is ominous if there coexist mental symptoms, especially those of clouding and obtundity of the faculties, with a tendency to physical breakdown.

Clinically, several forms of uræmic insanity are noted. The most common, as in all forms of intoxication, is the confusional-hallucinatory type, but in very chronic cases forms approaching a simple melancholia and insanity of a persecutory type, with an intense fear of some impending calamity (Bennett), may also arise.

The hallucinatory-confusional insanity may begin without other indications of renal disease, or may closely follow uræmic convulsions. Retinitis albuminurica and amaurosis are very frequent accompaniments; indeed, the mental clouding is supposed by some to be merely the result of damage to the optical remembrance.

Frequently the mental upset is but the beginning of the terminal stage of the disease. The psychical alteration is now the predominating and sometimes the only uræmie symptom (Honigmann), and any physical signs which may have been previously present—increased tension of the pulse, dyspepsia, and respiratory symptoms—retreat into the background or disappear completely.

The attack, which is often of sudden inception, is preceded by a period of somnolence and loss of memory for the past. Hallucinations and motor unrest then begin, and the mental clouding deepens. Sense deceptions of a painful nature are most frequent, although sometimes the patient is pleasurably excited, laughs at the sensorial hallucinations, and is extremely talkative. The motor unrest may increase to an intense degree, while the nutrition sinks rapidly, death resulting within a few days, being preceded by anuria, sopor, uræmic twitchings, and coma. The condition is not unlike delirium acutum, and has been mistaken for it. Remissions are fairly frequent; the patient becomes quiet, memory returns to a certain degree, the surroundings as well as persons are recognised, and speech is coherent. These lucid intervals may have a duration of hours or days. Immobility with contraction of the pupils and increase of the deep reflexes occur.

In cases of mild uræmia from cirrhotic kidneys, mental clouding, sometimes amounting to total confusion, with complete loss of remembrance of the past, may precede by months every other indication of renal disease, except the presence of a few hyaline casts in the urine. These patients suffer from a mild excitement and some confusion; they do not necessarily have hallucinations or delusions, but the latter, when they occur, are more apt to be of a persecutory type rather than of a pleasurable character. Usually some disturbances of the functions of the peripheral and central nervous system are to be noted. Increased reflexes are the most frequent, though occasionally they are abolished. The pupils may either be myotic and non-reactive, or widely dilated, regular, and slowly reactive to light and accommodation. In the end stages a progressive cachexia begins, which soon renders the patients bedridden. The urine, always of fair quantity, now shows a small amount of albumin and casts of several types. Uræmic convulsions precede by days or weeks the exitus, which is nearly always in deep coma.

The similarity between this form of uræmia and the demented type of general paralysis is very great, and frequently leads to errors. The only reliable diagnostic point is the intense confusion

characterizing the former, to which few paralytics attain until late in the second or third stages of that malady, when the most striking symptom is loss of memory. Albumin and tube-casts are as frequently found in the urine of the paretic as in these cases, so that their presence or absence is of little value from a diagnostic stand-point.

Instances of the hallucinatory-confusional form of mania in acute uræmia are fairly rare; they ordinarily have a stormy course, ending either in death or recovery within a few days. Traube's theory that the symptoms of uræmia are due to œdema of the brain is more applicable to these than to the chronic forms.

The hallucinatory mania sometimes changes after a time to a stuporous, non-resistive melancholia, from which the patient may pass gradually into a state of coma, death supervening after days or weeks of progressive decline.

The *prognosis* in the several forms is necessarily always grave.

Milder types of insanity are now and then seen in chronic uræmia. Some patients are rambling and incoherent; others exhibit delusions, usually those of persecution, and are restless and timorous; others, again, have melancholic attacks with cataleptic rigidity. Most of the simple melancholic cases are recorded by English writers who do not usually distinguish between the ordinary type and the stuporous form of this psychosis.

Diabetes.—The host of nervous phenomena attendant upon glycosuria in its severe form is almost innumerable. They comprise various types of neuritis, inclusive of tabes peripherica diabetica and herpes zoster, alterations of the knee-jerk, a form of Graves' disease, ophthalmoplegia interna and externa, reflex spastic myosis, optic nerve atrophy, double vision, retinitis, retinal hæmorrhage, sanguine apoplexies within the cranial cavity, meningitis, convulsions, and coma diabeticum, as well as epileptiform attacks, headache, and migraine. Some of this array must necessarily be accidental, but the frequent occurrence of others in the course of the disease—the diabetic apoplexy, for instance—show that they must be regarded as part and parcel of the constitutional disease.

Diabetogenous insanity in the final stages of the malady is by no means rare, though Naunyn, Seegen, and other recent writers on the somatic disease, either pass it by unnoticed or barely mention its occurrence. The severer forms of diabetes mellitus are in this country quite uncommon, and the cases of mental disturbance occurring in direct relation with it are correspondingly infrequent.

In studying cases of glycosuria we shall often discover a family tendency to the affection, and it is readily conceivable that, in individuals starting with such an unstable foundation, any depraving influence which lowers still further the vital powers might induce forms of psychoses of an exhaustion type.

According to Landenheimer, the relation of the psychoses to diabetes may differ in various cases: (1) The coincidence of the diabetes and the insanity may be accidental; (2) the glycosuria may follow the psychosis; (3) it may be the cause of the insanity; and (4) both glycosuria and mental disturbance may be present as concomitant symptoms of cerebral disease. Transient glycosuria may occur in a number of mental diseases, but is seldom an indication of importance. It is occasionally noted in post-apoplectic insanities, in melancholic and alcoholic cases, but most frequently in syphilis of the brain and general paresis of the true type.

The presence of sugar in the urine among the rank and file of the insane is infrequent. In 600 examinations made at the Baltimore Asylum, in which this point was specially noted, sugar was discovered only three times, and in two of these cases the glycosuria proved to be transient. This is in accordance with the experience of Hale White and others. Bond, on the other hand, in 175 insane women found 12 suffering from glycosuria, 3 paralytics, 6 melancholics, 2 with organic dementia, and 1 with senile insanity.

The forms of mental derangement in causal relation with diabetes are somewhat varied.

In the later stages of severe glycosuria there is often headache, migraine, vertiginous and epileptiform attacks, with retinitis, amblyopia, or double vision. Following these come alteration of the character, morbidity, depression, causeless jealousy, and ever-increasing irritability, which may last for weeks and months, to be succeeded by coma and convulsions, in which death frequently takes place. Melancholic depression of the resistive type is also found, the mental symptoms clearing up, if therapeutic measures produce an abatement in the severity of the physical malady.

A true intoxication psychosis is also occasionally noted. Preceding an attack of diabetic coma there may be mental confusion and active hallucinations, similar in character to those of the other forms of intoxication psychoses. The motor excitement may be very active and the patient difficult to restrain. The delirium may also be preceded by an epileptiform attack, followed by a period of hallucinatory confusion of an active nature.

The exact etiology of the coma that marks the termination of so many cases of diabetes is not fully understood, though by the majority of writers it is attributed to the acetone which is commonly found in the urine and blood of these patients. Stadelmann thinks that the important substance is not acetone, but an intermediate product between it and glucose—the oxybutyric acid. The observations of Lustig, that after extirpation of the cœliac plexus in animals, an artificial acetonuria without the presence of sugar, and in some cases death in acetonic coma could be experimentally produced, renders it highly probable that this poisonous agent is an active factor in the causation of the stupor. Furthermore, the characteristic fruity odour always present in the breath and excretions in cases of diabetic coma is strongly suggestive of acetone intoxication. According to von Jaksch, the motor unrest and delirium, tending toward coma, may be recovered from if ethyl-diacetic acid is not present in the urine.

In the train of mellituria may come an array of motor-psychical nervous symptoms that resembles in every respect the symptom-complex of paretic dementia—*the pseudo-paresis diabetica*. Headache, furunculosis, and violent vertiginous attacks may appear first, followed by apathy, weak-mindedness, and eye symptoms. At a still later period states of excitement may ensue, with the most absurd and changeable delusions of personal importance, wealth, and power. The intellectual defects deepen, there are disturbances of the motor functions of the facialis, alteration in the speech and handwriting, anomalies of pain sensation, and pupillary inequalities. The pupils react to light and accommodation, though unequally, and the patellar reflexes are sometimes increased, sometimes lost—*neuritis diabetica* (Auerbach, Eichhorst, Grube).

Auto-intoxication of Intestinal Origin.—The subject of autotoxis from fermentation or imperfections in the digestive processes in the alimentary canal has occupied considerable space in literature in recent years, but the conclusions reached are not entirely indisputable. Few of the cases observed are as clear as the two following. One of Solder's patients, a woman of forty, without hereditary history, after an obstipation for six days, suddenly became insane, and showed a typical picture of the confusional type of maniacal excitement. All the symptoms disappeared very promptly after appropriate means had been taken to relieve the abnormal condition in the bowel. Again, among my cases I remember a

man, seventy-four years of age, of unexceptional family history, who had allowed himself to go without an evacuation for a full week. On the seventh day an intense headache began, shortly followed by anxiety, symptoms of heart failure, marked clouding of the faculties, and the hallucination that by the side of his own head was a second one with a long, gray beard. No persuasion could convince him that the new member was other than real. Under lavage accompanied by the internal administration of a brisk saline, he recovered within twenty-four hours, recognised the falsity of the hallucination, and did not afterward relapse.

Two kinds of autotoxis from the intestinal canal are recognised by the presence of certain nerve-poisonous substances in the urine: (1) Large quantities of acetone, with later production of diacetic and oxybutyric acids. Von Jaksch and Wagner have found these toxic substances in a large number of cases showing certain types of mental symptoms, but it must be admitted that the same series of symptoms occur when only coprostasis, without acetonuria, is present, while they are not noted in all cases in which intestinal acetonuria is demonstrable.

The second kind of autogenic intoxication, from the splitting up of nitrogenous substances in the canal, and the formation and absorption of products of the indoxyl sulphate of potassium series into the general circulation, proved by their presence in the urinary secretion, is more frequent than the other form. That these substances act as irritants upon the nervous system is highly probable, since the ethereal sulphates are rarely found in large quantities in the urine of patients who have no mental or neurasthenic symptoms. The absorption from the bowel of the sulphates in quantities sufficient for them to appear in the urine must be considerable, as it is presumable that a part must be destroyed both in the liver and in the general circulation by oxidation.

The decomposition of albumin under the influence of bacteria in the intestine is ordinarily shown by the presence of two of the ethereal sulphate series, though in rare instances others may be discovered. These are the indican, or indoxyl-potassium sulphate, and the skatol, or skatoxyl-potassium sulphate. The indican originates after fermentation in the small intestine, and is enormously increased in obstructive diseases of that portion of the digestive tract, while skatol is supposed to be produced by putrefactive processes in the larger bowel. The absence from the urine of the ethereal sulphates is no positive indication that chronic coprostasis does not exist. In

several of Solder's autopsies there was an extreme degree of obstipation with secondary changes in the mucous membrane of the bowel, without any marked increase above the normal in the amount of indican or skatol. Excessive quantities of the earthy phosphates are wont to appear in the urine when there is a considerable degree of intestinal indigestion.

Symptomatology.—The auto-intoxications from intestinal putrefaction or defective assimilation do not offer a great variety of clinical aspects. From them originate the majority of the cases of confusional mania—cases in which there is hallucinatory excitement alternating with a mild stupor, that for the moment may be readily mistaken for melancholia of a passive type.

In all the forms, whether due to the toxines of the ethereal sulphates or acetone series, or to others that we are unable at present to recognise, the symptoms are essentially similar.

The onset may be either sudden, or, as is more frequently the case, the symptoms may appear gradually. There are headache of a dull, heavy type, præcordial anxiety, causeless distress, hypochondriacal ideas, inhibition of thought even to mental confusion, and actual stupor. Hallucinations may or may not appear, but, when present, have a manifold form, the confusion, allowing of no correction. Motor agitation may be extreme, the reduction and agitation resembling the delirium acutum in the intensity of the motor excitement and rapid decrease in the physical strength. Through its whole course the disease is ordinarily afebrile, and there are no remissions; these two points taken together serving to distinguish it from acute delirium.

Not infrequently the confusional manias from auto-intoxication follow a circular course. From ten days to two weeks there will be hallucinations and excitement, followed by a period, equal or longer in duration, of extreme passivity to actual stupor, during which time the patient may show catatonic symptoms, perhaps also verbigeration. Recovery may then follow, or the cycle be repeated.

The usual course is for the confusion, hallucinations, and excitement to abate gradually under treatment, the patient returning to mental health in from eight to twelve weeks. In severe cases death may follow an early developing weakness of the heart. Pneumonia also frequently occurs, and soon causes a fatal termination.

Pathology.—The few cases recorded in the literature of autopsies show primary and secondary changes in the mucous membrane

of the intestine, especially of the colon, together with coprostasis, and changes in the kidneys and liver on the order of a parenchymatous degeneration. The heart muscle sometimes shows fatty degeneration of its fibres; in the brain, œdema both of the meninges and cephalic substance with general hyperæmia have been noted.

Cholæmic Psychoses.—Mental disturbance following icterus, either as the result of gall-stone colic, or from acute catarrhal conditions of the duodenum and bile-duct, are comparatively rare. In some instances of acute yellow atrophy of the liver grave psychic implication occurs (Dausch and Cramer).

The form of alienation after ordinary icterus is one of hypochondriacal-melancholic depression, which passes gradually away with the elimination of the poison from the body. More rarely the psychosis assumes a severe type; the patients become anxious, excited, have a varying degree of mental inhibition, but rarely become actively maniacal. The physical symptoms are profound, the icterus is marked. The temperature is subnormal, the pupils are narrowed, the light-reflex is weak. The knee phenomena may be almost abolished, and various paralytic symptoms may be present. The tongue is heavily furred. Death may occur in coma if the original cause of the intoxication is not abated. Cramer, Korsakow, and Kischkin have described cases of icteric poisoning that followed the course of Korsakow's polyneuritic psychosis, with paralysis of the extensors of the lower extremities, loss of the sinew reflexes, pains in the limbs, and œdema of the feet. Disturbance of sleep, loss of memory, delusions, and at times hallucinations, accompany the neuritic manifestations. Autopsies have shown only fresh capillary hæmorrhages, with exudations of white corpuscles into the lymph sheaths, but no degeneration of the nerve elements.

Gout.—Though arthritismus is common in certain neurasthenic patients, actual psychoses are infrequent in gouty persons in this country. In England and Germany, where the severer forms of gout are common, the disease is recognised as an established cause of insanity.

The majority of persons who have well-marked gout are choleric and irascible in their tendencies, and often show an extreme irritability of temper. The gouty psychopathic disturbances manifest themselves in insomnia, pain in the head, giddiness, and diminution in clearness of vision, restlessness, followed by a miserable intro-

spection sometimes amounting to actual melancholia, with suicidal tendencies. Hypochondriasis frequently precedes a gouty attack (Duckworth). States of maniacal excitement have been noted in gouty subjects in good mental health before the attack; on the other hand, gouty mania has been occasionally seen in which the excitement rapidly supervened after the cessation of the joint affection (Garrod). Localized meningitis has been found in similar cases which had proved fatal. Lemoine and Charpentier look upon gout as one of the etiological factors in general paresis, principally on the ground that in their cases no other cause was assignable; but as yet no indisputable proof has been adduced that the disease can be the exciter of disturbances graver than those belonging to nervous instability.

Insanity following Alterations of the Glandular Secretions.—The most striking illustration of this form of alienation is seen in the post-operative myxœdema, in which the patient, previously mentally healthy, develops depression, loss of memory, diminished capacity for concentration of the attention, loss of originative power, and delusions of suspicion with the somatic indications of cachexia strumipriva. Cases of sporadic myxœdema are by no means infrequent, in which a variety of mental phenomena are noticeable. They are rare in native Americans, but are more often encountered in the Hebrew, Polish, and German members of the community who have come directly from Europe. Forms of insanity approaching the periodic maniacal type, and circular insanities, are the most common; but there are others in which the advent of the myxœdematous symptoms brings on a train of phenomena, beginning with excitement, incoherence, confusion, and changing delusions and hallucinations, that rapidly become chronic. As a result, the persons pass into a stupid, enfeebled condition; they are untidy and incapable of taking care of themselves, and unless appropriate therapeutic measures are taken, within a few months they become passively demented. This latter type should probably be referred to the presence of some poisonous substance circulating in the blood, rather than to hereditary instability of nerve tissue. Many of such cases under proper medical treatment can be ameliorated, or even cured. The results obtained with the thyroid or thyreoidin treatment are often surprising, the entire change in both personal appearance and mental state being one of the most striking achievements of modern therapeutics.

In exophthalmic goitre insanity is by no means rare. Many of the examples of this nervous disease are developed upon an hereditary basis, and it is not surprising that a mental derangement

Fig. 29.

Fig. 30.

Myxœdematous Insanity (Circular Form). E. D., Russian, aged forty years. Six years before her admission to the asylum the woman was delivered of her fourth child. Within a few months thereafter it was noticed that her face was growing very full, and that the hands and arms were abnormally large. An actual alienation did not develop until three years after the parturition, but since that time she has had alternations of mania, melancholia, and lucidity. Fig. 29 shows the facial expression in the depressed period; Fig. 30, that in the excited state. The myxœdematous condition is best developed about the face, scapular and clavicular regions, and the skin has the characteristic bogginess and earthy tint. The height of the woman is 142 centimetres; the circumference of the neck, 34.5 centimetres over the thyroid region; that of the right wrist, 18 centimetres. The thyroid gland is palpable, and seems a little enlarged. Under treatment with extract of thyroid gland she improved greatly, the periods of mania and melancholia completely subsiding. After being under observation for twenty months she was discharged apparently well, though the myxœdema had not entirely disappeared.

should be evoked in its course. Nevertheless, in some instances, especially in persons who have arrived at the middle period of life, and who have shown up to that time no psychopathia, it would seem that the pathological alteration of the thyroid gland has every-

thing to do with the altered mentality and forms an integral part of the original disease. Neurasthenia, hysteria, and epilepsy are sufficiently frequent in Basedow's disease, but the attendant psychoses are mainly of a maniacal type, sometimes characterized by morbid impulses, insane actions, and insistent ideas.

The course is very slow, ending eventually in a mild dementia. Three patients whom I have had under observation for several years have all reached the demented stage, one only after a number of recurrent attacks of violent excitement.

Treatment.—Except in the mental disorders from auto-intoxication through the intestinal canal and myxœdema, therapeutic measures can be only partially successful, since the original somatic disease is incurable.

Nephritis.—If the insanity belongs to a chronic form of uræmia, some little may be done to prolong the life of the patient and increase his comfort by the use of saline purgatives, the mineral waters, especially the Rubinat Condal, the Congress and Bedford, and by the use of mild diuretics and diaphoretics. Digitalis and camphor are not indicated, as they have, especially when used in combination, a tendency to increase excitement. If uræmic coma is approaching, warm baths, saline and alkaline draughts, and subcutaneous transfusion with sodium carbonate or salt solution, may be employed. The sodium salt is perhaps to be preferred, as it alkalinizes the blood and neutralizes the acids therein. Potassium bromide and chloral may be indicated to allay cerebral excitement, and ferruginous tonics should be used freely if the case is not far advanced.

In the acute delirium before or after an epileptiform attack in uræmia, warm baths, with diuretics, citrate of potassium, benzoate of sodium, and subcutaneous transfusion of saline solution, may be used. Opium, although it has no beneficial influence over the disease process, may be indicated to control convulsions, restlessness, and uræmic coma. Amyl nitrite and nitroglycerine lower the high arterial tension.

The diet in the chronic insanity occurring in the course of Bright's disease should be simple and unirritating. Meat more than once a day should be forbidden, while milk, either plain or with alkaline waters, should be the mainstay.

Coma should be treated with salines or croton oil, hot baths, and, if there is a tendency to convulsions, with chloral by rectum, and morphine hypodermically.

Diabetes.—The treatment of cases of melliturla so advanced as to show coma or convulsions is necessarily well-nigh hopeless, though a few cases improve for a time. The sheet-anchor here is opium, either morphine or the aqueous extract given hypodermically. Trausfusion of alkaline solutions, two or three per cent bicarbonate of soda or sodium chloride solution, after the method of Fagge, may be tried, but are usnally inefficacious.

Those patients, who long before the approach of serious symptoms become very querulous and show other slight indications of approaching alienation, shonld be placed on a fairly limited diet containing little sugar and starch, but abundance of milk and animal foods. It is doubtful in these cases whether the green foods, as asparagus, beans, peas, and potatoes, should be entirely withdrawn. Ordinary bread should be used in limited quantities, or gluten foods substituted for it. Of all the various medicaments used, opium is the best to decrease the sugar, and has some influence upon the conrse of the disease. Three or four grains a day should not usually be exceeded. Antipyrine has a decided effect in decreasing the sugar, but makes the patients more anæmic, which is to be avoided. Bromides may be used either alone or in combination with morphine or codeine to allay nervous irritability.

Intestinal Autotoxis.—In strong contrast with the results of medical treatment in the two preceding forms of intoxication, here they are sometimes most brilliant. When the focus of infection is supposed to lie in the lower bowel, this should be thoroughly washed out, preferably by a high enema. If this procedure fails to have a speedy effect, the injection should be repeated. A warm clyster of a quart to half a gallon of soap-suds, with one to two ounces of castor oil, should be slowly passed into the bowel through the rectal tube and kept there as long as possible. This injection should be followed for several days by smaller ones of olive or cotton-seed oil, from four to eight ounces in each, which should be retained for several hours, or overnight. Besides the clysters, calomel or a brisk saline should be administered, to be followed by an intestinal antiseptic. When the small intestine is the seat of infection, nothing is equal to the mild chloride of mercury in broken doses, to be followed by salol, four or five grains, at intervals of four hours for several days. Small doses of quinine and belladonna may be given with it. Bouchard recommends iodoform. Beta-naphthol, the salicylates, salts of bismuth, and orphol are also used, but my preference is for salol. The patients should be allowed a plain but liberal diet.

Gout.—The treatment of the mental disturbances occurring in this disease are palliative, and supplement that of the primary affection. The iodides and colchicum, with local applications of iodine, aconite, belladonna, and menthol, are most in vogue.

Myxœdema.—Preparations of the thyroid gland, the inspissated gland prepared by Fairchild Bros. & Foster, the thyradin of Merck, the active principle of the gland, iodothyrin, or the glycerinated extract, may be employed. No desiccated gland with an odour should ever be administered, as without exception they contain the putrescent ptomaines. The dose should be comparatively small; for the first few days not more than five grains should be given, the amount being gradually increased to ten or fifteen grains per diem of the dried gland, according to the results produced. Pronounced excitement and rapid wasting are indications for a decrease to a minimal quantity, or for the entire withdrawal of the medicament.

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GROUP III

THE INSANITIES OF THE PSYCHICAL DEGENERATE

CHRONIC PROGRESSIVE PARANOIA*

The word paranoia (*παρα*, close to, and *νους*, understanding) was first adapted by Mendel, from the writings of Plato, to indicate an especial form of mental disease occurring in individuals capable of considerable education, at times of brilliant acquirements, yet possessing a mental twist, that makes them a class separate and apart from the great mass of humanity. The affection has its origin in a structural weakness of the nervous system, more often inherited than acquired, and bears a close relationship to moral imbecility.

The recognition of the disease derives its great importance in psychiatry and medical jurisprudence, not from its frequency, because it is relatively one of the rarest forms of mental disturbance, but from the fact that ofttimes the affected person is a highly dangerous individual, frequently able to conceal his insane concepts not only from the laity, but also from medical men, until an outbreak of a violent character has taken place, which is not unlikely to result in death or injury to others.

By *paranoia*, then, is understood a psychical disease essentially chronic and progressive in nature, characterized by delusions and hallucinations; and yet at the same time there is retention of the reasoning faculties upon subjects other than those immediately involved in and directly touching the person's mental defects, until the malady has progressed through successive decennaries, after which time weak-mindedness succeeds with loss of the acuteness of the symptoms. The nucleus of the malady lies in the systematized delusions of persecution or ambitious delirium. Remissions are now and then observed, but a cure is not to be expected. Halluci-

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* *Die primäre Verrücktheit* (Ger.). *Délire Chronique à Évolution Systématique* (Fr.). Monomania (Eng.).

nations are not the exclusive mark of the paranoiac; they occur equally and even more prominently in alcoholic or cocaine poisoning, and in the acute forms of insanity. Nor do the delusions form the essential feature of the disease; it is rather their chronic, progressive, systematized, course, which forms the main characteristic of paranoia, everything else being secondary to this. The history of the patient must therefore be known before a diagnosis is possible, and we must differentiate the disorder most carefully from the intoxication psychoses with sensory deceptions chronic in nature, from chronic delusional insanity occurring after melancholia and mania, from the acute hallucinatory insanity of Meynert (acute hallucinatory insanity), from progressive paralysis, and from certain types of alienation occurring in the imbecile class that have fixed but unprogressive delusions.

Development

The development of all the various forms of paranoia depends essentially upon a constitutional neuropathic ground-work. This, while strikingly true of the earlier forms, is only hardly less apparent in those which come on later in life. So seldom, indeed, can the disease be traced to postnatal causes, that the paranoiac may be said to be one predestined to his morbid peculiarities, one from whom there is no escape except through the channels of especial environment. The proof of degeneracy is the imperfect development of some of the numerous faculties, and this condition the paranoic fulfils to the letter, despite his exalted position above his imbecile half-brother. The peculiarities eventually crystallize out of his ill-strung brain into delusions of systematized persecution.

The first step in the evolution of a progressive insanity is recognisable in early childhood. The candidates are either unusually rapid in learning to walk and talk, or abnormally slow, and as time proceeds develop various physical characteristics different from those of their companions. In their school days they keep aloof from their companions of a similar age; they are dreamy, irritable, and deficient in the correct understanding of ethical reasoning; they have perverted sexual instincts, and occupy themselves more with their own fantasies and dream-life than with natural play; they may study with apparent zest a multitude of subjects, but they do not become thoroughly grounded in any one, and are peculiarly deficient in mathematics or some other of the exact sciences. The memory of such individuals is frequently good, and despite the fact

that they are insusceptible of a complete schooling in the exact branches, they often pass for pattern children.

The environment in the years of childhood and puberty is all-important to such psychically defective ones. When burdened with only a moderate degree of inherited weakness, they may now acquire nervous stability sufficient to enable them to pass through the early years of adult life, and allow them to follow the customary occupations and pursuits of mankind. Eventually, however, they fall by the wayside when the retrogressive period of life comes on, and as happens in every brain with inherited peculiarities, in the case of these afflicted ones this involution begins considerably earlier than in the normal man. If, however, the degree of patrimonial psychical debility does not allow of a subordination of the abnormal *ego* to the discipline of home life and education, or should the environment be unfavourable, the intelligence defect shows itself at an earlier age, usually at the time of puberty, and from that date onward, to the end of life, falsified impressions of the outer world are begotten by a mind out of tune, and idiosyncrasies develop into alogical misconceptions arrayed in synthetic order.

We find, therefore, that there are two chief types of paranoia. In the one originating in early life, the victim may be said to be a paranoiac from the cradle; in the other, the beginning of the affection usually manifests itself after the thirteenth year, both forms being engrafted upon an hereditary tissue instability. According to the age at which they arise the types are known as the early and late paranoia (*paranoia originaria* and *paranoia tarda* of Amadei and Krafft-Ebing). Both forms are essentially similar in symptomatology, the chronic, progressive, systematized delusions forming the loadstone around which secondary symptoms circle, though naturally the age and consequent duties and pursuits in life vary greatly the picture of the several individual examples.

The immediate exciting causes of paranoia are the same as those of all forms of insanity, whether primary or degenerative: any influence that perverts or overturns in any way the controlling action of the nervous system—puberty, the simple anæmias, gastro-intestinal affections with accompanying auto-intoxication, uterine diseases, masturbation, exhausting discharges, distressing worries, the beginning of the climacteric, and senescence—may prove decisive. Many an individual might possibly have passed successfully through life without serious mental disturbance had not some shock or acute febrile disturbance, with its resulting debilitation, chanced

to destroy the hair-fineness of the mental equipoise, so that fixed ideas and morbid fancies, before controllable by the reason, now pass beyond its control, and the logical faculty becomes "a wreck, at random driven." The febrile or other disease has left an organic susceptibility to disturbance of the equilibrium, a true psychical disease. The attempt is made to restrain the persistently recurring delusions, but eventually from their continued recurrence they obtain full sway and the person becomes insane. Pathological excitation of the peripheral nerves, especially those of the sensory-psychical apparatus, contributes largely to the complete enthronement of the insane conceptions, the auditory apparatus being most frequently at fault. But with all his misconceptions and misconstructions the paranoiac retains for many years the power of thinking logically and clearly upon subjects other than those which touch his own false impressions. The disease is, therefore, an incomplete one, affecting only certain of the mental faculties, and leaving others undisturbed. The paranoiac reads, writes, converses, is often capable of various kinds of mental or physical labour, even though his mental capital is defective, and until the outbreak of some imperative delusion of suspicion—and this may be only after successive years of evolution—may remain an active and more or less useful member of the community.

General Symptomatology

We have seen in the above sketch that paranoia is essentially a disease *ab incunabulis*. To this view there are numerous dissentients, especially as regards the late form. In the fact that the affected individual has reached middle life before the symptoms of the malady become obtrusive, and that he has shown a fair degree of intellectual development, not a few of the authorities discern a reason for assuming for such cases an absence of an hereditary taint (Magnan, Mendel, and others). Accordingly, with rather unnecessary refinement, Magnan separates the early from the late form, considering the earlier as a strictly degenerative trouble, and the later as non-hereditary.

It is well known, however, that many forms of degenerative insanity do not develop until the patient has reached middle life. For my own part, I have never seen a paranoiac, in whose case a full and complete history could be obtained, that did not have an hereditary history of drunkenness, of family neuroses, or actual insanity. The foot-note on the following page gives the synopsis

of a case in which the paternal great-grandmother, grandmother, and patient all suffered from chronic delusions of persecution.*

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* The great-grandmother of the patient (P. E.) developed delusions of persecution in middle life, and made herself so obnoxious to the inhabitants of the small village in which she lived that she was incarcerated in the county almshouse. Her daughter (grandmother of P. E.) about the same period of life developed persecutory ideas, and accused the neighbours of systematically pursuing her for evil purposes. She at length turned upon those persecuting her, was arrested and sent to a prison, where she remained for the rest of her life. The patient's father, the son of this insane woman, died of tuberculosis at the age of twenty-eight years. His first cousin had some mental trouble, but what form the psychosis assumed is unknown.

The mother of P. E., who is yet alive, married a second time after her first husband's death, and had two children, a son and daughter, both of whom are living and show no trace of mental defect.

P. E., who is now forty-one years of age, was conspicuous as a child for having notions that she was of higher lineage than the other members of the household, and for her mysterious, important mien. Nevertheless, she took a common-school education, and was regarded as being of fair intelligence. She married about the age of twenty years, and had issue of two children, both of them dying in infancy.

Her husband also died when she was twenty-eight years old. During her married life there was no further development of eccentricities, but she had to be constantly humoured and indulged. After the death of the husband her life became irregular; she secluded herself during the day and walked the streets at night. About this time she acquired a syphilitic throat trouble, that ended, from lack of attention, in complete destruction of the uvula and palatine arches. Her half-brother now tried to control her, but found that he was unable to induce any change in her conduct. During this time he noticed that she spoke of people trying to poison her, that the shutters of her house were kept constantly barred, and that even he could only gain admittance after long-continued effort, and by parleying with her through the partly opened door.

Despite the ideas of persecution she had several lovers in attendance, whom she would meet on the streets at midnight.

This condition of affairs went on for several years, when slowly aural hallucinations began. The voices of those who were constantly plotting against her became audible. They came from the adjoining rooms, from the ceiling, and from the street, and through their agency the artifices and plans for her destruction were made manifest, and counter plans for their frustration were made by her.

Three years ago, when P. E. was thirty-eight years of age, grandiose deceptions began to mingle with those of persecution. The voices of the Virgin and the archangel Gabriel comforted and solaced her in her many trials and tribulations on this earth. They told her that she was born to become a saint, and that all the evils that had befallen her were but to purify her for the future life. When she becomes a saint she is to work under the direction of the Almighty, and redeem the world. Ten thousand thousand deaths are to be her portion before this is accomplished. To prepare herself for the great end and attain purity, she was to fast without sleeping for forty days, and this she attempted to do. A chariot was then to come and bear her to other and happier realms.

The delusions are perfectly systematized, and hardly vary from year to year, the

We find in paranoia a distinct disease entity, separated from the psychoneuroses by its insidious development over months and years, by the retention of the reasoning process, by the absence of pronounced dementia after the disease has progressed for many years; from chronic alcoholic insanity, by the absence of certain sensory delusions, especially those of sight; from the secondary chronic delusional insanity (paranoia secondaria), by the absence of previous pathological excitement or depression; and, lastly, from the acute hallucinatory insanities, by the chronicity characterizing the evolution of the disease, and by the constant failure of ultimate recovery.

It is usual to divide this "disease of comprehension" (Jolly) into four stages. The stage of incubation lasts over months and years; next comes the epoch of persecutory certainty, with delusions, illusions, and hallucinations of hearing, which persist for an equal length of time; thirdly, we have the ambitious period, in which recompense for persecution is obtained in the development of fantastic conceptions of grandeur, with loss of the persecutory ideas, a stadium in which it would seem as if the mental capital was beginning to wear itself out, the delusions being so absurd and inconsistent with the surroundings and habits of the patient; lastly, there ensues a stage of quietude in which a degree of weak-mindedness is apparent on close examination, but in which there is nothing approaching dementia except in a minor number of instances. Some atypical cases are met with that do not run the prescribed course, the most frequent being the paranoia hallucinatoria, in which sensory deceptions are dominant, or the ideative form, in which sensory disturbances are not developed.

Only one third to one half of all cases reach the ambitious period. Perhaps more would attain it if life were not abridged before it had time to develop. In infrequent instances grandiose ideas pervade the well-springs of thought before the development of hallucinatory disorders, but, as a rule, the inception of the hallucinations marks the acme of the malady.

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patient showing no decided evidence of an incipient dementia. She is extremely irritable and irascible, and does not hesitate to call down untold calamities upon the heads of those so unfortunate as to offend her, and to visit upon them the most obscene language.

When the redemption of the world is fulfilled, the Almighty is to make it known to her by the present of a mysterious and beautiful girdle, and she is now living in the expectation of this event.

The period of incubation usually begins in an insidious manner, *never abruptly*, and frequently after the occurrence of a physical disorder or period of worry. Sleeplessness, *malaise*, and loss of appetite follow, with inaptitude for the usual daily labour. Dreams or half-waking fantasies are misinterpreted; the individual becomes solitary and mistrustful; he starts at the slightest noise; the accidental omission of a greeting on the street by an acquaintance, or a fancied slight, renders him suspicious of the sincerity of his friends, and he begins to misinterpret the words and actions of associates or of members of his household. He discovers that people look askance at him, and he constantly hesitates, and doubts the meaning of actions seen and of words overheard. At this time no depression, no actual delusions, no hallucinations or illusions are present; thus far he only attributes to trivialities too great a relative value, and obtains falsified impressions of the outer world. On these he is constantly carping, asking himself why people, to whom he has done no wrong, bear ill-will to him and revile him; but instead of making inquiry and trying to set things to rights, or drawing logical deductions, he accepts alogically his conceptions, withdraws into his shell, and remains anxious, preoccupied with his misconceptions, and indifferent to all beyond the limits of his morbid egocentrism.

The patient is now rapidly passing the borderland of sanity. False conceptions assail him more and more; notices on the signboards are interpreted to contain innuendoes against him; in the laughter of passers-by, in the coughing of an acquaintance, he recognises contempt for him; the newsboys cry "extras" containing satires upon him; even the twittering of birds or the whistles of locomotives proclaim slanders against him. Attempts to placate him are received in silence, and only as evidences of a clumsily concealed derision. Little by little the misconceptions and false interpretations assume greater power; doubt is strengthened by various accidental proofs; snatches of conversation overheard now convey certainty; the ideative activity of his restless slumbers augment the conceptions of the day; imagination runs riot; the constant excitement of the over-used cortical centres produces a condition of pathological irritation in them—a mental hyperæsthesia. As a result, co-ordinate thought is interfered with by the prominence of the ever-insistent misconceptions, and delusions and hallucinations, tending to fearful certainty, take the place of doubt and anxiety.

The patient has now entered the second stage, that of delusions and hallucinations, with disturbance of general sensibility; he is paralogical; the disease has crystallized; the mental prostration has begun.

> "With curious art the brain, too finely wrought,
> Preys on herself, and is destroyed by thought.
> Constant attention wears the active mind,
> Blots out her powers, and leaves a blank behind."

The hallucinatory voices, central in their origin, are rarely evolved in completed form in the beginning of the disorder. At first simple noises, like the whir or click of machinery, are heard, the low murmuring of voices in the distance, the patter of falling water. The patient is annoyed by their presence, and very often seeks an explanation for them in some electrical or supernatural cause. Little by little the sounds resolve themselves into distinct voices, and ordinary acoustic stimuli are sufficient to elicit them. The voices pursue the subject continually; in the roar of the street or in the stillness of the night equally are they heard. They follow him wherever he goes, disturbing his sleep by their constant presence. After they have become fixed, acoustic stimuli are no longer necessary for evoking them, the disturbance being central. In the vast majority of these cases the voices are inimical; they threaten the person, they tell him that he is a miserable, dirty creature, a sexual pervert; they slander him in every manner, or excite him to stab himself, or to commit suicide in some other way. One by one his actions are repeated aloud to him; even his secret thoughts are filched from him and made audible. The patient is persecuted to a degree that renders life well-nigh intolerable, and death is sometimes sought as a means of relief from the torture. In proportion as the hyperæsthesia of the cortical auditory centres grows more pronounced the intricacy of the voice-persecution is increased. Continued conversations are held by his unknown tormentors, which utterly distract and render impossible collected thought. The patient complains that he is robbed of his mind, that his enemies take his brains away, and substitute others incapable of correct reasoning. These hallucinations are more frequently unilateral than bilateral, and are referred to one or the other ear. Voices are also heard arising from the throat, chest, or abdomen, but these belong more to a later than to an earlier period of the disorder, as their occurrence announces the implication of nerves of common sensation. In some infrequent examples of the disease, and usually at a

well-advanced period, two voices are heard, the one imprecatory, the other consoling, and promising sustenance and support.

It is exceedingly rare for the patient to see his persecutors, hallucinations of sight belonging rather to the alcoholic than the paranoiac. So far as his comprehension goes, they exercise their machinations upon him from a distance by means of electric or especially constructed dynamic machines, from behind the walls, or through the ceiling, beyond the reach of the visual apparatus. From their invisibility the sufferer infers that he is the victim of the machinations of secret cliques, of freemasons, of nihilistic societies, of priests, that have banded together for the purpose of tormenting him for their own ends. Imagined political ill-will against him is a frequent source of sense deceptions, the politicians associating together and tormenting him through the agency of the "machine" at the town hall, from which place the members of the "gang" work upon his mind to destroy it, to extract his vitals, or his semen, so as to render him impotent. Delusions of a mystic religio-erotic nature are more frequent with women than men. From such patients, especially in the menopause-paranoia, frequently come tales of nightly rapes and violation, the priests and pastors often bearing the onus of the crime.

Hallucinations of feeling, taste, and smell follow in order of frequency.

Hallucinations of common sensation may precede, accompany, or follow the inception of the auditory phenomena. Patients complain that at night their flesh is cut with knives by unseen enemies; that they are pricked, stung, or burned; that their semen is extracted; that their flesh is made numb; that a vampire comes and sucks their blood. Female patients sometimes tell us that another woman enters her body and coaptates herself to it, especially during the act of coitus. Others affirm that their energy is removed by electric currents, and place the feet of their beds on glass vessels filled with water for insulation.

In one instance the cutaneous sensation complained of was that of drops of water falling from a height upon the skin; in this case, covering the part with the bed linen did not protect from the impression. Others are sprayed with acids, or vibratory movements of the bed are made for the purpose of preventing the occupant from sleeping, and to otherwise annoy him. Actual neuralgic pains are rather rare, and if these occur, especially in the form of visceral crises, the presence of an organic malady (tabes or paresis) should

be suspected. Hallucinations of smell are sometimes met with in paranoia, although they are a far more frequent feature of alcoholic insanity. The air is polluted with the odour of fæces; poisonous gases permeate the atmosphere, sent by unseen agencies in order to deprive the patients of their senses, faculties, or life. Noxious vapours fill their rooms to steal away their sexual vitality. Attempts are made, by forcing upon them vapours of carbolic acid or chloroform, to suffocate them, and much sleep is lost in the vigils undertaken in order to thwart these hostile designs.

The sense of taste is equally perverted. Numbers of paranoiacs refuse food unless it has been especially prepared by themselves; they may even deny themselves water unless drawn at early dawn from a general drinking fountain, as they perceive, or suspect, poisons in their food and drink, taste arsenic in their coffee, opiates in their soup; their meat and vegetables are polluted with dirt, or contain noxious ingredients to benumb their sensibilities.

The absence of visual hallucinations is seemingly an especial provision of nature; for were such persons able to see and definitely locate their enemies, no one would be safe from attack.

All these ideas of persecution are constantly augmented and increased by trivial incidents and analogical conclusions. The patients bar themselves up, they provide themselves with loopholes of observation in their abodes, through which they watch the movements of their neighbours, and when they are forced to go out for food or other necessities, they claim they are constantly watched, their movements espied upon, until every thought and action becomes a part of the delirium of systematic persecution to which they are subjected. It is at this stage, when the delusions growing out of the hallucinations and sensory deceptions have extended to a complete co-ordination, that the sufferers not infrequently fly from their imaginary persecutors to the shelter of an institution, or to the police, and beg for protection from the inimical influences to which they have so long been the victims.

The advanced second stage of the disease is also the one in which the patient is most liable to turn upon his persecutors. The innocent remark of a chance passer may be rewarded by a violent attack. More particularly, in those instances in which the family, an association, or club, are singled out as the source of the persecution is some one individual likely to be chosen from among their roll as a sacrifice to despair. When committed, the crime is rarely secret, but done openly upon the street, or before witnesses; when

seized, the aggressor justifies his act, and even gloats upon his success in removing one of his enemies. The crime is never the result of a sudden outbreak of frenzy, but is a preconceived, planned action; he has sought to escape from his invisible but ever-present foes; he has covered his head with wraps, stopped his ears with cotton, isolated his bed to avoid electric currents, clothed his body in many non-conducting garments to ward off their machinations—all in vain. Wearied, tired, helpless to protect himself, with the gateways of the world closed to him, laughed at and despised when he unfolds his tale of despair to the authorities, he finally takes the further course of affairs into his own hands, and wreaks his vengeance upon the, to him, most tangible source of annoyance; the puppet and plaything of the persecutors has at last turned. Cerebral control has declined in the long years of despair; a pabulum of disease has been supplied to the ideation, and the mental capital is reduced to a point in which auto-criticism is impossible; self-consciousness has been deeply affected, while in the unconscious sphere of mental activity are formed continued series of delusions.

Perhaps not more than one third to one half of the ordinary persecuted paranoiacs pass beyond the stage of delusional misconception, their lives being too short to allow of the development of the third stage, that of ambitious ideas.

In the beginning of this third step in the evolution of the insanity, the persecutory ideas are still prominent, but the patient begins to interpret them differently. He asks himself: "Why am I, without reason, thus constantly subjected to these horrible torments? Am I different from my fellows? Have I been destined for higher aims? Am I thus under the hand of the Deity to purify me? Am I of illustrious descent? Is there not some object to be gained in ridding the universe of me?" Little by little these ideas of personal importance assume prominence in the mentality of the individual. The woman, who has been harassed and pursued through long years, now hears the voice of the Almighty in the watches of the night, consoling her with the assurance that she is a saint or a prophetess; that she has the power of life and death over her enemies, for at her command the angelic hosts will descend and destroy them; or that she is to be translated, undying, to other and happier realms, there to taste of the joys of everlasting bliss. To this class also belong the redeemers of the world, who are sent with the power of life and death to regenerate mankind, and separate the wheat from the chaff. The brides of

Christ, the woman arrayed in scarlet of the Apocalypse, the daughters of Righteousness, are frequent conceptions among paranoiacs. Many of these women, while preaching redemption and immortal chastity, are not uncommonly living lives of gross immorality, and in other ways departing from the tenets of their teachings—a striking evidence of the weakened condition of the faculties.

While the men are frequently redeemers, preachers of the Word, archbishops, or high dignitaries of church or state, a larger number become inventors of complicated electrical or perpetual-motion machines, the latter being a favourite subject for the exercise of their ingenuity; or they invent firearms capable of being discharged a thousand times a minute. Hallucinations of the auditory sense are still frequent; the commands of the Deity, of angels and archangels guide their footsteps, and become their innermost life; dreams are to them realities and controlling powers; the period of introspection is passed and the power of self-analysis is lost. In the asylums they become fairly good working members of the community, the sons of God finding pleasure in the work of artisans and labourers, the daughters of dignitaries being contented with needlework and household duties.

Fig. 31.—The patient was unsettled, an unsuccessful though persistent inventor, and a litigious and irritable man. He neglected his family, and was much engaged in religious and other public duties. From a photograph kindly loaned.

It is doubtful whether the auditory deceptions are alone responsible for the changed attitude of the patient as he passes from ideas of persecution to those having a grandiose or ambitious colouring. The change would rather argue a progressive weakening of the faculties, and a degree of mental reduction sufficient to allow the person to evolve such absurd conceptions, so entirely inconsistent

with the apparently fair amount of retained intelligence. That this is true is shown in the further progress of the disorder. As time elapses the proud and grandiose concepts become less and less prominent; the wrath of the heavens is less frequently called down upon the head of anyone so unfortunate as to contradict their statements; the patients become quieter, somewhat apathetic, and, without being reduced to a condition of real dementia, have forever lost the finer edge of their faculties during the troubled life of former years. The alteration is seldom rapid unless the environment is unsuited to their former life, or they are closely confined in prisons or ill-managed institutions.

According to Snell, the ambitious delirium may develop within a period of a year after the beginning of the delusions, or it may be delayed until six, seven, or even eighteen years have elapsed.

The one-sided character of the disease—the retention of clear reasoning powers on a majority of subjects connected with the daily surroundings, in conjunction with their absolute distortion on other points—might be taken as presumptive evidence of a localized change in certain cortical areas connected directly or indirectly with the peripheral special-sense apparatus. Whether in the paranoiac brain there is an early involution of these areas—an idea consistent with the early proneness to retrogressive alterations so frequently observed in incompletely developed or in tissues imperfect *ab ovo*—an alteration not so much in gross formation as in the minute histology that escapes our microscopic examinations, we do not know, but the theory is worthy of a passing thought. Likewise, a beginning arteriosclerosis in a vessel congenitally too small to carry a sufficient supply, may be by itself sufficient to evoke the persistent delusions and hallucinations of evidently central origin, yet may be insufficient to show at the autopsy table a macroscopic brain lesion.

The signs of organic degenerative troubles in paranoia are rather infrequent. The skin and deep reflexes are not disturbed except when, under the influence of some delusion of poisoning or religious ecstasy, the sufferers have starved themselves; in such cases the reflexes may become exalted. Actual abnormalities of the sense of hearing are found in a certain proportion of cases of the disease.

Pupillary anomalies are infrequent, spastic myosis being the most common change, having been observed in 1.2 per cent by Thomson, and in .3 per cent by Siemerling. It is rather notable that a proportion of cases of chronic progressive paranoia eventually develop into general paralysis after the disease has progressed for

years, a fact which is in support of the theory that local vascular disturbance may extend into a general brain disorder.

Renal lesions do not seem, in my experience, to be more frequent than in the sane, nor are abnormal substances found in the urine.

The *pathology* of paranoia is unwritten. Feist, it is true, found sclerotic changes in the posterior columns of the cord, but these are probably exceptional. Far more common are anomalies in the structure of the basal vessels, absence of certain minor vessels, or minuteness in the calibre of others. Skull-asymmetry is not infrequent in the paranoiac, and corresponding deviations from the normal in the formation of the convolutions, bridging of the fissures, or an unusual direction of the sulci, are more to be expected from the character of the malady than gross lesions. Charon found softening of one lobe of the cerebellum in a single case, but this was in all probability a mere coincidence. In my own autopsies the departure from the usual type in the formation of the convolutions has been the most striking feature of the gross examination of the brain.

The *prognosis* of paranoia from the neuro-pathological character of the disease is essentially unfavourable so far as regards complete recovery. It is, however, true that apparent remissions in the violence of the progressive delusions now and then occur, but these may be only apparent, and may be due to the ability of the patient to mask his false conceptions from the cognizance of the observer. Individuals showing the ordinary types of hallucinatory paranoia and the querulents are slowest in reaching the period of eventual weak-mindedness, while in those that early develop ambitious delusions, the eventual unfolding of psychical weakness may be expected to be more rapid and more profound.

The *treatment* by the time that the patient comes under the care of the physician is necessarily a negative one. Possibly in future generations the disposition of every infant born into an insane or a neuropathic family may be separately taken under consideration. In such cases, scientific training with suitable environment, adapted to each individual, might be instituted in early childhood, and the hereditarily defective kept separated from their better endowed school-fellows, to their mutual benefit. Kindness, quiet surroundings, protection from the gibes and irritation of unfeeling companions, might go far to prevent the development at a later age of the systematized persecutory ideas. The fully developed paranoiac is

a dangerous being, and should be placed within the sheltering walls of an asylum, or at least in the hands of competent attendants, and not allowed to wreak vengeance for his false conceptions of the world upon his family, former friends, or the accidental passers-by. His surroundings should be quiet, all possible freedom for recreation in the open air being allowed; he should be permitted to follow any line of work in which he is interested, and his desires and wishes may be indulged so far as is consistent with propriety. Unfortunately, many of these individuals do not bear the life of an institution well; they become impatient, embittered, and there is a constant strife between patient and the attendant, the latter being brought into the full scope of the system of persecution. The usual administration of the bromides, hydrotherapy, galvanism, etc., can have no permanent effect. Abstinence from food must be combated with the feeding-tube. Usually, after a few administrations the patient will prefer to take his nourishment naturally than undergo the mortification of forced feeding.

The polymorphous character of the delusions and hallucinations of the paranoiac renders a separation of the individuals into groups somewhat difficult. The classification of Amadei and Tonnini recommends itself as covering the majority of the forms. In concordance with Krafft-Ebing, they divide the paranoias into two chief groups, the early and the late form, *P. originaria* and *P. tardiva*. Both groups have the subdivisions of *P. simplex* and *P. hallucinatoria*, with the minor varieties of *P. persecutoria*, *religiosa*, *erotica*, and *superba*. The litigious insanity is included under *P. tardiva*.

For the sake of uniformity and simplicity, in the following short description of the individual varieties I propose following the lines laid down by Krafft-Ebing, rather than the classifications of Kraepelin, Werner, Magnan, Cramer, and others.

The *early form* of paranoia is so infrequent as hardly to merit more than a bare notice. The cardinal symptoms are in the main similar to those of the later form. The disorder begins to show itself either before or during the epoch of puberty. Krafft-Ebing noticed one case in which symptoms were remarked as early as the fourth year.

In the history one can always trace the profound impress of family neuroses. Insanity, alcoholism, and the neuropathic temperament are early shown in the descendant in the form of neurasthenic

manifestations, infantile hypochondria, perverted sexual instincts, and an unusual tendency to delirium during the course of slight febrile disturbances.

The children are dreamy, easily irritated to passionate outbreaks, complaining of fancied wrongs and bad treatment by their parents; they do not follow their brothers and sisters in their romps and play, preferring to read romantic and erotic novels, when they can be obtained, or to find solace and protection in the homes of strangers, where they believe they meet with much more consideration and respectful attention. Not a few, developing rapidly mentally, observe the poverty of their surroundings, contrast unfavourably the treatment of themselves by their parents with that accorded to the other children of the household, and build upon this idea various false impressions. The mother, for example, in her efforts to correct and impress a sense of morality upon such an one, may use the expression, "This is not my child," or a teacher may call attention to the similarity between her name and that of some person of social standing, whereupon a deep impression is immediately made upon the morbid mind of the child. Her parents are only foster ones, who have been hired to raise her. Such an idea, once brought to the child's notice, is constantly revolved in her brain; eventually she may dream of the time when she was brought from the magnificent abode of her true father. Self-deception produces certainty, and the idea becomes fixed, perhaps under the auto-suggestion of the most trifling events, such as a whispered conversation between father and mother which she at once conceives to be about her, and to relate to some mystery about her parentage. Romantic ideas now obtain full play; people seem to greet her respectfully upon the street, ladies of the higher classes call attention to her as she passes, and the squalid surroundings at the actual home become less and less endurable.

Misconceptions of the outer world make rapid progress; the papers are full of notices about her; dreams sustain and augment the certainty that she is of exalted birth, and the days and years are spent in attempting a solution of the mystery of her origin.

As puberty succeeds childhood, erotic ideas mingle with the deceptions, and are fostered by recurring dreams and novel reading. Love scenes are enacted, hallucinations mingle with the delusions, and nightly intercourse is had with imaginary lovers of high degree. Symbolic adornment of the person with bizarre and fantastic dresses or ornaments is common, in order that the expected

lover may know his bride when he comes to carry her to his home, and nonsensical conduct is indulged in for the sake of attracting attention. One individual is often singled out and beset with these affectionate attentions, possibly to his or her great annoyance and the despair of the family. Infatuations of this kind are more often platonic than sexual, the paranoiac following out the line of thought and action induced by the mystic interpretation of novel or dream. The treatment to which the patient is subjected for these escapades occasionally induces persecutory delusions. She deems that every desire and wish is contradicted and derided, that proper respect is denied to her by the members of her family, or that she is shunned by friends and acquaintances. As a result of all this, a morbid introspection is induced; the patient becomes more and more intolerant of contradiction, and her fancied wrongs become as mountains before her. The future course is a combination of persecutory and ambitious delirium, with memory falsifications, intensified by recurring hallucinations and illusions.

THE LATE PARANOIA

While the incubation period of this form may reach back into adolescence, the actual outbreak may not occur before the third or fourth, more rarely in the fifth, decennary. With women the pre- and post-climacteric epochs are most eventful for the cropping out of the latent disease.

The simplest type of the malady—indeed, the essential nucleus of the whole series—consists in systematized delusional ideas of persecution, without necessarily any defect in the intelligence, though the lack of correction of the erroneous impressions would essentially determine an implication of the faculty of comprehension. This simple chronic persecutory insanity is by far the most frequent form of the disease, while paranoia hallucinatoria, and the religious and erotic sub-forms, are more rare. An early commencing expansive character to the delusions implies a greater degree of mental weakness than is usual in the persecutory or hallucinatory types. Combined forms are also met with, and, indeed, are quite as common as the fundamental varieties. According to statistics, women are more frequently affected with systematized progressive insanity than men, Garnier giving 8.6 women to 2.1 men; but these proportions are below those mentioned by other authors.

The Persecutory Paranoia

To this form belong the most frequent examples of the disease, and from a clinical standpoint it constitutes a distinct entity. The hereditarily ill-balanced brain shows itself *ab initio* in a peculiar temperament, a ready excitability, a mistrustful character, with distaste for companionship, and melancholic tendencies. Suspicious and self-centred, the patient passes through adolescence in constantly looking for insults from others, the earlier educational training still retaining some of its influence. At last the long-continued doubt and alogical reasoning upon the meaning of words and actions of family and friends crystallize into a delirium of suspicion, having its central core in a delusion affecting the health, life, honour, or possessions of the individual. Unconscious thought eventually comes into prominent consciousness through the medium of a dream, a febrile delirium, or after any depressing physical condition, particularly the climacteric or exhausting discharges, anæmia, sexual excesses, or loss of sleep. The last-mentioned cause is of great frequency, and is often overlooked or regarded as unimportant.

Psychical reaction to bodily depression is normal to all persons, but with the mentally debilitated this reduction is more profound and productive of a deeper disturbance of the intellectual health. The sequence to the disarrangement of the vital powers is seen in illusions, and if sleeplessness be added to the physical debility, the rise of delusions, now uncorrected by the influence of daylight and environment, is rapid. The person soon believes that the outer world has altered its relations to him; everything is seen in an unfavourable light; a spell, which he has no will-energy to remove, is upon him; everything is a burden. Friends no longer treat him as of old; they slander him behind his back. Persons speaking together on the street regard him with an unfriendly eye—even leer at him. Self-correction is at first attempted, but the old reticence of youth prevents him from inquiring into the significance of these changes in the disposition of society toward him, and his own irrational reasoning as to the meaning of the change strengthens his misconceptions. Soon relatives and friends are converted into deadly foes. He is hounded on the street, slandered by the passers-by; his family distrust and annoy him; they place compromising papers mysteriously worded among his effects. The newspapers are full of his misdoings; the preachers talk at him in their sermons, holding him up as an example of sin and immorality, and making

him a scape-goat for the misdeeds of all mankind. Closer and closer the net of the systematized persecution is drawn around him. Astounded, he retires more and more within himself; if spoken to, he is irritated; if left alone to follow his own devices, he regards it as a studied insult. The evolution of this persecutory system lasts over numbers of years before the limits of the borderland of insanity are passed.

FIG. 32. — PERSECUTORY PARANOIA. This man was a restless wanderer, inclined to take up with the latest and newest developments in religion or in politics. He was suspicious and apprehensive; an agitator lacking in continuity of thought or definiteness of purpose. From a photograph kindly loaned.

Gradually, or suddenly, as the case may be, there comes an hour when after exhausting watching, or some exciting scene, produced by his falsified impressions, certainty is reached that attempts are being made to poison him, to rob him of his possessions, or to take away his life by hypnotic influences. More particularly in the quiet of the night season he begins to have aural hallucinations. Voices tell him that his life is in danger from poison, that bands of conspirators, or secret societies, have set spies to follow and assassinate him. Secret police follow to arrest him for crimes committed in the long past; his family wish to end his days in order to obtain his accumulations, or for even more evil ends. Quickly the meaning of the whole long-endured persecution is apparent to him; doubt is succeeded by certainty, recurring illusions and hallucinations strengthen his beliefs, and systematized deceptions of a persecutory nature result. The inimical hallucinations now form the basis of his life, and render him progressively more and more miserable. The most frequent of these are the voices coming from the walls, from behind articles of furniture, from the windows, from near and from afar. They call him a fool, a pig, a thief, a whoremonger; they sing mocking songs to him, or reveal the plans of his enemies, tell him their names, their methods of working upon him with mysterious machines to steal away his vitality or

reasoning faculties, to make him insane, or subject him to their diabolical machinations. Sometimes two sets of voices answer each other, one abusive, one protective. When the hallucinations have lasted for a long period, they may arise from any part of the body, the throat or the epigastrium, and are known as the verbo-motor variety. Cutaneous hyperæsthesias soon mingle with the special-sense hallucinations; the head is compressed by bands which benumb his intellect, needles and knives rend his flesh, abdominal sensations give rise to ideas of pregnancy, even in the male. Magnetic gases are forced upon him, in ways only revealed by the voices, to destroy his health. The genitals are nightly irritated, his "seed" is taken away by electrical or magnetic influences to rob him of virility. Less frequently there are sensations similar to those of coitus, to stimulate him to sexual attempts. Taste and smell hallucinations mingle with those of perverted cutaneous origin; a smell of the closet pervades everywhere; arsenic is in the food, chloroform and sulphur are in the air, iodoform is blown into his room at night all by the unseen but ever-present and active enemies. States of intense mental anxiety are produced by these persistent persecutions; not alone is his own life in danger, but those nearest and dearest to him are being equally enmeshed in the widespread net. The aid of the police is sought, but in vain. In despair he flies to other cities, where for a short time he finds a respite. But soon the unseen enemies discover his whereabouts; they laugh and jeer him at his attempt to escape. Again he flies, to be discovered anew, and finally the rest and relief of an asylum is sought, either voluntarily, or by the advice of friends, or the interposition of the authorities. Not all, however, flee from their persecutors; some turn upon them and seek to destroy. This is more especially the case when the voices communicate the names of the tormentors—it may chance to be of members of his family or friends, or the agents of secret societies; or the voices may urge him to destroy the first person that comes in the way, as the whole world is against him. Herein lies the danger of the paranoiac to society. He has not deserved the persecution; he has fled from it or shut himself up to escape from it, but he is chosen as a sacrifice; its originators are, except through the chance medium of the auditory hallucinations, unknown to him, and in his hour of despair vengeance is to be wreaked upon whom he can as a just reward for these crimes.

Throughout the entire course of the delirium the paranoiac is neither confused nor unnaturally depressed. He follows his con-

ceptions of the difference between right and wrong, although these are brought into accord with his ideas of the nature and course of the persecution; he accepts the malignant oppression not as it is the custom of the melancholiac to do, without resistance and as well merited because of his own sins, but opposes to the best of his limited mental abilities the inimical attitude of his enemies.

In the majority of cases of paranoia persecutoria the height of the delusional insanity is reached at this period, after which there begins a long process of regression and weakening of the mental powers. Hallucinatory and simple forms are not clinically separable, as it is only among the litigious varieties that delusions do not occur (Neisser). The patient remains for months or years without showing palpable intelligence defect, yet eventually a mental weakness is developed.

Fig. 33.—Head of a Paranoiac of the Tramp Class. From a photograph kindly loaned.

In the other one quarter or one third of the examples of this type the persecutory ideas are eventually relieved by the rise into the sphere of consciousness of a delirium of an ambitious nature. This change in the personality is achieved either suddenly or gradually. The long persecution, together with the influence of the consoling voices, eventually give the patient the conception that he is persecuted because of his great mental endowments, his exalted position, his great wealth; or delusions of a religious character, in which he is the world-saviour, a prophet, the chosen of God, or any one of a hundred others, are conceived in his disordered imagination. In dream or half-sleep he is visited by supernatural or celestial personages, and possibility becomes certainty. Castles in Spain on the most improbable order fill the mind of the patient.

At first, intermingled with these grandiose ideas are those of persecution, but in many instances the latter slowly recede, leaving the patient enrapt in pleasant ambitious deceptions. The newspapers are filled with his doings, and he is a universal object of notice and admiration; he is happy, though still irritable when his wishes and desires are contradicted. When the ambitious delirium arises suddenly, it is not infrequently after a period of stuporous or hysterical manifestations, the alogical conceptions of a religious or militant type proceeding out of the half dream-like state of ecstatic excitement.

The grandiose ideas of the paranoiac, while equally absurd as those of the paretic dement, differ from them inasmuch as they are of a fixed character, lasting over months and years, in contrast to the daily changing phantasmagoria of the paretic. In contrast also is the partly retained intelligence of the paranoiac, who will attempt to logically defend his delusions, while the paretic will state them as facts incapable of being disputed.

The further course of the persecutory paranoia is slow but progressive. Years may elapse before there is a well-defined mental weakening; even in patients that have lived ten or twenty years after the inception of actual delusions there is seldom anything approaching a terminal dementia.

Of the sub-varieties of persecutory paranoia the sexual type is the most frequent. The delusions now appertain to the sexual apparatus, arising from neurasthenic or masturbatory antecedents, or actual disease of the reproductive organs. Jealousy is a frequent symptom in paranoiac women; the husband is untrue, even copulates, while the lawful wife lies in the same bed, with unseen females, whispers to them in the street or in corridors, or makes signs to them on the highway. All the friends and neighbours sympathize with the maltreated wife, and the peace of the home departs forever. The most insignificant actions are misconstrued, and bitter recrimination is the daily bread of the household. "What frenzy dictates, jealousy believes." The woman, according to her nature, becomes either a martyr or a virago. Religious ideas help to sustain the former attitude, and strange interminglings of sexual feelings and religious exaltation are met with.

It is somewhat doubtful if the cases of so-called litigious insanity belong strictly to the paranoias, and are not rather to be classed with the ethical imbecilities, as the subjects show more somatic anomalies and a greater degree of intelligence defect than the average persecuted paranoiac.

The mental obliquity is different in so far that the persecuted now become the persecutors, ofttimes appealing to the law as a means of bringing them into unusual notoriety. Repeated failures to attain their aims are only met by renewed efforts to reach the goal. The litigants deem themselves deceived by their legal counsel; they study the law, make endless notes to be used in the court room, and are always martyrs in the hands of mistaken justice. Eventually many of them become actually insane, and have to be confined in an institution, there to bewail their fate, calling the judges and lawyers thieves and scoundrels, and writing letters to every functionary in the State, until they finally attain a mild degree of weakmindedness.

The Ambitious Paranoia

Perseeutory ideas are, in this second chief division of the disease, replaced by ideas of pre-eminent self-importance. The patients are world poets, founders of new religions, reformers and saviours of mankind, prophets, women "clothed with the sun," or Don Quixotes seeking after an unattainable love, a pursuit which leads them into the most ridiculous achievements.

Krafft-Ebing divides these several types into three chief groups: the reformers, the religious, and the erotomaniac paranoiacs.

To the first belong the one-sided or mentally inferior persons, who have an exalted and unwarranted idea of their own importance. The patients are fantastic, self-centred, noise about their wonderful achievements, are readily irritated to violence. Vague hallucinations mingle in with their fantastic personality. Voices are heard ordering them to achieve a mission for the reformation of society, to go on journeys to some distant spot, there to obtain the power to complete their discoveries in mechanics or natural sciences; or divine inspirations are received. Still these persons retain, partially, the power of logical thought, are only on the boundary line of insanity, and are often somewhat original and interesting members of society, until their delusions become too absurd, and the constant desire to shine forth with their pre-eminent talent or reformation schemes becomes too irritating to be longer borne by the community in which they mingle. Provided his plans are assisted and furthered, the reformer or inventor is willing to bear every deprivation to attain his ends, to starve, or preach without tiring day after day and month after month; but, if opposed, he is ready to crush all before him. These individuals are not really produc-

tive; their logical and critical faculties are faulty, and their powers of mental assimilation defective.

Times of war and distress transform their inspirations into active delusions; the eccentric becomes the demagogue, ready to redeem a people or to annihilate it. Many of these reformers eventually find their way into insane asylums, there to continue their crusades against the existing order of society, but, fortunately for it, harmlessly.

Religious Paranoia

The subjects of this form of the disease stand on a little lower plane of mental development than those belonging to the last subtype. Women are more frequently affected than men. In youth the patients are noticeably deficient, or at least one-sided in evolution; they are apt to run after fancies, and are terrified by night visions. At the time of adolescence they begin to evince a tendency toward certain phases of religious life; they undertake long fastings, attend revival meetings, become excited, and at times uncontrollable. The pulpit pictures of heaven and hell are presented to their minds as veritable truths. The eventual upset usually follows a time of prolonged abstinence, the excitement of a revival meeting, or onanistic sexual excesses. It is this class of paranoiacs that make the lives of ministers miserable by their constant attentions, evident hystero-sexual inclinations, and general tendency to excesses of every kind, provided only that it bear the name of religion. To attend church and listen to exhortations is to them the *summum bonum*, their elixir of life; home duties are slighted, the members of the family neglected, the mealtimes forgotten; "all things are counted but loss" in the ardour of religious fanaticism.

In the more pronounced examples hallucinations follow the ecstatic fancies. In dreams, or as the result of perversions of the special senses, they feel the inspiration of God fall upon them; they see the heavens open and angels descend to give them celestial messages, to tell them to go forth and prophesy, for they are the beloved of Christ. Delusions follow in order the hallucinations; they become in their own right prophets or Messiahs. In the case of women, sexual perversions may occur. In half-sleep, sexual excitement of a vivid character takes place, equivalent in sensation to coitus, and soon delusions of pregnancy follow; the favoured woman is to be delivered of a holy child who is to redeem the world from its wickedness, a greater and more powerful Son of God than Christ, who shall bind the devil after a space of time, and free humanity.

These delusions are often manifold, though co-ordinated systematically. No reasoning can undermine their foundations, and although opposition and ridicule may for the moment make the patient doubt the correctness of her conceptions, certainty returns after an hour of reflection. These persons support their alogical misconceptions by diligent reading of the Bible, misapplying passages to their individual aims, stultifying the sense of the Word. I saw, in one instance, hundreds of verses throughout the Holy Writ indicated by peculiar characters, one mark designating the passages justifying the ambitious delusions of the patient, another those denunciatory of her enemies, the wrath of the day of judgment being foretold in them.

Only a complete acquiescence with these delusions renders life supportable for those around such patients. The slightest opposition calls forth the powers of wrath, the opposer is denounced as the child of the devil, and the fires of hell are heaped upon his head.

Patients of this class are, as a rule, unbearable in the community, and soon find a place within the walls of an institution. There the delusions continue, the loss of liberty is regarded as a consequence of their holiness, and the institution as a place of martyrdom, whence they are to be translated to the heavenly realms. Ofttimes this translation is to be corporeal as well as spiritual; they are to attain rest without seeing death, or to live until the day of judgment, when they expect to play an important part in the world's salvation. These delusions continue until the sufferer is removed by the course of some intercurrent physical disease, or, in other instances, until the long continuance of the malady has rendered them weak-minded, less obtrusive, and more useful members of the asylum community.

Comparatively few of these patients are really dangerous as long as they are unopposed, though occasionally such an one may receive the command of God to destroy the life of some sinful individual, and in so doing promote the welfare of society. On opposition, many become violent, fanaticism in the sane or insane being universally intolerant.

The medical treatment of these two forms of paranoia is, so far as any hope of cure is concerned, without avail. The bromides and morphine, by obtunding the sensibility of the brain, may lessen temporarily the vivid character of the hallucinations, or reduce a state of ecstasy, but their influence on the progress of the disease toward weak-mindedness is of no value.

The Erotic Paranoia

This form is rare in its complete development. The gist of the delusions lies in an imaginary love which has been aroused in some person of the opposite sex, usually much above the patient's own social standing. As a consequence the desire is ordinarily of a secret, mysterious, and platonic character, the actual sexual excitement finding vent in perversions of the natural sexual instincts, especially onanism.

The subjects of this variety of paranoia are commonly psychically and physically undeveloped, society-shunning individuals, who look upon members of the opposite sex from a distance, and form romantic ideas not only about them, but also of their own personal qualifications. Every peculiar toilette, a chance word overheard in passing, a glance, or the waving of a handkerchief, have for such an individual a peculiar romantic meaning. His love is an open secret to every one; the maiden of high estate bestows favours upon him, but from the opposition of the guardians the mutual affection must be unknown. All communications between them are necessarily in secret fashion; articles of dress, a flower, announcements in the newspapers, the flight of birds, have all a mysterious meaning.

In the night season sensory deceptions are overpowering; the kisses of the beloved are felt upon the brows, delicious odours are wafted into the bed-chamber, all impossible fantasies are indulged in, ofttimes mingled with ideas of personal unworthiness. All must be secret, and not rarely the delusions pass for years unnoticed, until in the fulness of time, when the bridegroom is ready for the bride, he begins to attract attention by his fantastic following of some woman upon the street, or by his visits to the house of the elect's parents to claim his own. Met with rebuffs, or given into the hands of the police, he not infrequently adds a delusion of persecution to his other symptoms. The lack of logical criticism in these patients, considering the fact that many of them have acquired a fair education and are able to reason fairly well upon other subjects, is astonishing. They cannot be made to comprehend that their attentions, photographs, and constant letters are distasteful to the objects of their desires. In the long course of years a mild dementia begins, which relieves most of the prominent symptoms, especially the hallucinations, and renders life more tolerable.

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PERIODIC INSANITY

The Borderland of Insanity

At times in the life probably of every man or woman there are periods of depression or exaltation which recur with a certain degree of regularity. These conditions often depend upon the state of physical health, the change of the seasons, the amount of physical or mental work, accomplished or to be done, or any one of a thousand intrinsic or extrinsic factors. Periodical differences are also noticeable in the capacity for mental labour; writing and study, for example, being difficult one day, while on the morrow all goes smoothly and easily. In man the sexual instincts ebb and flow with a periodicity that is well recognised, an analogue to which is found in the lower animals, in whom the acme of the procreative desire is reached in the spring-tide, whence the special name, the "rutting season."

All of us can recall instances in associates or comrades in whom the periodic disturbances have been just a little more pronounced than in the above examples. To-day we find an acquaintance emotionally elevated, the next time we meet him he has the "blues," and in the place of being lively, he is taciturn and depressed. Ask him the cause of his exaltation, he can give no reason except that he feels, physically, unusually well, but adequate cause for the high good humour is lacking. Many of us are also duller in the morning than in the evening; the early hours are filled with gloomy forebodings, which, as the day grows older, vanish, and are replaced by a sense of well-being.

A step further, and we come to a class that spend their lives in a see-saw between depression and pleasurable exaltation. Such individuals are either gloomy, easily irritated, or profoundly depressed by the most trivial incidents, such as an unmeaning glance from a passing stranger, or a word overheard and interpreted into personal ridicule. At other times they are joyous, easily excited, run eagerly after pleasures they would shun in the other stage, but

withal are reasonable, perfectly coherent in thought and action, and in no way overstep the physiological limit of sanity, whatever may be their failings in the matter of common sense. While we must recognise this last class as unstable, and not to be depended upon in every emergency, they may never in the course of their lives do anything which would justify us in classifying them among the insane; we may hold them to be labile and nervous, but not alienated.

A consideration of these alterations within physiological limits, in the daily humour of many persons, enables us to understand more clearly the forms of insanity of the periodic type. When upon an ordinary unstable brain—unstable in the sense that the mental equilibrium is deficient—we bring to bear a strain such as belongs to the age of puberty and adolescence, that being the period of active growth and expansion of the association centres, to the periods of ovulation, the menopause, to disaster or failure, we frequently find that the physiological boundary is quickly overstepped, and the person becomes affected with one or other of the forms of the psychoses, depression or exaltation, and that now the moods, cravings, and tempers become dominant.

The periodic insanity is always founded upon the ground-work of an hereditary predisposition. The father, mother, or both, have been "nervous," neurasthenic, or have themselves suffered from the same form of recurrent excitement or depression which is reproduced in the offspring. To this general class belong a host of mental affections, the majority mild in form, a few more severe. Some of these patients have attacks of periodical mania, others of melancholia; or the mania and melancholia may alternate, the disorder taking the form known as *circular insanity*. Again, there may occur at intervals uncontrollable impulses to sexual excesses or drunkenness, the insanity sometimes manifesting itself in women with every menstrual flow; or more rarely there may be periodic attacks of stupor, with suppression of the secretions.

The inception of any one of these forms is found to occur either during adolescence or in late middle life (in women at the climacteric), two epochs in the life of man which are dominated by the important adjustments and changes in the relations of the sexual mechanism to the central nervous system, and burdened with the development or beginning retrogression of cortical fibre associations.

Before the age of puberty few average children show indications of approaching mental disturbance, unless the hereditary pre-

disposition is very strong; these exceptions should be relegated to another class, that of the higher imbeciles, in whom all types of mental disorders are rife.

Among the children of the higher types of degenerates we find a certain number that early become the slaves of onanism, or chafe under the discipline of the home or school. They are irritable and moody at times; they withdraw from their associates, leave their play, and mope for days; they show an inaptitude or even actual dulness of comprehension in learning the school lessons, and for a while even retrograde in their studies, but soon take a fresh start forward, and for a time progress rapidly. These children are candidates at a later age for the periodic insanities; they may escape during adolescence, only to fall victims in the retrogressive period, from forty-five to fifty-five years of age.

Many show the customary stigmata of degeneration, the early synostoses with consequent cranial deformity, malformations of the hard palate and ears, as well as defective innervation of local cutaneous surfaces.

The onset of *puberty* is particularly trying for the female sex, for in addition to the development of the higher association-centres of the cortex, joined to the approaching maturity of the reproductive organs, there is not infrequently added a monthly cycle of physical discomfort and pain, which often renders even the mentally sound woman fretful, peevish, and subject to vague longings and desires.

When, besides the trials and stresses incident to this epoch of life, we have also an inherited instability of the nerve tissue, it is obvious that even a slight addition to the burden already carried may be sufficient to destroy the equilibrium, and produce a mental upset. This, when once inaugurated, is liable to continue; and even if it passes off, may again be evoked at times of undue stress, and will probably recur at various times throughout life, unless proper prophylactic treatment be begun at once.

On account of these etiological factors periodic insanity is more common in the female than in the male sex, although this is not true for every form. The melancholic and the circular varieties, and, of course, the menstrual insanities, predominate in women; while with men the periodical mania, the dipsomania, and the impellent sexual acts are more frequent. All types (the menstrual excepted) do occur, however, in both sexes.

The cardinal features of all the various forms are the brusque beginning and the tendency for the insanity to recur at regular or

irregular intervals, it may be of days or weeks, perhaps even of years, the cycle of the disturbance in each attack being of a precisely similar nature, though not necessarily of the same duration.

A third characteristic, with only rare exceptions, is the mildness of the various disturbances; the victims are seldom found within the walls of asylums, but are more commonly seen in outside practice.

Again, the mental disorder in these milder forms does not usually tend toward dementia, unless in the case of patients who labour under a severe hereditary burden, but the *restitutio ad integrum* during the interval between the attacks is in a great measure complete. Thus an individual may have half a dozen or more attacks of mania, and even after the last recurrence it may be difficult to determine any marked degree of mental enfeeblement.

Furthermore, the periodic insanities are more directly amenable to appropriate treatment than any other form of hereditary trouble.

The periodic psychoses offer fewer signs of grave disturbance of the lower functions of the nervous system than the majority of mental derangements, even in the severer forms. The deep reflexes are neither depressed nor exalted; the pupillary reactions are unchanged, the digestion is seldom disturbed to a pronounced degree. The urine, however, may be diminished in quantity as well as in its total nitrogenous contents during the stage of depression (circular form), while in that of exaltation the flow as well as the total amount of the nitrogenous substances may be markedly increased. In those cases, however, which have originated directly from an antecedent anæmia, the state of the reflexes may be much altered from the normal, there being usually increased activity; while the iris reactions, on the other hand, are slow, and the pupil is in a state of moderate dilatation.

The condition of the arteries in the several varieties is of practical interest. For example, in the melancholic stage of the circular form, as well as in several other types, there is vascular spasm with weak, unsteady pulse, and every indication of temporary anæmia of the cerebrum and of the extremities. In the maniacal stage, on the other hand, the condition is reversed; the pulse is full and throbbing, the pressure great, the face and extremities are flushed, and there is probably hyperæmia of the cerebrum.

Basing his views upon these alternations of hyperæmia and anæmia, Meynert has put forward a theory which would ascribe the disease to variations in the influences exercised by the vaso-

motor nerves. But even granting that vaso-motor cramp or paralysis is present in all cases, the theory is deficient, inasmuch as it does not determine the cause of the neuro-vascular disturbance antecedent to the mental symptoms. The other theories of the trophic origin of the disorder, which have been advanced (Meyer), are, however, still more improbable. Our knowledge of the vascular condition of the brain, in health, or in consequence of the action of drugs, is still unsatisfactory, and whether we have at times a general or only a local congestion of the brain is unknown, though it might be assumed that under certain conditions there may be present an anæmia of the cortex with hyperæmia of the basis cranii, as happens, for instance, in morphine poisoning. It is also supposable that previous to these congestions there may have been an accumulation of the toxic products of incomplete tissue metamorphosis resulting in an outbreak of insanity in a constitutionally labile person, in the same way as an attack of acute gout follows the piling up of the acid urates in the blood.

THE PERIODIC MANIAS

As we have seen, the characteristics of this form of pathological excitement are the frequent recurrence, rapid course, and the apparently complete restitution to mental health. The duration is from a few days to several months, the symptoms are mild, the degree of reduction is rarely profound, and the patient is completely restored. The diagnosis cannot be made at the onset of the first attack, as the disorder may present every likeness to the ordinary primary simple mania. As mentioned in a previous chapter, Kraepelin would class as "periodic" all cases of mania that have recurred in the same individual, and even if the patient had had an attack of excitement at the age of twenty, and not another until his fortieth year of life, he would still call the case one of periodic insanity, although, strictly speaking, there has been no recurrence at stated times, but simply a return. It would seem better, perhaps, to adhere to the older nomenclature, and see in these instances simply a relapse from an ordinary attack of idiopathic mania.

The cardinal *symptoms* of mild periodic mania are three in number: facility and ready flow of language, impulses to continued action, though the work accomplished may be inconsiderable, and preternaturally high spirits, without the presence of hallucinations, delusions, or mental clouding. The thoughts and mien of the affected

individual may be fantastic and unstable, but there is nothing approaching an insane delusion.

Somatic indications at the inception of the attack may be absent, or there may be an ill-defined period of morbidness, loss of appetite, an icteroid hue of the skin, and a general appearance of increased age. Suddenly these symptoms disappear; the man or woman looks younger and becomes full of life; the eyes sparkle, the expression and mimetic motions alter with lightning rapidity; speech is more than normally fluent; quick, often sarcastic repartees are returned to questions; the tendency to see the weak side of his fellow mortals is uppermost, and a degree of excitability is apparent, which rapidly increases to its maximum.

This excitement is of a pleasurable nature, and is mingled with feelings of self-satisfaction and confidence. Natural cautiousness is now forgotten, new projects beyond the limits of common sense are undertaken, speculations are indulged in, journeys without object are begun, love affairs, before in the background, are taken up and pursued with avidity, or new ones are sought after. Persons who have previously followed a quiet mode of life seek frivolous society or the pleasures of the drinking-hall, and, in fact, give way to excesses of every description.

Through every act or thought the intense mental impulse to movement and freedom is encountered, the individual flying from one project to another with surprising fickleness, while any opposition results in outbreaks of peevishness, scorn, and angry recrimination. The person at this stage is in identically the frame of mind that can be noted in excitable persons in the early stages of drunkenness, and he retains just about the same degree of capability for correct reasoning as the inebriate, and to a certain extent is responsible for his acts. Sleep at this stage is much disturbed; the individual may rest for an hour or so, but soon, as some new impulse or project is conceived, seeks a vent for his restlessness in constant movements, long walks, or aimless running to and fro. The bodily weight also tends to fall off at this time, not so much from any want of appetite or failure in assimilation, as that the person, driven hither and thither by the constantly changing impulses, neglects his regular meals, takes food at irregular intervals, and only a few mouthfuls at a time, being now too much absorbed to be able to attend to such seeming trifles. The total quantity of urine at this stage is considerably increased, either because a large amount of fluid is taken, or because the arterial pressure is increased.

After a period of days, weeks, seldom months, there comes a stage of exhaustion, the beginning of the decline of the exaltation. The patient now feels weary and faint, mentally worn out, and is slightly depressed; soon he passes into his normal state, the convalescence being customarily quite rapid.

Fig. 34.—Periodic Mania. This patient had many attacks of excitement. Eventually she became somewhat demented. The photograph was taken during one of the phases of excitement.

More rarely than the above described form, the malady may assume a severe aspect, the patient presenting a striking resemblance to the customary clinical picture of typical mania, the motor agitation being extreme, the logorrhœa great, and the incoherence pronounced. The majority of these cases, however, have none of the prodromal indications of idiopathic mania, but the inception and decline are equally sudden.

The *prognosis*, in all except the most severe cases, where the excitement reaches a state of frenzy, is extremely favourable; only rarely are there after-symptoms of mental decline. Above all, there is a good prospect of aborting the attacks at their onset, and of lengthening the intervals between them.

Treatment.—Various methods of aborting the attack have been advised; the injection of morphine, the exhibition of bromides, of quinine and other drugs—all have their supporters. But in my hands such measures have not been attended by any marked success. On the other hand, for several years I have used belladonna with almost uniformly good results. The drug apparently relieves the cerebral congestion at once, and if continued for a while definitely cuts short the attack. Once commenced, it must not be stopped until the attack is over, otherwise a relapse is certain to

occur. My use of the remedy dates from several years ago. I first employed it on purely empirical grounds, and having found it efficacious in a number of cases, I have since continued to give it, usually in combination with salol and nux vomica. The dosage can only be regulated by the amount requisite for the production of the physiological effects of the drug, dilatation of the pupils, and dryness of the skin and mucous membranes. Usually one eighth to one sixth of a grain of the extract every three or four hours is sufficient. Very recently Hitzig has published a paper advocating the same treatment; atropine by subcutaneous injection being used by him with equally good results.

Fig. 35.—A photograph of the same patient after she had attained to a degree of mild dementia. The placid expression of the face is in strong contrast with that in the preceding picture. Both cuts are from photographs that were kindly loaned.

PERIODIC MELANCHOLIA

The *periodic melancholia*, unlike the equivalent form of mania, is an affection not of early but of advanced life. It is somewhat less frequent than the exaltation, but, nevertheless, is comparatively often encountered.

In women it is ordinarily a post-climacteric trouble; in men it follows business failures, money losses, or ill-success in their life-work. Inherited instability is by no means so prominent a feature as in the already described form, but the vesania is, nevertheless, built upon the ground-work of nervous lability. In several cases I have seen the disease transmitted from parent to child, taking the identical form, and reappearing in the descendant at about the same age as in the parent.

This form of mental trouble is pre-eminently characterized by its mildness and the tendency to return at regular or irregular intervals. It is nearly always a pure, reasoning melancholia, without delusions affecting the personality, as of personal sinfulness, or of

the soul being doomed to eternal damnation. It is rather a simple depression of the intellectual faculties without reduction to a lower level. This depression is recognised by the individuals as beyond the physiological limit; they strive to the best of their ability to overcome it, but succumb to the overpowering languor and gloom. Agitated and stuporous states of a pronounced type are rare, as there remains self-control still sufficient to ward them off.

The inception of the disease is slow, and is ushered in by sleeplessness, headache, neuralgia, arterial spasm with frequent pallor and coldness of the extremities, a small pulse, gastric disturbances, constipation, a foul tongue, a rapid falling off in the nutrition from anorexia, an insufficient secretion of urine, præcordial anxiety, and general *tædium vitæ*, with marked inhibition of thought and memory.

In the mildest forms of the affection there may be nothing more than a feeling of mental distress or sorrow, with a degree of inability to pursue the ordinary duties or business. These symptoms come on at certain intervals, usually in the winter and early spring, but the condition hardly proceeds to an actual melancholia even of the simple type. Not a few of these patients will go through the warm months of the year in comfort, or even with a sense of mental well-being and full capacity for work, only to fall victims to the depression during the colder weather. Evidently there is some relation here between the retardation of the skin and urinary secretions, the defective assimilation, and the immediate factor inducing the attack, the vascular spasm.

Certainly measures which bring about a relaxation of the arterial contracture, and the flushing out of the channels of excretion, have an immediate beneficial influence in cutting short or aborting the attack. It would seem that we have here something analogous to the paroxysmal seizures of the epileptic, which also recur at stated periods, and which, as has been fairly definitely proved, are preceded by an accumulation within the organism of waste tissue products, that are eliminated immediately after the convulsion.

When the interval of depression begins the patient immediately looks older by years than he did a few days before. He withdraws from the society of his fellow-men, is gloomy, despondent, neglects his correspondence and affairs, but remains capable of conversing intelligently. On adroit questioning he will tell you of his gloomy forebodings, his incapacity for work, and his restless nights, but denies all delusions, or the presence of any unnatural anxiety, and is

manifestly not suicidally inclined. The world, however, appears to him through distorted glasses; everywhere is darkness and gloom.

The disease may reach a point of intensity much beyond this phase, particularly if there have been antecedent attacks. Actual retardation of thought comes on; interest in family affairs or friends is entirely lost, the patient remains for days sunken in self-examination and introspection, and even vague delusions affecting the personality supervene. Night is dreaded, not only on account of the attendant sleeplessness, but because the morbid thoughts have freer play, when the correcting influences of daylight and of familiar surroundings are removed. Suicidal impulses must now be guarded against; indeed, it is never wise to trust any melancholiac, no matter how mild may be the degree of the affection.

Diagnosis.—Neurasthenic depression, and the possibility that the attack is only the beginning of general paresis, must be thought of in this connection. Indeed, the diagnosis of "periodic melancholia" can only be made out with certainty when a recurrence has taken place.

In the *treatment* of cases seen early enough, efforts should be made to render the attack abortive. The exhibition of belladonna is almost equally effective here as in the form just described. Asafœtida in combination with belladonna is useful, as it induces a distinct sense of well-being in those patients not too profoundly depressed to feel the beneficial influence of any drug.

The frequent administration of light, nutritious food is of the utmost importance. Baths and other hygienic measures should never be neglected; broadly speaking, the treatment is similar to that of the idiopathic melancholia already discussed.

CIRCULAR INSANITY

The frequency of habitual alternating gloom and unmotived exaltation in the feeble-minded class, the high imbeciles with strong hereditary defect, renders it more than probable that circular insanity is only a pathological expression of the physiological variation between exaltation and depression so frequently noticed in certain types of the degenerate. It is equally true, however, that many of the subjects of circular insanity are of fair intellectual development.

The disease is always developed upon the ground-work of an inherited defect, the affection recurring in the offspring in the

same type as in the ascendant, or beginning *de novo* upon the basis of an inherited neurasthenia, alcoholism, or other ancestral neurosis.

The circular form of insanity is more common among females than males, and begins at puberty or in early adolescent life. It is characterized by an alternation of melancholic and maniacal states, the melancholia passing into mania, to be followed by an interval of complete lucidity; then again in order come melancholia, mania, lucidity. Other combinations are seen, such as melancholia, lucidity, mania, lucidity, melancholia; or there may be no free interval, the melancholia and mania alternating throughout the life of the individual, the excitement and depression being sharply separated, and the transition from one to the other occurring during sleep or after slight prodromal symptoms.

Apparently there is no hard-and-fast rule for the duration of each period. The melancholia may last for days, months, or years, the mania for an equal length of time, while the lucid interval may be short or long according to the nature of the case. In one patient, who has now been under observation for about five years, the stage of excitement lasts for six weeks, the melancholic period four weeks, and the interval only one week, the entire cycle being completed in a space of a little less than three months. This case presents a phase exactly contrary to the ordinary rule that the melancholic state is usually longer than the maniacal condition. In another patient the melancholic period continues for six months, and is followed immediately by a state of mild exaltation lasting precisely the same length of time, which is again succeeded by the depression.

Probably the larger number of instances of the circular form of insanity, owing to the mildness of the types, never come before the physician, or are only brought to his notice during the depressive stage, when the host of attendant incidents peculiar to the profound despondency alarm the friends and lead them to seek his advice.

Perhaps during their school days it is noticed that the girl or boy is subject to fits of depression, which in due course of time change to a lively, frolicsome humour. In the depressed period the child is mentally slow, inattentive to his books, makes little progress, and withdraws himself from his associates. Play has lost its interest, there is unmotived fear, or the obtrusion of hypochondriacal whims. Soon the scene completely changes. Black Friday has become Easter Day. In the place of being slow, reticent, inapt, the child is now joyous and obtrusive; lessons are

learned with ease and facility, lightning progress is made, the memory is retentive, apathy gives place to displays of passion; and then, without warning, all this is lost and the cycle begins anew, to be repeated to the end of life.

The milder forms show little difference in the mental symptoms from the simple manias and melancholias, but the corporeal indications are interesting. In the melancholic stage the appetite fails, the arteries are contracted, the pulse is weak, the tongue foul, the skin dirty; sleep is in abeyance; the patient appears aged; he is incapable of mental exertion; the urine is scanty in quantity and high coloured, and the bodily weight steadily decreases.

Fig. 36.—Circular Insanity. This patient was regarded as a bright boy up to the age of puberty, about which time he had his first attack of pathological depression. This was followed by a period of elation and excitability, during which he ran away from home. Finally, he gave so much trouble as to require to be placed in an institution for the insane. During the following ten years he had periods of short depression succeeded by others of elation. When depressed, he was orderly and docile; when elated, he had schemes of matrimony and business enterprises which were never well considered nor adequately carried out. The facial expression is indicative of mental incapacity, and the ears are deformed. From a photograph kindly loaned.

Suddenly, usually after a night's sleep, the individual arises, feeling perfectly well, mentally capable, even joyous; the eyes are bright, the gait is elastic, and the man looks ten years younger than he did the day before. Work is begun with eagerness; correspondence, affairs of all sorts, that have lapsed during the period of inertia, are taken up and despatched with rapidity and correctness, while new plans are projected and carried into effect. The arteries are now full, the pulse is bounding, the skin rosy, sleep is short but refreshing, appetite and digestion return, and the urine is secreted freely and often in large quantities, while the bodily weight progressively increases. This state of

fiery activity lasts for a time; then follows the reaction from over-stimulation and constant mental strain, and the melancholic phase is begun anew.

In some severe types, depression, even stupor, alternates with maniacal fury, necessitating confinement in an appropriate institution for life, or absences only during the sane intervals. The cases do not differ from the milder forms except by the intensity of the symptoms.

The *diagnosis* of circular insanity can only be made upon the basis of an indubitable history of the case and of the family record, or after observation for months or years. Pathognomonic is the sudden inception of a melancholic or maniacal outbreak at the age of puberty, or in women about the time of the climacteric, which runs a course of a few weeks and suddenly ends during sleep. The repetition is then to be expected, as it is, in fact, in all examples of excitement or depression which end suddenly and have no recognisable after-symptoms.

The differences in the arterial conditions in the melancholic and maniacal periods, the sudden increase in the flow of urine in the stage of exaltation, the slight diminution or even gain in bodily weight during the period of elation, all help to confirm the diagnosis of circular insanity.

The *prognosis*, owing to the hereditary taint prominent in all forms of the affection, is nearly always unfavourable, not so much for the outcome of a single attack, but for the ultimate freedom from their recurrence. At the same time a certain number of cases, when properly treated, recover, which they will not do if allowed to follow their own devices, especially when alcohol is indulged in. Even in the most severe types the tendency to mental decline under the repetition of the attacks is exceedingly slow, and profound dementia somewhat rarely results. In the milder forms the attacks are repeated over and over again, without inducing indications of mental degeneration.

The *therapy* is not usually so capable of favourably influencing the ultimate course of the disease as in the forms of periodic disorder already studied. Atropine is still the best remedy at our disposal for abridging the attacks, but it is doubtful whether it can do more than shorten them. Hyoscine and the bromides have advocates. The best treatment of all consists in the withdrawal of the afflicted individual to a quiet country life, where he may enjoy to its full extent exercise and open-air amusements, and cultivate quiet

hobbies that will afford at once instruction and entertainment. The somatic indications (obstipation, etc.) should not be neglected during the melancholic stage, proper treatment in this direction tending to shorten the duration and render the affection milder. It is unwise to attempt to force melancholic patients to take journeys, to go into company, or visit baths. They need, while husbanding their strength, to have a proper amount of diversion of a kind not to be obtained in hotels and caravansaries. At the same time, confinement to bed is seldom necessary, except when a temporary lightening of the duties of the attendants is absolutely imperative, which sometimes happens when there are impulses of a suicidal nature. Drives in the fresh air, plenty of good, healthy exercise obtained by walking in the country, are strongly to be recommended; in this respect the melancholic is not likely to overdo his strength. Prolonged tepid baths are of service in increasing the action of the skin, and in this way helping to eliminate waste tissue products. Opium is to be avoided, and alcohol is only to be used to relieve distressing anxiety.

THE MENSTRUAL INSANITIES

This form of periodic insanity is of sufficient importance and frequency to justify a short description.

Slight deviations from the normal disposition are frequent with the vast majority of women at the time of ovulation. Usually such changes do not proceed beyond indefinite longings, peevishness, and a more than ordinary irritability. If, however, the woman has an unstable brain, whether inherited, or acquired in early childhood, the altered mentalization sometimes reaches a lower level, and signs of psychical disturbance appear, which, however, may be strictly confined to the periods coincident with the menstrual discharge.

Excitement is in these cases more frequent than depression. The beginning of the trouble is abrupt, the decline almost equally sudden.

The *pathogenesis* of the disorder is probably to be looked for in the sympathetic disturbances of the circulation naturally present at these periods, inciting spasmodic contraction of the cerebral arteries, and inducing venous stasis or retardation of the return current.

As a rule, the greater the instability of the individual the more pronounced the tendency to an early appearance of the mental dis-

turbance. Seldom is the inception later than the twenty-fifth year. The mania may come on before, during, or immediately after the menstrual flow.

There are the usual prodromata: sleeplessness, headache, flushings, gastric disturbance, irregularities of the circulation, and an increased secretion of urine. Then ensues a sudden outbreak of active excitement, often controllable, though now and then verging upon maniacal frenzy. Hallucinations of an erotic or pleasurable order occur, or the patient may fall into a dreamy state, broken now and then by active visual hallucinations, in which figures are seen, scenes upon the stage of a theatre are enacted before the patient's eye, or imaginary journeys are taken and recounted in detail.

From this condition the patient sometimes passes into a state of stupor, and if roused becomes irritable to an intense degree, or even violent. Hysterical symptoms are frequently present. In mild cases this state of altered mentality lasts from a week to ten days; in the more severe instances it persists longer, the mental reduction, which is usually profound, being noticeable throughout.

Finally, the patient passes into a deep sleep, from which she awakes mentally normal, but weary, unequal to exertion of any kind, a feeling which disappears within a day or two.

Having once made its appearance, unless active measures are taken the disease is only too apt to recur at each menstrual period. The identical form of mania is not necessarily repeated at each attack; in one, stupor may be more prominent, in another, acute excitement. As time elapses, and the influence of certain irritating factors (dysmenorrhœa, ovarian congestion, Fallopian colic) are not allayed, the attacks become more and more severe and prolonged, with the result that the person may become chronically insane and eventually demented.

The *prognosis*, on the whole, is not unfavourable if therapeutic measures are begun sufficiently early. Abnormalities in the menstrual flow from displacements of the uterus, or inflammation of the Fallopian tubes, should receive appropriate gynæcological treatment. Constitutional depravities, as anæmia, should be combated by a nutritious and well-regulated diet and by preparations of iron. Hydrotherapeutic measures should not be neglected. Belladonna and the bromides tend to cut short or lessen the severity of the attack. Rest in bed is indicated in all cases in which it is possible to keep the patient quiet.

The time for *treatment* is in the interval between the periods when diet, iron, and baths can have a more decided effect. The administration of belladonna should be begun a few days before the time for the catamenia, and the drug should be pushed to the production of its physiological effects, and continued until the cessation of the flow. It may be combined advantageously with aloes, asafœtida, and nux vomica, the last in small doses. Iron in the form of the pepto-manganate is to be preferred, as it rather stimulates digestion than retards it.

ALCOHOLIC PERIODIC INSANITY

In a small number of alcoholics, especially in persons who have an hereditary predisposition to insanity, repeated attacks of delirium tremens, instead of bringing about a permanent psychosis of the persecutory delusional or demented type, lead to a form of periodically recurring insanity, the main features of which closely resemble the mental phenomena of acute alcoholic delirium, except that the tremor is absent. This periodic form may continue long after alcoholic liquors have been permanently withdrawn, and be repeated at intervals of a few weeks or months, the individual very slowly dementing in the course of years.

In several examples that have remained under observation for three or more years, and in which there was no history of mental trouble antedating the original attack of alcoholic delirium, after an interval which varies somewhat, but is usually from two to three months, the clinical picture of the original disease is repeated with slight modifications.

The delirium is preceded by a period of irritability and anxiety, without well-defined somatic accompaniment other than furring of the tongue and constipation. Then suddenly follows an outbreak of hallucinatory delirium, the subjects of the sense deceptions being always such as are common in alcoholics. The patients are tormented by worms crawling through their flesh or by insects upon their skin ; vivid flashes of flame appear before their eyes, the horrors of hell come upon them, the faces of dead relatives or numerous awesome forms of animals, or a multitude of other constantly changing deceptions terrify them. Aural hallucinations are less prominent than visual, but are not uncommon. One of my patients beheld the form of his mother who had been dead for many years, and the spirit addressed him and answered his questions. Olfactory

hallucinations are less frequent, though some patients speak of the foul odours around them.

The hallucinatory delirium at first does not last more than a week or ten days, but after the attacks have been repeated many times their duration is much prolonged, the lucid interval being correspondingly shortened.

The final dementia is of slow growth. Marked weakening of memory and of logical thought is only noticeable after many attacks, though in the end there is considerable mental reduction. Not a few of the patients pass into a condition of delusional insanity, the false ideas becoming of a persecutory type before the final stage is reached.

THE PERIODICAL DRUNKENNESS

Dipsomaniacs are found only among persons who have inherited from drinking parents an impellent and periodic desire for strong drink. When the impulse seizes them, time, place, and responsibility are as nothing in the face of the overpowering craving for the benumbing stimulant. And yet there is no pleasure for them in the wine-cup; they sit silent and alone; companions are shunned; their sole wish is to become profoundly intoxicated. If spirits are not obtainable at the moment, the next most convenient liquor is seized upon, whether it be hair tonic, one of the various essences, or turpentine.

Before the impulse to this excessive indulgence in liquor comes on there is a period of sleeplessness, headache, despondency, unrest, and mental anxiety, which paralyze the faculties and the energies. The first glass of alcoholic liquor alleviates the distress, but only quite temporarily, and the individual continues to drink to induce forgetfulness and oblivion. Glass after glass is swallowed, until at length the man shows the usual indications of alcoholic intoxication; but to attain this stage he has to take astounding amounts, much greater than would render the normal person helplessly drunk. Days pass in this fashion; more and more alcohol is imbibed, remissions now and then occurring. At length overcome, he falls into a sleep which is continued for many hours, and from which he awakes physically exhausted but quiet, and with an absolute distaste for alcohol, which lasts until the next attack. Delirium tremens may follow a debauch of this kind, and the consequent symptoms of collapse are then likely to be severe and protracted.

Treatment in an institution is our only possible resource for these cases; even then the alcohol has to be replaced for the time by some other hypnotic drug, opium, sulfonal, trional, or the like.

PERIODIC SEXUAL EXCITEMENT

Closely allied to the dipsomanias are the periodic attacks of intense sexual excitement, uncontrollable in character, satyriasis or nymphomania. The sexual perversion may be either homosexual or heterosexual, while in the intermission the desire is neither abnormal nor intense.

As in the periodic manias, in these cases also the inception is sudden, with insistent ideas of a sexual character. What in the normal state is disgusting and abhorred, now becomes pleasurable and indispensable; the man visits houses of prostitution openly and without shame; the married woman leaves her husband for intercourse with strange men, without thought of her honour or of her children. The abnormal excitement may endure for weeks, or even months, but as soon as it is over, shame and remorse are felt, together with a sense of weariness and mental lassitude, which disappear after a profound sleep.

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GROUP III

SUB-GROUP: PSYCHOSES ACCOMPANYING OR FOLLOWING CONSTITUTIONAL NEUROSES

THE EPILEPTIC INSANITIES

The mysterious affection known as *epilepsy*, with its cardinal symptoms of convulsive movements and loss of consciousness, may be presumed to have its source in the most highly developed regions of the brain cortex. In its train follow a variety of psychical disturbances, some permanent, others of a more transient character.

It seems to be of small import from what form of the disease the afflicted individuals suffer, whether it be the *epilepsia gravior*, the *epilepsia mitior*, or even the Jacksonian epilepsy; all, sooner or later, show deterioration of the intellect, or the periodic occurrence of graver forms of insanity. Nevertheless, it may be stated as a general rule that the earlier the disease shows itself, the greater the liability to mental deterioration and the more rapid the decadence; while in those persons in whom the attacks begin in the later years of life, the deteriorative process is much slower, owing to the stability of the nerve tracts acquired in youth and earlier adult life.

Idiopathic epilepsy is essentially a disease of childhood and of adolescence. Gowers found, among 1,450 cases, that in 23 per cent the attacks appeared before the age of seven, in 28 per cent between the ages of seven and thirteen, in 31 per cent between thirteen and twenty, and in 13 per cent between twenty and twenty-five years, leaving only 5 per cent for the later years of adult life. It is therefore pre-eminently a neurosis of the developmental period of life, beginning either at a time when the growth of the brain is at its maximum, or when the associative centres are attaining their full development.

Besides the true epilepsy there are a large number of convulsive troubles followed by loss of consciousness, which, though simulating in every detail the idiopathic form, etiologically have nothing in common with it, but come on in the course and as a result of some

other affection, such as chronic intoxications, for example, from lead poisoning, alcohol, or syphilis, or follow injury to the cortex of the brain or a hemiplegia. These epileptiform manifestations may also be followed by mental trouble, and for the sake of convenience are generally classed with epilepsy, although it would be far more preferable, for the sake of clearness, to assign them to categories of their own.

Epileptics that have had fits for years show a dimming of the reasoning faculties, defects of memory, alterations of character, a sinking to a lower plane of intellectual fineness, and, above all, a tendency to impulsiveness, irascibility, and a susceptibility to groundless dislikes. To this rule there are but infrequent exceptions. In many instances of the disease seen in general practice, the patients are irritable even to violence, unmanageable, careless of the sensibilities of their families or friends, and are among the most difficult mental cases to deal with. The physician is often consulted by the families of such epileptics as to the measures to be undertaken for their proper control. Unfortunately, such patients are not legally irresponsible, except at the moment of the attack; as a rule they will not submit themselves to treatment for any length of time, and, since the law regards them as free agents, forced seclusion is not usually possible until some deplorable incident has occurred.

As a general rule, when the insults are far apart, the mental deterioration is slow; when the attacks follow each other closely, the degradation is relatively rapid.

In the so-called idiopathic epilepsy, insanity, in its stricter sense, does not immediately follow the nascence of the disease, but appears only after the lapse of years. Furthermore, my own experience has been that the epileptiform manifestations based upon organic brain disease are much more frequently followed by the graver forms of insanity than are the true epilepsies. Where there is a well-defined pathological lesion, as from syphilis, it is presumable that the cause of the epilepsy and the cause of the insanity are one and the same, and the two conditions are to be regarded as the combined result of the general disturbance of the nutrition affecting the brain, particularly its higher centres.

The psychic type of epilepsy—the *epilepsia larvata*, or masked epilepsy—in which the fit is unaccompanied by tonic and clonic spasm, but consists solely in the transient loss of consciousness, is not free from forms of mental disturbance. Not infrequently, some of the most furibund phases of mania are the direct sequelæ of a

transient loss of consciousness without spasm. A large proportion of cases of sudden maniacal excitement, of a violent, impulsive character, but of transient duration, lasting only a few hours or a day, are nothing more than instances of masked epilepsy followed by blind, furious excitement. The subject of masked epilepsy and the consequent mania is replete with interest to the physician and the jurist, since such patients are prone to impulsive acts of violence and automatic states, in which the most complicated but entirely unconscious actions and crimes may be carried out without premeditation on the part of the sufferer, being also out of all accord with his character during his intervals of mental health.

The Mental Symptoms of Idiopathic Epilepsy

The mental symptom-complex varies very greatly in the several cases, but there are certain striking features that are common to the majority of them. All epileptics, no matter how mild and peaceful their usual disposition, show some irritability at a time antedating the insult by a few hours to several days, or immediately after they have passed from the comatose into the semi-conscious state. Delusions may also be present at these periods, when at other times there is no sign of grave mental defect.

Besides the irritability, impulsiveness is an equally characteristic feature. No form of insanity more frequently gives rise to assaults and murder than epilepsy, and in no form of alienation is the physician so frequently called to the witness-stand to determine the responsibility of the criminal.

Religious emotionalism is another strange feature of epilepsy. No class of patients in an asylum show such a perversion of the religious instincts as does the epileptic. He carries his Bible under his arm, recites innumerable passages from the Scriptures, mainly applied to his own aims, sings psalms continuously, is hypercritical, fault-finding with his associates and fellow-patients; but while one moment he is quoting the most peace-inspiring passages from the Book, the next he is begging piteously to be furnished with a weapon to kill some one who has annoyed or irritated him.

Pre-epileptic and post-epileptic delusions occur in a number of patients subject to excitement and present great variety. Very often they are of a persecutory nature; at other times the patients are harassed by the appearance of Satan, of demons, or even of animal forms. Hallucinations of sight are also frequent; perversions of the sense of smell, the idea that the air is filled with putrid

vapours, and similar conceptions, are less usual. Hallucinations of hearing, the reception of imaginary messages, communications from the Deity or other invisible presences, are met with in both the pre-epileptic and the post-epileptic states.

Unfounded aversions, especially toward their relatives or attendants, are common among epileptics, and tales of woe and ill-treatment are poured into the ears of strangers. Conscious anger may pass into uncontrollable mania at any moment, and homicidal acts characterized by a blind, unreasoning violence may be committed under the varying conditions of complete or clouded consciousness. No class of patients can plan more skilfully to conceal their wrong-doing than the epileptic, and it is ofttimes impossible to decide whether an assault has been committed with full consciousness or in a transient but blind epileptic fury.

EPILEPTIC VESANIÆ

The *epileptic insanities* are readily divided into classes, according to the peculiarities of the manifestations in the particular individual and according to the cause of the disease.

1. **Epileptic Dementia.**—The most numerous class of epileptics show, after the lapse of years, a slowly progressive dimming of the active perceptions of the mind, a loss of memory, a blunting of the affections, a permanent mental obtuseness which increases and grows until, if the patient lives long enough, there is a more or less absolute annihilation of all the faculties. Throughout the course of this progressive enfeeblement there are no signs of any active insanity, motor disturbances, delusions, or hallucinations; only an increasing obscuration of the intellect is to be noted. The final result is probably eventually brought about by the repeated paralyses of the muscular coats of the vessels, consecutive to the frequent paroxysms, by the consequent vascular thickening, with damming back of the return lymph flow, leading to disturbances in the nutrition of the encephalon, and in a degree also to the exhaustion of the nerve cells from the explosive discharges at the time of the fits.

2. **Epileptic Psychoses.**—The acute epileptic insanities begin directly after or before the seizure.

The first form is the more usual. The patient, after passing through the clonic spasms into the comatose state, does not return to his normal mental condition, but becomes actively maniacal, often with hallucinations and delusions of an impellent character,

so that he is incapable of control or of being reasoned with. Indeed, the chief differential indication of epileptic mania is its blind, unreasoning fury, which is not exceeded even in the maniacal paretic dement.

A paroxysm of this kind is more common after a series of convulsions than after a single seizure, but the furor may occur after the event of a single paroxysm, and that, too, when the person has them at far-apart intervals. Maniacal fury may also replace the epileptic paroxysm.

Stuporous states may also follow the fit and last for a few hours to days and even weeks. The stupor may be broken at intervals by paroxysms of wild motor agitation, in which the patient not infrequently attempts to injure any one who may be in the vicinity, or destroys every movable article in the room. After recovery there is absolutely no recollection of any event which has transpired during the course of the attack.

The loss of mental equilibrium may begin one or several days before the fit. The patient becomes unusually irritable, suspicious, impulsive, confused, and walks about in a state of semi-consciousness. In one patient now under observation, the first indication of an approaching seizure is a tendency to strike blindly at any person, or even some inanimate object, that chances to be in his way; he next passes into a stuporous condition, lasting until the fit takes place, after which he returns to his usual mentality, or again lapses into a hazy, half-conscious state, retaining but imperfectly the impression of things going on around him.

In the *epilepsia larvata*, without the apparent occurrence of a convulsion, the mental disturbance shows itself as an equivalent of the fit. This is rather a rare form of insanity, and has nothing distinctive from the other type of disturbed mentalization occurring at the time of the epileptic seizure.

The several forms of acute epileptic insanity are characterized by a comparatively short duration and a deep degree of mental confusion, the entire cycle of fit, insanity, and restoration taking place usually within a period of one week. Only in rare instances is it prolonged over several weeks. In the absence of an accurate history of any case, these important facts are by themselves sufficient to differentiate the epileptic vesaniæ from the primary manias, and from the states of excitement taking place in the course of the degenerative psychoses (periodic insanities), in which confusion is an unusual symptom.

It will be advisable to deal here a little more fully with these several forms of psychical disturbance and the peculiarities associated with each.

1. *Epileptic Dementia*

As has been already stated, the majority of all cases of idiopathic epilepsy show a progressive defect in the intellectual apperceptions. In the minor forms, and in those individuals with seizures at distant intervals, this may be present only in a very slight degree; but when the attacks are frequent, or have been long continued, the enfeeblement becomes very apparent. The originative faculty is lacking in the idiopathic epileptic; he reproduces in a defective manner what he is taught, or what he has learned in other years; the association of ideas is imperfect; there is defective appreciation of the meaning of language, a weakness of remembrance, and faulty reproduction of intellectual precedents.

The epileptic is essentially deficient in finer moral tone; he is cruel, delighting in producing suffering, in annoying his companions or fellow-patients by pinching or striking them, and, if aroused by resistance, will make most brutal attacks, not hesitating to gouge out an eye or to bite off an ear or finger. Irritability of disposition is thus characteristic of a large proportion of these patients, for whom nothing is too evil or too malicious.

Not a few epileptics show also a morose, suspicious disposition, which, as mental enfeeblement progresses, separates them more and more from the outer world, and eventually results in imperative conceptions and delusions—of being poisoned, of having their food polluted (hallucinations of smell); in frightful hallucinations impelling to acts of destructive violence, either in the semi-conscious period following the epileptic seizure, or even during the time of closest approach to normal consciousness.

The terminal stage of epileptic dementia differs from that of other insanities only by the presence of the fits. The face assumes a characteristic, apathetic, motionless look; the facial innervation is often unequal on the two sides; there is tremor of the muscular groups, fat accumulates in the subcutaneous tissues, the lips and eyelids are puffed, the skin is coarse. The mental activity is now absolutely annihilated, and the subject, incapable of thought or even of associated action, is reduced to a purely vegetative life.

2. *Intercurrent Attacks of Acute Epileptic Insanity*

A very remarkable phase of the disease in some cases of epilepsy is the automatism occurring after the fit. The patients will go through the most complicated acts, as, for instance, in the well-known case narrated by Gowers. An epileptic cabman, after an attack, drove through the most crowded portions of the thoroughfares of London in a state of entire unconsciousness, without accident, and entirely without after-remembrance of what he had done. Others steal, make sudden onslaughts upon fellow-patients, change their clothing, or conceal weapons about their persons. All this is done in the most deliberate and purposeful manner; but of such acts they are entirely oblivious when they return to their normal state. These automatic exploits are to be explained in one of two ways. At times they represent the execution of some rational idea conceived in the pre-epileptic period, which was about to be carried into effect when the individual's thoughts were interrupted by the coming on of the insult; in other cases, they are the natural result of the rise into the active conduction paths of a delusional idea that has been evolved in the inter-paroxysmal period through the perverted mentality.

The attacks of insanity in the epileptic are characterized by their sudden onset and short duration—a few hours or days. A third point to be remembered is that the attack is not always preceded by a classic epileptic convulsion, but is equally liable to occur after the epilepsia larvata, in which there is no motor disturbance.

Frequent among the post-epileptic indications are the states of half-consciousness with great confusion of ideas, and the stuporous conditions.

In the former, the patient appears half-conscious and suffers from the deepest psychical depression. Mental confusion and the burden of a great anxiety are shown in the expression of the face. Harassed by a fearful uncertainty, the patients wander hither and thither restlessly and without purpose. Under the direct influence of fear, in the clouded mental condition, readily arise delusions of impending danger which result in purposeless brutal attacks upon attendants, destruction of furniture, and frenzied conduct.

Other patients develop an active hallucinatory delirium, in which delusions of persecution are intermingled with hallucinations of a frightful nature. They are intimidated by fearful spirit forms, are threatened with death, by visions of being burnt alive, or of similar

tortures. The clouding of the mental vision allows of no correction of these sense deceptions. Overpowered by despair, the patient becomes totally uncontrollable and dangerous to the last degree; in the wildest frenzy he rushes against his phantom persecutors, heedless of the harm which he may cause to himself or those around him.

Others show religious delusions of an exalted character; they communicate with God; they are the Deity himself, or Christ; they see beatific visions, are transported to heavenly realms, and receive divine commands. The form of the delirium is not widely different from that just described, since the expansive ideas may alternate with threatening visions of hell, of devils surrounding them with intent to destroy; and the chief distinguishing feature lies in the fact that the reduction of consciousness does not proceed to such a profound degree as in the previous form. Alternations of hallucinatory delirium with deep stupor are now and then observed.

Somnambulistic states, with apparent co-ordination of thought and action, are also met with in post-epileptic conditions, usually following *petit mal*. The patient talks and acts with seeming consciousness, but evolves extravagant ideas, acquires a temporary purpose or mission contrary to his usual mode of thought. Thus, he becomes a thief, a vagabond, tramps from place to place following his new aim, and at length wakes into full consciousness, perhaps to find himself in a locality far from home and entirely unknown to him. Such a mental state may last for hours or for months. This phase of epilepsy is a favourite subject with the psychological novelist, as it affords an unlimited field for the play of the imagination.

All these conditions arise equally after minor attacks, psychical epilepsy without convulsions, or after severe seizures. The first form is perhaps more common after the *petit mal*, the second after a protracted series of attacks of *grand mal*.

Attacks of deep stupor may also follow the epileptic seizure. The subject remains motionless and mute; he has difficulty in recognising persons or surroundings, and is sunk in a deep confusion, which may be broken at intervals by outbreaks of furious delirium of a blind, impulsive character with much motor agitation.

Epileptics occasionally have attacks of insanity of a more protracted nature, but resembling in every other respect the above-described forms. They are characterized by sudden outbreaks of overwhelming anxiety, frightful hallucinations, prolonged disturbance of consciousness, a tendency to blind, impulsive fury, with intervals of stuporous conditions. Complete return to lucidity does

not take place until the end of the attack, which may last over weeks and months, before the patient eventually returns to consciousness after a stuporous phase.

The *pre-paroxysmal epileptic insanity* is far less frequent than that following the attack, and may be considered as among the rare phases of the disease.

In some cases I have known a period of violent but transient excitement to precede the attack, the culmination being cut short by the onset of the spasm, the sufferer, on recovering, having lost all knowledge of events which had occurred immediately before the fit. In others there is present a hazy mental condition with much somnolence, approaching stupor, which passes off immediately after the paroxysm. Again, the patients may be actually stuporose, the stupor being interrupted by occasional outbreaks of mania, as in the post-epileptic form. Many of these individuals are dangerous to themselves and to others during these periods; if at large, they should be provided with suitable attendants capable of restraining them.

The frequency of attacks of insanity in epileptics predisposed to them is extremely variable. Some individuals exhibit only one or two attacks in a whole lifetime, while in others the seizures occur with a periodic regularity.

The attacks resemble each other in every respect, the excitement and delusions being repeated over and over again. The majority of epileptics do not show signs of mental disturbance beyond the irritability and progressive dementia.

The *etiology* of idiopathic epilepsy is mainly to be sought in alcoholism in the parents, which induces a defective organization of the brain structures in the descendants. Inherited syphilis is a less frequent factor. The signs of inheritance are chiefly seen in the departure from the normal in the skull formation, microcephalus, macrocephalus, as well as asymmetries of the skull and facial bones. Flatness of the cranial arch is found in a considerable proportion of epileptics, particularly among the males. Signs of rickets are especially frequent in epileptic children.

Aronsohn, in a study of heredity among 508 epileptics, found a history of neuropathic disease in the parents in 32 per cent. Females showed a stronger tendency to inherit the disease than males, 33⅓ against 30 per cent. The disposition on the part of the mother to transmit epilepsy to the offspring is greater than that of the father (39.5 against 29 per cent of inherited cases). Where both parents are hereditarily burdened, 63 per cent of the

children inherit the disease. In 82 per cent of the inherited cases the disease began before the twentieth year of life. Wildermuth, in 145 cases of early epilepsy, found inherited tendencies in 49 per cent, drunkenness on the part of the parents contributing nearly one half (21 per cent) of the examples. Traumatism in early life furnishes a small number of cases of epilepsy. Among 210 patients assembled by Wildermuth antecedent injury to the head had occurred 8 times. In the majority of the traumatic cases the seizures followed the injury within a few days or weeks, seldom after months. Epileptiform seizures and their sequelæ are sometimes found where there has been antecedent meningitis, porencephalia, or cerebral hæmorrhage in infancy; they may also result from the effects of acute infectious processes; but in these instances they are to be regarded not as belonging to true epilepsy, but as the symptomatic expression of a coarse, irritative cerebral lesion.

The epileptiform manifestations of advanced years may be ranged under the same category, namely, *symptomatic* epilepsy. They are frequent in chronic alcoholism, after traumatic injury, in the course of progressive arteriosclerosis, and after the infectious disorders, especially typhoid fever, which more than any other acute disease seems to fall with especial stress upon the brain tissue.

The *pathology* of idiopathic epilepsy is unknown. In a small number of individuals who have come to autopsy, sclerosis of the Ammon's horn has been determined; others show thickening of the meninges, and, more rarely, coarse lesions of the brain substance, which have been unsuspected during life. The very inconstancy of these various pathological alterations makes it obvious that beyond them lies the inherited instability of the neurones, which, far from being evident to the unaided eye, is not as yet demonstrable by microscopic methods of examination. Various changes in the nerve cells, it is true, have been described as characteristic of idiopathic epilepsy—vacuolization of the cell bodies of all the cortical layers, fatty deposits in the nuclei of the pyramidal cells of the smaller sort; but these are also found in degenerative brain diseases of many types not accompanied by convulsive attacks. It is hardly too much to expect, however, that improvements in our technique will enable us in the near future to recognise the molecular changes in the nerve-cell bodies, which, it is evident, are the only constant lesions belonging to the affection.

The *prognosis* in epileptic insanity is altogether gloomy. It is true that the attacks may be repeated only a few times, and may

then not recur; but under the repetition of the excessive discharges of nerve power the mental downfall of the individual is rapid and progressive. Cases of epilepsy do occasionally recover, and a more favourable result may be expected from treatment in those cases which have begun in early adult life, after the nerve tissues have acquired a certain degree of stability, than when the patients have become afflicted in childhood or in late life. This is only natural, since the young show a pronounced lability that has been inherited, while in advancing age the tendency is due to the inception of degenerative processes, arteriosclerosis, and alcoholic changes in the tissues. Few traumatic cases do well, even if operated upon at an early date, though the apparent injury to the cerebral substance may be slight.

The *temperature* after an epileptic seizure is of some importance to the clinician, principally as a means of recognising malingering. From a study of numerous cases observed, Bourneville gives after single epileptic seizures a rise of from 0.5° to 1.5°, the average being 0.6° C. When the fits are repeated at intervals, but come in series of several in rapid succession, the temperature follows the same rule as after single seizures. In the intervals between the attacks it sinks to the normal. In the status epilepticus the fever may rise as high as 43° C. (107° F.), and the pulse and respiration may be concomitantly accelerated. In the psychical epilepsy, without loss of consciousness, there is no elevation of the bodily warmth.

The *urine* in epilepsy has been the subject of much discussion, especially from the stand-point of its toxicity. Voisin and Jeron made a series of experiments, in which the urine of a number of epileptics was injected into the veins of guinea-pigs and rabbits, and reached the following conclusions: (1) Before a series of fits the toxicity of the urine was below normal. (2) During the epileptic series there was still hypotoxicity, with a tendency to a rise. After the series the toxicity increased, but not above the normal, unless the convulsive seizures were for the time at an end. If the series was not complete, the toxicity remained below the normal. (3) During the course of an epileptic psychosis the toxicity remained sub-normal. (4) In the interval between the attacks the toxicity was of the same intensity as in the healthy person. The authors regard the epileptic crisis as due to the retention in the blood and non-excretion of certain poisonous substances, the culmination being reached in the seizure; afterward there is elimination of the poison,

this being accomplished through the medium of a consequent polyuria, sweating, or diarrhœa. This view, then, would make epilepsy dependent on a transitory disturbance of the secretory powers, subordinate in turn to a pathological instability of the nervous system. Crainsky attributes the insult not to the increase of uric acid and urea in the blood, but to an excess of ammonium salts, especially the carbamate. The blood is most poisonous immediately at the time of the seizure, and there is a gradual rise to this point. Haig's theory of the uric acid causation of epilepsy is not warranted by clinical facts, as not all epileptics show increase of urie acid in the urine directly after the fit, and when the attacks are frequent, the amount of the acid urates excreted remains stationary, or the differences are so trivial as not to allow of accurate estimation by any of our present methods of examination (personal observation).

Albumin is not infrequently found in the urine of epileptics after the seizure, occurring in about five per cent of all cases. In epilepties with permanent albuminuria, the quantity is considerably increased after the crisis. Transient glycosuria is rare in epilepsy, but I have seen it in a few cases. Apparently it does not influence the course of the disease, although one of my patients had maniacal attacks at infrequent intervals.

The total amounts of chlorides and phosphates are increased after the seizure, while in the interval they are normal. Indican and skatol are seldom found in any quantity.

An analysis of the urine of 11 cases of epilepsy (10 idiopathic and 1 traumatic, taken at random from among 40 epileptics) is not without interest. All examinations were made in the interparoxysmal period, and all the patients were upon the same diet, which included meat only once a day. Eighty per cent of these cases showed an excess in the secretion of uric acid, while in 54 per cent there was an abnormal elimination of urea, varying from 50 down to 32 grammes per litre. In the other 46 per cent it varied from 14 down to only 4 grammes, the average for the 11 cases standing at 23.15 grammes per litre. The chlorides were normal in 10 cases, diminished in 1. The total amount of phosphates was above normal in 7 cases, decreased in 4 cases. Indican was present in considerable amount in 1 case. A trace of albumin was observed in 4 subjects, and in one other there was a considerable amount. Glucose was present in one individual for several days after a seizure, and then disappeared. Hyaline casts were found in 4 cases, granular casts in 3, and mucous cylindroids in 3 cases.

The *deep reflexes* in epilepsy have not been sufficiently studied. My own observations have shown a great variety of disturbances, and agree in the main with those of von Bechterew. In the largest percentage of cases they are markedly increased, and there are occasional differences between the two sides. Few show a constant annulling of the knee-jerk. After the occurrence of a crisis of any severity the reflexes are completely abolished—a diagnostic point of some value in enabling one to differentiate from malingering, but not from apoplectic seizures. The loss of the patellar reflex persists for a considerable time after the seizure. A few examples show decided exaltation of the knee-jerk several hours after the insult.

The *pupils* of the eyes in the epileptic are frequently dilated, and the iris reacts slowly to light and accommodation. Pupillary inequalities are now and then seen (10.6 per cent according to Browning). During the comatose period following an epileptic seizure the pupils are widely dilated, and remain insensible to light and accommodation for some minutes. The ocular fundi seldom show any alteration in the interparoxysmal period.

The *diagnosis* of epileptic insanity is ordinarily not a matter of great difficulty. Together with a history of repeated epileptic seizures, with a rise of temperature, and the sudden onset of the mental trouble, we find the absence of garrulity with the mania-like symptoms, the deep disturbance of the consciousness, confusion to actual stupidity, alternating with furious delirium arising out of persecutory ideas and hallucinations; in addition, we have the dreamy, half-conscious states that betoken an insanity only of epileptic origin, and finally, the course of the disease, running over a few days to a week, in contrast to the weeks and months of the true manias. Sudden delirium, not of alcoholic causation, with great confusion and blind, ungovernable fury, is usually of epileptic origin, except when occurring in the course of febrile maladies.

In the instances in which, instead of the convulsive attack, there is only the psychical equivalent, the diagnosis is much more difficult, as there may be an absolute lack of any history indicative of epileptic seizures. In dealing with doubtful cases, it is well to remember that other forms of insanity rarely begin without previous prodromata, and that they do not run so short a course. It is true that alcoholic delirium in this respect is an exception, but here the character of the hallucinations is usually a distinctive feature, and it should always be borne in mind that an attack of psy-

chical epilepsy may be directly induced by indulgence in spirituous liquors. Again, no other form of insanity shows the same depth of reduction of consciousness, and besides, dreamy confusion and relapses into stupor are peculiar to epileptic cases. In the latter, moreover, after recovery there is a clear recollection of events up to within a few minutes or hours before the outbreak of the maniacal or confusional symptoms, but a complete or nearly complete blank for all events that have transpired during the attack. Finally, in epileptic insanities the restoration to the former condition is usually not gradual, but sudden. An exception to this last statement may be noted in those patients that have had a considerable number of attacks, the restitution then taking place after a period of stupor.

The *treatment* of epileptic insanity is inseparable from that of the primary disease itself. Sources of peripheral irritation should be removed, wherever possible; the diet should be carefully regulated; animal foods should be used sparingly; the patients should lead an outdoor life; they should have an abundance of vegetables, eggs, milk, and bread. Under these measures the largest number will steadily improve without the aid of drugs. Alcoholic drinks should be shunned by the epileptic as a virulent poison, and as a drug that in his case is capable of producing the most rapid deterioration of the neurone.

Of all the medicaments in use the bromides have decidedly most influence upon the course of the disease, lengthening the interval between the paroxysm, and decreasing the severity of the attacks themselves. Among the various bromides, the C. P. strontium bromide, in doses of from twenty to thirty grains, thrice daily, has proved most efficacious in allaying the epileptic irritability and lessening the frequency of the seizures. It does not produce the unsightly acne that results from the use of the bromides of potassium and sodium. Next in efficiency is the potassium salt.

If the bromides have no effect in delaying the dementia consecutive to epilepsy, they certainly do not hasten it. By warding off the seizures, they retard it to the extent that the neural tissues are subjected to less frequent shocks. Belladonna and hyoscyamus are sometimes useful adjuvants, and may be given without the bromides in cases where these are not well tolerated. Digitalis and adonis vernalis, recommended by von Bechterew, are in exceptional instances indicated where there is a tendency to cardiac weakness. The adonis vernalis is more distinctly of service, as it increases to a considerable extent the excretion of the acid urates, and does not

disturb digestion. It may be ordered in an infusion, containing five or six grains to the ounce, with the bromide dissolved in it. The dose should be one or two teaspoonfuls, repeated at least four times a day. Amyl nitrite is sometimes useful where there is a recognisable aura to warn of the approach of the seizure. The "brom-opium treatment" of Flechsig is adapted to few epileptics, and may become dangerous. Sympathicectomy, advocated by Chipault, is the latest form of surgical treatment, but its usefulness is not yet proven. The increased flow of blood to the brain tissues is supposed to induce favourable results.

In a few instances, less with the strontium than with the potassium salt, the bromide has a tendency to increase the disposition to attacks of insanity. In these cases careful attention should be given to the diet, the amount of water taken and the exercise, while at the same time an occasional intestinal antiseptic, as salol, should be administered. In one instance in which salol was exhibited in small doses, the fits remained absent for months, where previously they had occurred daily, or several times during the day. Epileptics show a marked tendency to store up waste tissue products of the uric-acid series in their tissues, which should be combated by the administration of large quantities of water containing lithia salts, or exceedingly small doses of urotropin over short periods. The lithia should not be administered continuously for any length of time, as it has a tendency to promote rapid tissue degradation.

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NEURASTHENIA AND NEURASTHENIC PSYCHOSES

I. Neurasthenia

Psychoses, the actual outgrowth of neurasthenic seed, are so rarely seen in practice that a description of them would occupy only a few lines. But, in their place, one finds a whole host of minor psychical phenomena, with a predominance of certain stigmata, that necessitate a more extended delineation. Chief among these are the psychical and moral depressions approaching some of the forms of simple melancholia, the insistent and imperative ideas, the *délire du doute et du toucher*, and other brand-marks of the incapacity of the highest nerve centres to properly perform their functions.

History.—Nerve weakness is no new disease. It has been known ever since man became addicted to excesses of any and all kinds, whether in wine, venery, onanism or other homosexual perversions, and its perpetuation began from the time that the first children of degenerate parents were begotten. Any lowering of the physical vitality in the ascendant is ever prone to show itself in the descendant under the form of very varied disturbances of the nervous functions, sometimes in neuroses, sometimes in even graver organic diseases.

Fernet in the sixteenth, Sydenham and Willis in the seventeenth, Tissot in the eighteenth, as well as numerous authors in the early part of this century, under the various names of *état nerveux*, *diathèse nerveuse*, neuropathic nervous weakness, spinal irritation, spinal neuroses, have described very fully certain forms of the malady that we to-day designate as neurasthenia. Even in the writings of Hippocrates there are conditions referred to that show the affection was not unknown in his day. But when we consider the great alterations in the social life of the past forty years, the accentuation of the struggle for existence that in civilized countries is daily becoming more and more severe, the increased abuse of alcohol, and the strain upon the nervous system attendant upon

the excitement of the ever-growing life of the town in contrast to the more quiet one of the country; furthermore, when we realize the great increase in the number of hereditarily burdened persons owing to the constant marriages of neuropathics with one another, and the sometimes obscure, but often far-reaching, influence of inherited syphilis upon the children of many such parents, we can hardly be surprised that, in the past four decennaries, the disease has shown a tremendous increase in a way analogous to that of paretic dementia, a disorder also having its genesis in similar causes.

Owing to the desuetude of the study of nervous diseases during the middle portion of the present century, however, it was not until Beard in the United States, and Bouchut in France, about 1870, had recalled attention to the more prominent forms of the malady, that a clear knowledge of it was spread among the medical faculty. Stimulated by the work of these pioneers, so many other observers entered the field that for the past twenty years the medical journals in all languages have been replete with clinical and other studies upon it, and numerous books have been published, in which the characteristics of neurasthenia have been described and its phenomena refined upon to a degree almost unknown for other neuroses.

Etiology.—At the present time neurasthenia is usually regarded as a primary affection of the nervous system. Against this view it might be urged that no matter how defective a nervous organization may be inherited from unstable parents, it may, under good conditions, be able to function within what we may call natural limits; and only when the stress of an anæmia, a digestive disorder of chronic nature, or a febrile or traumatic affection disturbs the normal balance, do we find the rise of pathological phenomena attendant upon loss of stability. Despite these cases, however, which are rather exceptional, it must be conceded that the hereditary taint is the all-important factor, and that constitutional disturbances, trauma, intoxications, or other causes are, after all, in the majority of examples, only provocative agents. A sound nervous system is an inheritance that only the most strenuous provocation can overturn for any length of time, and even when an upset has been accomplished, a restitution to the normal is soon obtained under favourable circumstances. The neurasthenic is, therefore, in a large majority of cases, neurasthenic in latency *ab incunabulis*, though it may take some shock, moral or physical, to evoke the train of subsequent symptoms. As Bouveret has written, "those

predestined to nervous disorders may go through life without being attacked by a psychosis or grave organic malady, but they very rarely escape neurasthenia." Some, by reason of their greater constitutional stability, may pass safely through the crisis of puberty or the maladies of early life, but at a later date, at the time of beginning senile involution, they show to a varying degree the train of asthenic indications.

Few, however, of the hereditary *déséquilibrés* find a fate so kind. The predestined children at an early age are noticed to be excitable; they have nocturnal terrors, and are prone to have convulsions during dentition or from other slight causes. As they grow up, they are given to morbid impulses, are eccentric and quarrelsome, and while they have a fair degree of intellectual development to start with, this may soon suffer partial arrestation, so that further progress is slow, or they may come entirely to a stand-still. Not every neurasthenic child, however, becomes dull. Some are endowed with a fair degree of intellectual ability, and grow up to be brilliant but one-sided men or women.

Race is a considerable factor in the etiology of the affection. The Hebrews are particularly predisposed to it, largely owing to the intermarriage between consanguineous strains; perhaps also the urban and clannish life they have led for many centuries has had considerable influence. The Teutons are less often affected than their neighbours, the French and Russians. In America the influx of the population into towns, and the exciting life of the city, with its vices and constant nerve-strain from business affairs or social competition, has done much in late years to produce a harvest of nervous weaklings.

The secondary causes of neurasthenia are manifold. A faulty system of education in childhood—the lack of moral instruction, of the toning of the judgment, of the fortifying of the will power by proper methods in the household—ill prepares the young for future trials. Later the forcing of all grades of mental development into the same classes at school, where the duller ones are urged into active competition with those of higher mental organization, is responsible for an immense number of nervous breakdowns about the time of puberty with both sexes.

Severe maladies of infancy and childhood are also predisposing causes in both the predestined and in those nervously sound; naturally, when the vital energy is already deficient, the stress of a scarlet fever, or other infectious disorder, with its nutritional disturb-

ances, renders the capacity for the nerve cells to be restored to the normal far less than in the children who have started in life with healthy nerve tissues.

Exhausting processes, particularly those incident to the various fevers or influenza, even natural conditions attended by depletion of the vital constituents of the blood, as pregnancy and lactation, conduce to the evolvement of nerve exhaustion in the labile. Neurasthenics, from their constitutional tendencies to defective metabolism, are very often anæmic, and may at times show grave imperfection in the blood-forming powers. Intoxications—from alcohol, tobacco, opium, cocaine, lead or other metallic poisons—induce directly more or less depravity of the nervous system and an attendant loss of nerve vitality. The acute neurasthenia of the carbon disulphide worker is well recognised, and has already been described in another chapter.

It is perhaps unfair to look upon every case of nerve exhaustion arising after the intoxications and constitutional disturbance as having an hereditary basis, inasmuch as certain of these poisons—alcohol or lead, for example—leave a perceptible impression on the nerve cell, changing the chemical metabolism, perhaps permanently and without hope of reconstruction. It would be better, therefore, to refer such instances to a subclass apart from the already comprehensive one of hereditary asthenics.

Persons with dyspepsias, particularly of the chronic order, without actual organic lesion of the stomach or intestinal walls, are often troubled with headaches, palpitation of the heart, insomnia, and general prostration. The separation of cause and effect is here ofttimes most difficult; but where the dyspeptic indications have preceded by years the nervous symptoms, it would seem only proper to look upon the indigestion as one of the predisposing factors in the evolution of the neurasthenia. Subacidity of the stomach is more liable to be associated with flatulence and other indications of gastro-intestinal fermentation than its converse, superacidity, and is more frequent. The finding of an excess of the ethereal sulphates in the urine of neurasthenics, especially when hypochondriacal symptoms coexist, is a daily event, and affords direct proof that the nerve cells are being bathed in a vitiated serum, as well as being an evidence that constructive cell metabolism cannot be perfect.

Sexual excesses, by their extremely debilitating effect upon the nervous system, frequently conduce to nervous exhaustion. Of

these the most frequent is onanism, which is often begun at an extremely early age and practiced until the virility is exhausted and a degree of impotence begins. The moral effect of constant masturbation is very great. The children addicted to it become fond of solitude, unsociable, irritable, are often profoundly anæmic, and have cold, clammy extremities. Cases of genital neurasthenia are frequent, the secret vice being universally the cause of this subvariety of the malady. Heterosexual excesses, especially those committed at or shortly after puberty, when the sexual functions have not fully attained their development and stability, exercise the same general effect as onanism. Spermatorrhœa and nocturnal pollutions follow in the train of the original vices, and out of them arise a host of depressive symptoms approaching a virtual melancholia, or even graver forms of alienation of the confusional or paranoiac type.

It is doubtful whether uterine and ovarian affections can be held to be responsible as inductive causes of neurasthenia, unless they have first produced a condition of physical adynamia. The local pains, the general hyperæsthesias, the neuralgias, are rather to be considered as a part of the symptomatology of nerve exhaustion than as exciting factors. Suggestion from friends, too often from the physician himself, may direct the neuropathic's attention to the genito-urinary tract, with a subsequent self-centering of all ideas upon the sexual apparatus. Organic affections of the uterus rarely give rise to neurasthenic symptoms. A careful study of cases of genital hyperexcitability will show the majority of them to be of mental origin, and while it may be permissible in rare instances to treat vulval or uterine hyperæsthesia by local applications in order to produce a moral effect upon the mind of the woman, the routine resort to such measures is reprehensible.

Among other causes that help to bring about neurasthenic conditions may be mentioned depressive surroundings, inducing a lowered physical condition ; auto- or direct suggestion—as, for example, from an unstable mother to an adolescent daughter ; the association between neuropathic sisters in a family ; the exhaustion induced by the round of diurnal and nocturnal pleasures, with overeating of improper food and insufficient rest, followed by young girls in their first years in society. Trauma and shock, especially from injuries experienced in railway catastrophes, are often the starting point of a neurasthenia. Excess of intellectual work is of importance in this connection, when the hours are long and the subjects

are little varied from day to day, inasmuch as it is the lack of variety rather than the actual work that conduces to mental exhaustion. Lastly, psychical shocks, an unfortunate love affair, a fright, or the death of a well-loved friend or relative, by whose bedside the person has watched for months with unremitting zeal and without sufficient rest or nourishment, often usher in a profound nervous breakdown.

Speaking generally, then, the neurasthenias are mainly developed upon an hereditary basis, but in many instances the sufferer might have escaped were it not for the chance intermediation of some affection or trouble which overcomes for the time the stability of the nervous organization, and leads later to a generally defective cell metabolism. More rarely neurasthenia may be imposed upon a sound constitution by the advent of a typhoid or malarial fever, or by conditions of chronic intoxication produced by such agents as alcohol or carbon disulphide. The variety and the multiplicity of possible causes of the malady should impress upon us the fact that, to obtain any success in treating it successfully, the etiology of each case should be separately studied, for measures that may avail with a neurasthenia from chronic intoxication will not succeed with one of the hereditary variety.

Clinical Forms.—Until we have a clearer idea of its pathology, it will, perhaps, be well to consider neurasthenia not as an entity, but rather as a symptom-complex. In this view we follow Charcot, G. de la Tourette, and the majority of the French school, rather than Möbius, Biernacki, and others among the German writers.

In neurasthenia, as in all symptom-complexes and neuroses, the clinical phenomena are most varied, and the several authors who have issued monographs upon the subject have refined the classification of the several types beyond all actual necessity. As they are met with in practice, the forms are so blended and confused that it is often impossible to differentiate between them, even if it were not needless to do so. For practical purposes, partly following Bouveret, a classification may be made into two main divisions:

a. Hereditary neurasthenia.
b. Acquired neurasthenia.

Gilles de la Tourette's classification is more complex:

True neurasthenia,
Hereditary neurasthenia,
Hystero-neurasthenia.

These main groups admit of further separation into subdivisions according to the prominence of one or more definite symptoms. They are:

Cerebral neurasthenia, or cerebrasthenia,
Spinal neurasthenia, or myelasthenia,
Genital neurasthenia,
Traumatic neurasthenia,
Acute neurasthenia,
Hystero-neurasthenia,
Gastric neurasthenia.

In all of these forms any one or more of the following mental phenomena—moral depression, states of anxiety, insistent and compulsory ideas—each indicant of cerebral asthenia, may coexist with symptoms of adynamia of the spinal and peripheral nervous systems.

Symptomatology.—The manifestations of the disorder are legion, and every nerve bankrupt affords a new train to the careful observer. Yet among this host a certain number of fairly constant and prominent ones may be picked out as characteristic of the malady. These are the neuro-muscular asthenia, the headache, the back pains, insomnia, cerebral depression, indications of cardiac disturbance, and gastro-intestinal dyspepsia.

Neuro-muscular Weakness.—By all writers this is accounted as the most frequent objective sign of the disease. The sufferer is always tired; walking, writing, reading, conversation, manual work, every act involving mental or motor exertion, soon causes an irresistible fatigue. The patient may have slept soundly eight or ten hours, yet a few minutes' exertion soon brings inability for further effort, and the remainder of the day is spent on the lounge or in an easy chair. Examine the muscles of such a patient, and while they may be somewhat flaccid, they are yet capable of considerable energy, and the dynamometer at first shows no marked diminution of the muscular power. But after the tests have been several times repeated, the hand muscles are found to have lost a part of their force. The condition would, therefore, seem one of mental rather than physical impotence. True paralysis or contractures never coexist with neurasthenia; the patients are able to execute any ordinary co-ordinate movement—to bend, extend the limbs, or resist a forcible manipulation of them—but at the same time seem incapable of storing dynamic force sufficient to provide the capacity for prolonged exertion. They lack nerve-force reserve, and their brain cells seem incapable of retaining what is laid up

during the periods of rest; the metabolism is imperfect, and waste apparently proceeds more rapidly than repair.

When we test the tendon reflexes they are found to be in no wise modified. Loss, or undue excitability of the deep reflexes, indicates something more serious than a true neurasthenia; it marks the beginning of an organic disease, and the array of neurasthenic symptoms is now to be looked upon as only concomitant.

The legs are ordinarily more adynamic than the arms and hands. This is more frequently the case in the female than in the male sex, and is often the most striking feature in acute neurasthenias. Actual confinement to bed from motor powerlessness of the legs is not rare in females, or even in males after severe physical shocks. The motor exhaustion is usually accompanied by sensations of profound lassitude, by muscular *douleurs*, and aching sensations along the course of the sciatic nerves and their branches.

Not every case of muscular asthenia is so severe as the form just described; all varieties and gradations are found. In the most frequent type the patient gets up in the morning unrefreshed by rest in the recumbent position, and in a state of profound motor-mental disability. After the breakfast has been eaten, and some mild stimulant in the form of coffee or tea has been taken, there is a lessening of the lassitude, so that, as the day wears on, the individual acquires a feeble energy and takes an interest in her surroundings and in her social or other pleasures. The diminution of the cardiac force and relaxation of the arteries are at their acme in the early morning hours. The filling of the vessels by the fluids and products of digestion helps to raise the vascular tone, which is increased as the day wears on—a fact which accounts in a somewhat mechanical way for the accession to the nerve force in the afternoon hours. This rule, however, is far from being without exceptions.

Cephalalgia and Migraine.—Often toward or during the epoch of puberty, in both sexes, the neurasthenic candidate begins to show indications of the approaching neural instability in paroxysmal attacks of sick headache. In girls these occur most frequently just before or just after the catamenia. In males they may come on with equal regularity at stated periods. As the years roll on toward middle life these migraine seizures are usually interrupted and sometimes cease entirely, especially under appropriate treatment.

The cephalalgia, in contradistinction to migraine, which is symptomatic of many other disorders of a trivial character, has a

distinctive quality in nervous exhaustion that brands it as one of the stigmata of the affection. It occurs in a vast percentage of all cases, and is rarely absent in the constitutional form. It is sometimes continuous, lasting over months and years, sometimes intermittent, but always at its worst after attempts at physical or mental exertion or at times of moral depression. Most severe in the morning hours, it slowly lessens during the day, and by night has nearly disappeared. The influence of food and stimulants upon it varies considerably, one patient being favourably influenced by the ingestion of a meal, while in others an unfavourable effect is produced.

The headache rarely amounts to an actual painful sensation, but is usually spoken of as a weight, a feeling as of a vertex-band or a constriction about the region of the temples. Slight vertigo, sensations of roaring in the ears, retinal hyperæsthesias, muscæ volitantes, hyperæsthesia of the scalp, and other phenomena accompany it. The cephalalgia is not always diffuse, but may be limited to the temporal or orbital regions, although its favourite site is in the occipital and nuchial regions. It is only noticed with the same constancy in these last territories in one other affection, namely, melancholia simplex. In the neck and occiput the sensation is frequently spoken of as an actual pain, and is more often a source of discomfort than when situated in any other place.

Rachialgia.—Pain in the back is of equal importance as a characteristic stigma as are the various cranial paræsthesias. It is much more frequent in women than in men, and is elicited on any attempt at motion; hence those afflicted with it not uncommonly assume a supine position, which it is difficult to make them change. The occurrence of the menses is a constant source of aggravation, the pains and aches being increased perceptibly by the congestion of the genital apparatus, while ovarian and abdominal neuralgias are frequent. When the rachialgia occurs in men it is frequently confounded by the patients with rheumatoid troubles and with preataxic pains, and gives rise to mental depression and hypochondriasis.

The vertebral sensations suffered from are very varied. The most common consist of pains in the lower cervical, lumbar, and sacral regions. With the rachialgie *douleurs* come feelings of heaviness in the limbs, and sometimes urethral and clitoridian hyperæsthesias. Other patients complain of diffused sensations of heat, of burning, of formication, of coccygodynia, or of general hyperæsthesia of the entire spinal column. There may be exaggerated sen-

sibility of individual vertebræ, or of the skin lateral to the column. Pressure upon the spinous processes may elicit painful perceptions, or contact with the clothing may be unendurable. In other instances there is entire absence of morbid sensibility on pressure, but prolonged standing or enforced movements of the spinal column may give rise to disagreeable sensations.

Rachialgia is sometimes transient, but usually there are minor residua that remain over years. In one case under observation, the pain, with some short intervals of respite, has now lasted over nineteen years without the development of any more serious trouble.

Insomnia.—The sleeplessness of the neurasthenic is one of the most troublesome symptoms with which the physician has to deal, as well as one of the most rebellious to treatment. The lack of active exertion, especially of the muscular system, always has a tendency to beget insomnia, especially when it is combined with indications of gastro-intestinal disturbances. Perhaps this last affection is the most common source of the evil in neurasthenias of a severe type, but cardiac irregularities and deficient vascular innervation also play no inconsiderable part. Two forms of neurasthenic sleeplessness are noticed. In the first and most frequent the patients fall asleep soon after retiring, but after two or three hours they are awakened, and toss restlessly until the morning, when they arise unrefreshed and totally without energy. To other patients sleep does not come readily; they lie awake listening to the irregular or tumultuous beating of their hearts; or are troubled by imperative ideas, which control their whole being and prevent the needed tranquility so essential to repose; again, they are disturbed by various pricking and tingling sensations over the skin of the body, or by muscular twitchings and contractures that arouse them into full mental activity at the moment when the courted god seems just about to accord their desire; or they are suddenly aroused by noises, pistol shots, or whirring sounds, evolved by the imperfect functioning of the auditory nerve.

> "Sleep is no servant of the will;
> It has caprices of its own;
> When courted most, it lingers still;
> When most pursued, 'tis swiftly gone."

Only toward morning does refreshing sleep come, and they rest undisturbed for several hours.

The apparent lack of ill results from loss of sleep is often remarkable, and engenders distrust of the accuracy of the statements

to this effect on the part of the patients. Some few that I have had watched for weeks showed a true sleeplessness, perhaps aggravated by a knowledge that they were being observed.

Few of these neurasthenics show any decided tendency to sleep during the daylight hours, but occasionally one is noticed in whom the drowsiness is invincible during the day.

The imperfect nocturnal rest of the nervously exhausted is frequently broken by dreams. This is in accordance with the tendency to anxiety with which they go to bed, the mental processes being carried on in imperfect form after consciousness is partly lost. The dreams are nearly always unpleasurable and disquieting. The patients awake in fear and peril of their lives; dreadful accidents are about to happen, either to themselves or to others, and when they are again quieted and sleep returns, the same incidents and scenes are repeated three, four, or five times during the night.

Inhibition and Mental Depression.—One of the first signs of an approaching nervous bankruptcy, especially in those cases that come on after too prolonged mental effort, or intellectual work continued without relaxation over many hours of the day, is loss of memory and inability to recall facts and deeds. The names of those with whom the patient is associated are gone beyond immediate recall; in writing, he stops for a word, and finds it impossible to continue. The preacher in the course of a sermon halts, the thread of his discourse is lost and cannot be recovered, and to his great mortification he is obliged to bring his sermon to an abrupt and perhaps lame conclusion. In extreme examples the highly educated man is unable to fix his attention for any length of time upon work of any kind; books are read without after-remembrance of their contents; the newspapers are conned for hours, but no question relevant to the subjects mentioned in them can be coherently answered; letters cannot be written because the neurasthenic has forgotten how to associate words, and the details of business fall into entire abeyance, to the loss and detriment of the patient and his family. The sufferer is hardly any longer able to take care of himself; he spends his time in the complete idleness of a dream-like reverie, and what little power of attention remains is concentrated upon his unfortunate and hopeless self. These conditions of inhibition are more prominent in the hereditary cerebrasthenia than in other forms. The same indications are met with in women, who, totally exhausted and inert in the early morning, lie enrapt in languorous half-dreams upon the sofa, unable to express a coherent thought or raise a hand

in action. The assemblage of symptoms is usually more vivid from depression of the cardiac force in the early morning, while during the afternoon and evening there is some recovery.

Desire for stimulants, alcohol, coffee, morphine, tobacco, among the intellectually exhausted is often imperative, and knows no limits. A majority of the mass of morphine *habitués* and cocainists belong to this class, having sought relief in the artificial stimulation of their brain cells obtained from drugs.

The loss of memory, the inability to take any active part in affairs, the utter powerlessness to carry on the cherished schemes of the life-work, naturally, do not fail to react upon the cerebrasthenic, and psychical depression results. The business man unable to carry on his occupation, the teacher unable to co-ordinate his thoughts on the daily discourse, regard life as at an end for him, and looks forward only to a renunciation of his work or profession. They become disquieted, uncertain, timorous, habitually silent; they readily renounce their cherished opinions when contradicted in conversation; they regard life as painful and impossible, are without decision in affairs of minimal importance, or become anxious and distraught when forced to express a definite opinion. Pseudo-hypochondriacal states in this condition are not uncommon; true melancholia is much more rare. The psychical pain is never extreme; the patients will tell you that they are in low spirits, that they are unable to think or to exert their wills; but suicidal ideas and self-depreciation are infrequent. On the other hand, errors of judgment and of appreciation, irresolution, and hesitation are a part of the daily burden of the asthenic.

This will-enfeeblement reacts upon the moral tone; they abandon every purpose, leave their families in want and misery, to be taken care of by friends or as chance may fall, while they themselves seek the sheltering arms of an institution, there to be free from contact with the responsibilities and miseries of the outer world, and to lie sunken in their dreamy reveries. The character under these influences necessarily changes; the formerly cheerful man or woman accustomed to bear equably the untold petty annoyances and cares of the present age, now becomes reactive and irritable to all noises; the sounds of the street, the music of a hand organ, the cries of children, the presence of members of the family, all cause untold annoyance; and when in addition to the ordinary symptom-complex a train of cardiac, auditory, and retinal hyperæsthesias supervene, the state of the sufferer is truly a miserable one,

in which a little sympathy and condolence may sometimes be of more avail than direct therapeutic measures. A few—unfortunately only a few—of these patients react to direct suggestion, but the mental inertia into which many fall nullifies only too often the effect of this measure.

The mental depression is always a symptom of grave moment in the neurasthenic. It is constant in many, difficult to overcome in all, and has a tendency to plunge them more deeply into a morbid preoccupation and an abyss of "a thousand deaths in fearing one."

The Neurasthenic Heart.—Among the various phenomena implicating the nerve supply of the vascular apparatus, none is more frequent than tumultuous beating and irregularity of the action of the heart. The cause of the nervous cardiac palpitation probably depends upon a transient paresis of the vagus fibres (Lehr), which comes about more readily owing to the weakness of the reflex centres peculiar to neurasthenia, and is therefore only one indication of the general asthenia. The immediate cause of the paresis is found in psychical emotion, varying from genuine fright or anxiety to the mere prospect of passing a sleepless night. Farther back than the immediate cause may lie excesses in venery, in wine, mental over-exertion, and prolonged anxiety.

Two forms are found in practice. First, that in which the frequency of the heart beat is not perceptibly above the normal, and the pulse of the patient has a medium or slightly increased tension. Here there is but little feeling of tumultuous irregularity, but the patient complains of sensations of pressure and tension in the cardiac region, with an unpleasant feeling of fulness in the head, disturbed sleep, and a general sense of extreme muscular lassitude. Slight emotion may, in this form, bring on a high degree of irregularity, with anxiety and præcordial distress. The pulse during the access is of high tension, and there is throbbing of the carotids and temporal arteries. The attacks last only a few minutes, leaving the person much exhausted.

In the second form, the heart's beats are constantly raised above the normal, varying from 90 to 130 a minute, and while quite regular in rhythm, the pulse is lacking in tonus, the vessels being only moderately well filled. When a nervous seizure is imminent, there begin various sensations of anxiety; the pulse becomes small, the tension sinks so that the beats are almost imperceptible to the finger, and the rate is increased by twenty-five or thirty beats.

With the sinking of the vascular tonus the anxiety increases, there is excessive reflex irritability, and an inclination toward emotional states, together with intense lassitude and exhaustion. Vertigo, trembling, even unconsciousness, may accompany or follow the seizure. The entire attack may be over in a few minutes, or may be prolonged for five or six hours. Both forms are sometimes observed in the same patient.

Cold applications to the cardiac region, lukewarm baths, galvanization of the trunk and limbs, the exhibition of small quantities of alcohol, aconite, and the bromides in combination with the infusion of adonis vernalis, do most to allay the immediate symptoms, and during the interval a superabundance of nourishment, and iron, should not be omitted.

Digestive Troubles.—The frequency of these in neurasthenia is great, but the degree varies with each individual. In a major part of the cases the disturbance is of the combined gastro-intestinal form, mainly of an atonic character, although instances of purely duodenal indigestion are not rare. In the milder forms the physical condition is not greatly reduced; in the graver ones the loss of bodily weight may be considerable or even profound. The dyspepsia is one of the several causes of the anæmia that is present in the majority of neurasthenics.

In the milder forms of neurasthenia the appetite is capricious, varying with the degree of mental depression, of emotional excitability, or dreamy lassitude into which the individual has fallen. The dyspeptic symptoms begin shortly after a meal in the gastric atonic types, after an interval of an hour or longer in the intestinal varieties.

The ingestion of food causes a sense of immediate well-being, but this is soon displaced by various vague feelings of discomfort in the epigastric region, with sensations of weight and distention, and frequent eructations of gas. The distention is an actual one, and causes pressure upward upon the diaphragm and pericardium, as well as disturbance of the regularity of the rhythm of the heart. After the ingesta have passed from the stomach into the bowel, there is a lessening of the gaseous fermentation, and partial relief is obtained, which may continue or be replaced, after a time, by symptoms of intestinal implication. The meteorism then extends into the small bowel, and disagreeable borborygmi begin, so severe at times as to cause the patient to shun the society of companions. Colicky pains accompanying the bowel distention are a source of

true discomfort, and may be even quite acute. The expulsion of the gas *per rectum* assuages the severity of the distress, and after the lapse of an hour or two the person returns to his usual condition. But although this disagreeable process may follow every meal, incapacitating the person from any enjoyment of life, it rarely causes any marked emaciation—a proof that at least a portion of the food is properly digested and assimilated.

It has long been ascertained that in the atonic dyspepsia of neurasthenics there exists actual subacidity of the gastric juices, as shown by the phloroglucine-vanilline and other tests. This insufficiency of hydrochloric acid in the stomach juices accounts very satisfactorily for the active fermentation that succeeds the meal, as it is known that the presence of three or four parts per thousand of the acid will prevent for a considerable time such bacterial action. Either through the ingestion of decomposing matter during the meal, or from the retention of particles of food stuffs between the teeth sufficiently long to allow of the commencement of a putrefactive process, and the after-swallowing of these particles with the saliva, a general fermentation is started up, which, being unchecked by the presence of hydrochloric acid, results in rapid gas formation in the stomach and intestine, the gaseous production in the bowel being caused by extension of the process from the stomach, the alkaline juices of the duodenum rather favouring than preventing its continuance.

Mental depression and states of anxiety, as in other nervous diseases, tend to further diminish the secretion of acid and to aggravate the dyspepsia. Constipation of an obstinate character nearly always accompanies nervous dyspepsia, and when under the influence of cathartics the fecal matters are expelled, they are in the form of hard scybala, or small cylinders. When there is intestinal irritability, as after a chronic catarrhal affection of the small bowel, diarrhœa may replace the constipation, and the emaciation may then be considerable, though rarely grave. In the mild types of neurasthenic dyspepsia there is rarely any considerable degree of dilatation of the stomach walls, and the expulsive motility is retained, not perhaps to the normal degree, but sufficiently to cause the passing on of the alimentary mass within a reasonable time. Digestion in the neurasthenic is much slower than normal, and a part of the gastric fermentation may be owing to the retention of portions of the food from one meal over to another. Like all the other cardinal symptoms of the nerve bankrupt, the gastric atony

is but a symptom of the loss of nerve force affecting the entire organism.

The dyspepsia from subacidity is rebellious to treatment; it may persist over years without amelioration, or may rapidly subside on the return to health of the patient. The exhibition of acids lessens the fermentation and promotes general nutrition.

The graver form of the atonic dyspepsia of the neurasthenic is virtually an aggravation of the milder type. Each repast is followed within a short time by the indications of rapid fermentation both in the stomach and intestine. Fatty, starchy, and albuminoid substances are digested with equal difficulty; eructations are constant, and the constipation is most difficult to overcome. The imperfect digestion in both stomach and duodenum now causes a new and grave series of symptoms. The bodily weight steadily decreases, the skin assumes a dry, earthen tint, and the facial expression is one of languor and distress. In some instances the emaciation is extreme. One patient, under my observation, decreased from one hundred and sixty to ninety-six pounds within a period of eighteen months, but under careful dieting and hydrotherapeutic measures she regained a considerable portion of the loss, although she still retains many of the characteristic stigmata of neurasthenia.

It is most difficult in these extreme cases to distinguish between the atonic gastro-intestinal dyspepsia and organic disease of the digestive apparatus, particularly that of the pyloric end of the stomach. The gastric contents lend little aid, the hydrochloric acid being diminished or absent in both instances; but the anorexia and loss of weight, the yellow, shrunken skin and visibly progressive blood deterioration are always strongly suggestive of pyloric cancer. Continued absence of hydrochloric acid is always suggestive of the presence of carcinoma.

Usually some hints pointing to the correct diagnosis may be gathered from careful physical examinations. The absence of a tumour in the pyloric regions, and a history that the patient has suffered from others of the cardinal symptoms of nervous exhaustion for a number of months antedating the violent onset of the gastro-intestinal disorder, are strongly indicative of a neurasthenic basis for the trouble. Some help may also be obtained from the slow and imperfect character of the gastric digestion, food remaining in the stomach for six to seven hours after its ingestion, as shown by the tube, although it must be remembered that this state of affairs is also found in some cases of carcinoma. In this atonic

condition of the muscular walls from defective innervation, complete evacuation of the gastric contents is hindered, and the food lies within the organ, fermenting and causing distress. Actual dilatation of the stomach from gaseous distention and loss of contractility, which seldom occur in the milder forms, is here by no means rare.

The severe varieties of atonic nervous dyspepsia may also be directly induced by acute chagrins or lively emotions. They are exceedingly obstinate to treatment, but yield more readily to hydrotherapeutic measures with suitable diet than to other means. A complete change of surroundings is often requisite to help to overcome the accompanying depression, the nervous fears and distress.

Attacks of acute intestinal indigestion are frequent in neurasthenic patients that have none of the more common forms of atonic dyspepsia. The attack begins with nausea, vomiting, and frequent diarrhœal discharges of watery consistency, without the peculiar odours characteristic of intestinal putrefaction. Icterus occasionally succeeds the attack. In milder forms, sudden pains of a colicky character may be followed by profuse watery discharges, which pass off within a few hours, leaving no trace of any serious ailment. Such attacks frequently follow acute moral emotions, quarrels, frights, or even unusual mental exertion under compulsion.

Nervous diarrhœas, with frequent discharges of clear watery fluid, are occasionally met with in neurasthenic patients. With the predisposed the thought of having to undertake a railway or other journey, of being obliged to address an audience, or do anything unusual, will produce them, and as soon as the cause of the excitement has passed, they cease. Vomiting also is noticed under similar conditions.

The appetite is often irregular and capricious. In some there is a tendency, considering the small amount of exercise taken, to overload the stomach; while in others—and these form the majority—the amount of food taken is insufficient to keep up the bodily nutrition to a nearly normal level.

The tongue in the various forms of dyspepsia is slightly furred, but the indications given by it are inconsequential. A heavily coated tongue, when constantly present, indicates some more serious trouble than atonic dyspepsia. Deglutition is frequently accompanied by a sensation of difficulty in swallowing, sometimes sufficiently severe to induce the belief on the part of the patient that

there is actual stoppage of food in the œsophagus. A peculiar digestive symptom is the so-called neurasthenic hunger. A few hours after a full meal certain of these patients experience an urgent craving for food, which, if not quickly appeased, brings on a state of intense motor weakness, followed by vertigo, perhaps fainting seizures. The ingestion of food immediately allays the paroxysm. This condition has been attributed by Benda to an abnormal irritability of the vagus fibres, with secondary excitation of the vaso-motor centres of the medulla oblongata, both conducing to a reflex brain anæmia.

Besides the above detailed cardinal symptoms there are others equally pathognomonic of nerve weakness, though clinically less frequently found. These are the disturbances of the special senses, of the circulatory apparatus, general sensibility, genital and secretory organs, and mental symptoms, comprising mainly the phobias and fixed ideas. Except with the last, it will be impossible in this place to give more than a bare outline of their most prominent features.

Troubles of the Ocular Apparatus.—Transient congestions of the conjunctivæ are noticed especially in women. The congestion is usually diffuse, most apparent in the early morning, and soon disappears after the morning meal. It appears to be connected with defective vaso-motor innervation, and is sometimes associated with a feeling of weight and heaviness both of the eyeballs and lids.

Pupillary phenomena vary greatly in different individuals with neurasthenia. The most frequent anomaly is for the pupils to be moderately dilated, reacting slowly to light and accommodation. Less usually they are moderately dilated, and react with great rapidity to alterations of light and shade—the "jumping pupil," as it has been named. The pupillary widening is often indicative of the general condition of the patients, being more pronounced when they are exhausted, more closely approaching the normal after prolonged rest. Myosis, marked differences in the size of the pupils, or irregular contractures, are not found in the simple neurasthenic, and point to serious organic disease if they are more than transient. The sympathetic reflexes and consensual movements of the iris suffer no perceptible abnormal variation in uncomplicated examples of neurasthenia.

Many neurasthenics are troubled by passing specks, by visions of angular pieces of wood or other objects, even small animals, or

insects, floating before the eyes; the simpler forms being the more frequent. These are the so-called *muscæ volitantes*, which may persist over years. The ophthalmoscopic examination shows nothing to account for them in the vitreous fluid, and they are variously ascribed to floating white corpuscles in the eye humours, or to defective innervation and transient hyperæmia of the retinal vessels. Eye examinations in nerve exhaustion are ordinarily negative, the signs of congestion or anæmia being all that can be recognized with the mirror. Transient narrowing of the field of vision has been noted by Westphal. Large numbers of the neurasthenic class seek the care of oculists for a varied assortment of eye troubles, particularly for defective innervation of the external and ciliary muscles, but the treatment by glasses is rarely satisfactory.

Chief and most important among the many ocular disorders is the neurasthenic asthenopia. The eyes, in writing, reading, and in pronounced instances by simple exposure to light on the street, rapidly become fatigued; if the person persists in using them, painful neuralgias, sensations of tension of the eyeball, and visual confusion result. The symptoms are aggravated by pressure upon the eyeballs. The condition, when the patients are improperly treated, soon becomes so extreme that they can only sit with comfort in dimly lighted or entirely dark rooms. The asthenopia may be transient, or last for months, even during the lifetime of the person. It is much more apt to occur in the severer than in the milder cases of exhaustion. A satisfactory explanation of the morbid irritability of the retina has not been given. At present we can only say that it forms a part of the general cerebral invalidism, intensified by minor peculiarities in the anatomical innervation of the muscles of accommodation and retinal arterial vessels.

The *other special senses*, hearing, taste, smell, and the general sensibility of the cutis, suffer from similar perversions of innervation as the eye. Auditory hyperæsthesias are most frequently met with. Pulsations, whistling in the ears, sounds of hammering, are the most common, and the imperfect sleep may be broken by sudden whirring sounds, such as would be caused by the flight of birds or the noise of explosions. Morbid susceptibility to odours, perversions of the sense of taste, which inspire a feeling of repulsion for food, are now and then noticed. "All things taste alike," is a not infrequent complaint.

The anæsthesias so common in hysteria are unknown among the simple asthenics, but in their stead come tormenting hyperæs-

thesias of great variety. The rachialgia and vertebral tenderness have already been noted, but similar impressions may be felt over the entire body. More usual, however, are the various formications, itchings, pricklings, tinglings of heat and cold, sensations as if insects were crawling through the skin, and ill-defined hyperæsthetic *douleurs* confined to the distribution of certain nerve trunks, notably the ulnar, musculo-spiral, plantar, and cranial nerves. Some local tenderness may be found occasionally upon deep pressure over the nerve trunks. Visceral hyperæsthesias, from ovarian neuralgias to sensations of heaviness in the epigastric region, are most common, but no portion of the anatomy is exempt from implication in some form. Hyperæsthetic states of the genital apparatus, the vulva, clitoris, or penis, are also frequently noticed, and may not only be sources of annoyance, but may also have a tendency to induce masturbation, followed by states of anxious depression.

Neuralgias are among the most common symptoms, both of the cerebral and spinal forms. The pectoral regions, the brow and face, the inner aspects of the arms, are the customary seats of the localized pain. Lancinating pains in the lower extremities may simulate the true ones of tabes. Neuralgic pains, particularly those located in the intercostal or the sciatic nerves, may induce the belief on the part of the patients that they are suffering from a grave organic malady, as cancer or locomotor ataxia; and the thought that such is the case, despite assurance and persuasion on the part of the medical attendant, returns with such force that it may have all the power over the sufferer of an imperative idea. In a similar manner brachial pain may conduce to the impression of a paralysis beginning in the arm, and from force of habit in avoiding distressing movements, the muscles of the limb may fall into partial disuse. The left arm is more usually affected than the right, and sinistral intercostal neuralgias are far more common than those on the contralateral side.

Disturbances in the Circulatory Apparatus.—Pallor or turgescence of local portions of the skin, especially of the face, hands, and feet, are frequent in neurasthenia. The chronic masturbator, who through the evil habit has lost his nerve vitality, always shows a sluggish circulation of the extremities, with dilated vessels, and moist, clammy palms, as an evidence of the paralysis of the sympathetic vaso-constrictor fibres. Less pronounced and more transient are the lividity and coldness of the extremities that follow prolonged mental exertion or emotion. The pulse in these instances

shows a marked degree of feebleness and slowness, and the *vis a tergo* being insufficient to drive the blood through the veins toward the heart, there results a corresponding venous congestion of the extremities. Other disturbances of the vaso-motor innervation are to be seen in the tendency of the neurasthenic to blush frequently, or in the habitual pallor of the countenance and hands, although the blood examination shows a relative sufficiency of red corpuscles. Œdema of the eyelids and of the fingers is noted in some women. Disturbances in the domain of the cardiac innervation are of common note. Any emotion will bring on an attack of palpitation, and both permanent tachycardia and abnormal slowness of the pulse have been recorded. This tachycardia may give rise to symptoms of extreme gravity.

The typical pulse of the neurasthenic shows defective innervation of the large arteries, with corresponding loss of tonus, as shown by the decreased tension. Emotional states produce a marked increase of the pulse rate, and exaggerations of the pulsations of the abdominal aorta and larger trunks of the extremities may induce a condition of lively apprehension.

Respiratory Troubles.—These are not so common as affections of the circulatory apparatus. In attacks of nervous anxiety, especially those following a paroxysm of cardiac asthenia, the respiration may become involved. It is then slow, difficult, broken by prolonged sighs, but the dyspnœa is slight. The voice under such circumstances is feeble and constrained, as if the person was completely exhausted. A dry pharyngitis, or sudden coryzas are frequent among neurasthenic women.

We now reach one of the most important phases of the symptom-complex of neurasthenia, the phenomena of which are more difficult to comprehend than those of the somatic nervous type, and more difficult to elicit from the patient, who considers them for the most part as evidences of disturbed mentalization, and shuns speaking of them even to the physician. Not every person affected with nervous exhaustion has these troubles, but at the same time they are found, if careful inquiry be made, in a large proportion of the cases of cerebrasthenia.

The mental phenomena of unstable vitality are extremely varied, and are chiefly associated with, or arise from, imperative or insistent ideas. The sensations of depression, of indefinable agony, and the emotional states have been sufficiently dealt with in the preceding

pages not to need repetition; but now a new class is superadded. Out of the imperative conceptions and their equivalents are evolved states of mixed motor-emotional agitation, the numerous phobias, the *délire du toucher et du doute*. These false conceptions result from the imperfect adjustment of the brain equipoise. When in thought-association, either in the alert or subconscious states, certain ideas obtrude themselves and become dominant, they gather a morbid clearness and fixity that impress them upon the faculties of the person, and as time goes on, owing to imperfections of volition, they assert and reassert themselves, until they become all-powerful in the daily life, and, unless some change of habit or of surroundings intervenes, finally exercise a permanent and controlling influence.

Nearly every one has experienced an irresistible desire, after the gas has been turned out, to go back and try the cock, not once, but repeatedly, or to see if the fire has been properly extinguished, or the door locked, a half dozen times before retiring, although we are perfectly well aware that everything is right in the house. Despite this knowledge, if we force ourselves to abstain from these acts, we experience a vague sense of disquiet that may last for an hour or two afterward. Similarly the dreads, those of void places and crowded assemblages, and various other strange fancies, have for the main part their prototypes in the natural fears of childhood. Few children like to remain by themselves in a vacant room, or to be left in the dark, or in a crowd, no matter how stable their nervous systems; and under such circumstances they quickly become anxious, and then either depressed or excited, according to their inherited disposition. Fear is a natural tendency of mankind, and when there is a pathogenic strain in the blood, any unusual incident may set up a reflex thought-train that is irresistible. These imperative conceptions are recognised by the adult patient as absurd, as an evidence that their ideas are not travelling in the beaten channels, but to resist them only produces a mental distress, while to yield is to increase their power over the unhappy individual. They have no relation to hallucinations, and but slight consanguinity with delusions, as they are recognised to be false, and are constant and not alternating in their character.

Motor-Mental Agitation.—The dominating idea forcing the patient to do some absurd or repulsive act may bring on an outbreak of agitation that can only be relieved by incessant motion, during which the person is in a state of indescribable mental hyperæs-

thesia, wringing the hands, praying, or weeping. The gratification of this imperious desire to be in active movement gradually conduces to a sense of relief, and after a short time the person is again calm, collected, and reasonable. The attacks are very transient in character, and bear a striking likeness to the anxious states noticed so often in cases of hereditary mania and melancholia, but lack their intensity and duration.

Neurasthenic Anxiety and Compulsory Ideas.—These are mainly based on the same general pathogenic factor—loss of will control. They frequently follow half-conscious dream-states, which may give rise to a form of auto-suggestion, or are due to long-continued habits that, beginning as the tiny stream of sand from beneath an opened bank, gradually acquires force and direction until the whole structure is overthrown. They may also arise in a weakened psycho-physical condition after febrile disease, but are then usually transitory. Except in extreme instances they are not to be regarded as evidences of true insanity. The patients recognise their absurdity, and in a feeble way strive against them, but the lassitude of will is too great to be overcome, and they return to their fears and anxieties. These fixed ideas are in contrast to those of the paranoiac, who believes that all his false conceptions are true and have a basis in reality. Nevertheless, imperative ideas may form the substratum of a system of delusions, the wearing of a persistent train of thought upon unstable brain matter finally causing it to assume pathological proportions.

The imperative ideas of the anxious neurasthenic assume so many forms that it is necessary to refer in detail only to a few of the more frequent. Provided only that the foundation upon which they arise is clearly recognised, they may be treated with some degree of scientific comprehension. Thus the fear of the presence of filth, of contagion, of poison, of unpleasant resemblances, of solitude, of being in a crowded place, or of thunder-storms, may all cause morbid concepts of marked intensity and persistence. One person finds that in conversation he has the constant inclination to interpolate some obscene word, an idea repeating itself over and over again to his extreme annoyance. Another thinks there are lice or particles of filth on his clothes, the notion, perhaps, being founded upon some actual occurrence. The thought renders him miserable, and he spends hours in searching for their presence, the most minute examination of the articles never convincing him of their absolute cleanliness. Women fear contamination from syphilis when

passing their urine in public closets; they take the most elaborate precautions, and are unhappy lest their skin may have touched the seat. Others will not touch their genitalia unless the hand is protected by a glove. The neurasthenic at the time of the menopause, and the woman living in solitude, are more liable than others to conceptions of morbid intensity.

For a few of the obsessions of the neurasthenic, owing to their frequent occurrence, distinct names have been assigned. Thus *agoraphobia*, the fear of being in open spaces; *claustrophobia*, the oppression felt in a closed room; *anthropophobia*, the fear of coming in contact with one's fellow-men; *monophobia*, fear of solitude; *pathophobia*, the fear of becoming diseased; *zoöphobia*, the dread of animals, and hundreds of others, are by no means uncommon. One of the most difficult to understand is the impellent inclination in refined, well-educated women to mingle blasphemous and filthy expressions with their conversation, a tendency that is most difficult to repress, and gives them the most acute mental distress. Agoraphobia may cause infinite trouble, even danger, to the unhappy one afflicted with it. In walking along the street he clings to the railings and houses, and if by any chance he comes to a crossing, his anxiety becomes terrible; he starts, hesitates, starts again, and when half-way across turns back, only to repeat the same performance, perhaps at the imminent risk of his life in crowded thoroughfares. The mental chimes are out of tune, and the bell-puller seizing the wrong cord produces a lively discord.

The délire du toucher et du doute also arise after compulsory ideas. In the first variety the person affected has an irresistible desire to touch certain objects—pieces of paper with writing on them, for example. Wherever a piece of paper is seen he must know its contents, whether it is in the hands of other persons, lying on the street, or even upon the table of a private room to which he has been admitted. Such impulses naturally lead to unpleasant results, and attempts to read writing over the shoulders of some chance stranger may be productive of conflicts. The reverse order of things may also happen. The individual is afraid to touch certain objects—a door-knob, the chamber-vessel, or to shake hands with friends. Every forced contact induces a lively disquietude, which can only be allayed by repeated ablutions, sometimes only with strong antiseptic solutions, and the person will try every possible measure to avoid this contact either by wearing gloves or by going out of his way in order to escape the contamination.

The *folie du doute* is of similar nature. Every conceivable thing has to be reasoned about and considered from every possible stand-point. Was the world created, or did it come by chance? If created, did the Almighty bring it into being, or did he appoint the angels to do it, and, if so, why? Is this object before me a box? Why should it be called a box? Why should it be square, and not round? If the lid is taken off would it still be a box?—and so on *ad infinitum*. Through an equally absurd and endless series of mental equations, but in a similar fashion, an accountant conceives the idea that his books are false; he spends hours seeking an error, is never satisfied that the figures are correct, and is finally obliged to cease his life-work, from the apprehension that some mistake may arise which would produce mortifying, perhaps serious, results. The Germans have rightly named this peculiar mental attitude *Grübelsucht*—the refining disease.

The various symptoms of neurasthenia may show a periodic or intermittent tendency, being severe at one season and slight at another. The majority are less annoying in warm than in cold weather, from the diminution of the effects of the vaso-motor paresis.

Pathogenesis.—The disease neurasthenia belongs mainly to the hereditary type of degenerative neuroses. At autopsy neither gross nor minute lesions are demonstrable. In the faulty organization of the brain cell, together with an incapacity on the part of the elements to absorb a sufficient supply of pure pabulum, is to be sought the origin of the train of symptoms of nervous hyperexcitability. Gutnikov has demonstrated, by means of accurate chemical analyses, that the brain of neurasthenic persons has far less phosphorus-containing substances than is usual—0.30 per cent against 0.8 to 1.50 per cent for the normal man. Few neurasthenics, even those that accumulate fat, have a blood supply perfect in all its essential vital characters; the serum is vitiated, the fibrin being deficient, the corpuscular elements are lacking in quantity, or abnormal elements are in excess.

Neurasthenia is, ordinarily, a disease of post-developmental life, after the constructive period has passed, when the active vitality of spring has been succeeded by the stationary period of summer.

Differential Diagnosis.—A correct diagnosis is most important. A neurasthenic symptom-complex may arise at the beginning of divers grave mental maladies, and unless close examination be made, mistakes of a serious character may obtain. Again, nerve-exhaustion

may be the forerunner of organic physical maladies, particularly tuberculosis. In this last category, however, should not be included those neurasthenics that have suffered for years and have become enfeebled from prolonged and severe dyspepsia, so that they fall an easy prey to the bacillus.

So far as concerns the organic nervous diseases, the symptoms of cerebrasthenia may suggest to some extent an incipient general paralysis, or brain syphilis; while those of the spinal form may point to the beginning of certain varieties of tabes, or even of myelitis of specific origin. Indeed, the diagnosis may be more than doubtful in any of these cases, if there is a clear history of luetic infection. Repeated, complete, and methodical examinations, bringing to our aid all the means and apparatus of scientific neurological research, should be made in every case in which doubt arises as to the nature of the phenomena, and the assemblage of symptoms and signs should be thoroughly sifted and weighed before a balance is struck.

Paretic Dementia.—The decision between this malady in its early stages and neurasthenia cerebralis is of the gravest moment for the prognosis, because what slight hope there may be in the treatment of paresis can only obtain in those cases in which the therapeutic measures are undertaken in the earliest stage of the affection. Added to this, its early recognition is necessary to protect the family of the patient from serious ethical and financial misadventures, as well as from possible brutalities.

Three differential indications claim the first attention: the state of the pupillary reflexes, the age of the patient, and the mental condition. In uncomplicated forms of nervous exhaustion the pupils are usually in a state of moderate dilatation, or, although widely dilated, react, nevertheless, promptly to light, accommodation, consensual and sympathetic stimuli, and are regular in outline. The "attention reflex" is also not impaired. In paresis, if careful examination be made, some departure from the normal reactions are to be determined at an early stage of the disease in fully ninety per cent of all cases. The pupils may be of normal size, but react slowly to light and consensual stimuli. They may be too small (pupillary myosis), non-reactive to light, and to consensual and sympathetic stimuli. They may be irregular in outline, and react slowly or not at all to the various excitations. One pupil may be larger than the other, and the reaction times be different in each. The pupils may be widely dilated, and react slowly or not at all to

light, consensual and sympathetic stimulation. The "attention reflexes" are found to be lost or diminished at an early stage of the disease. The power of accommodation is so frequently retained, even in the spastic myosis, that it cannot be held to be of much value as a diagnostic sign.

The age of the patient is of considerable importance in diagnosis. If the symptom series has commenced before the thirty-fifth year in a neuropathic individual in whom there is no history of lues, of alcoholic or nicotine misuse, or excesses in masturbation or venery, and the breakdown is sudden, not gradual, the indications are strongly in favour of cerebrasthenia. If, on the other hand, in a man in middle life the malady has come on gradually, with a growing alteration from month to month in the moral character, with memory losses equally progressive in character, we must think of paresis. Neurasthenia may have its onset at any period of life after puberty, but is more frequent before forty than afterward, while the mean average for paretic dementia is forty-one years. In the neurasthenic of middle life, overwork, anxiety, or moral emotions are commonly the immediate cause. The same factors may apply in rare instances to paresis, but in a preponderating proportion of cases syphilitic degeneration of the encephalic tissues, slowly coming to an acme in the early period of the second stage, is the essential feature.

The mental state of the neurasthenic affords reliable aid for a discriminative diagnosis. The failure of memory is subjective, and not objective, and is corrected with but little effort, being purely functional. Neurasthenics do not make the gross mistakes of the paretic; the day and year are not wrongly given, and when errors occur they are slight. A tendency to emotional states, to irritability, to egotism, are common enough with the nerve bankrupt, but they are not combined with delusions of an ambitious type. The numerous phobias of the neurasthenic, that they are afflicted with grave organic diseases, is practically unknown among paretics, who in their own opinion, at least in the early phases of the disease, enjoy the best of mental and physical health, while in the demented form they are simply inert, and apathetic to surroundings. Hypochondriacal states are comparatively seldom noticed in the first stage of paresis, but are frequent in the neurasthenic. Marked alteration in the sensorial sphere, mainly affecting the code of ethics, is frequently seen in dementia paralytica, but seldom in neurasthenia. Rarely do we find in the latter disease a man who has led an upright life suddenly break out into active debauchery, visiting

houses of prostitution, seeking the low company of the gambling hall, and indulging in trivial thefts unmotived by want, or in unwonted brutality. Such lapses are only too frequent in dementia paralytica. Disturbance of actual intelligence is rarely found in the neurasthenic; in paresis it is one of the earliest symptoms, and is progressive in its character. An enfeeblement in judgment is common to both affections.

Other differences may be noted between the two maladies, but these are of secondary moment. The voice in both may be disturbed, but in the adynamic, while it may be lowered, and the utterance be slow, even uncertain, there is none of the syllable elision, or stuttering, jerky speech, which is a prominent feature of dementia paralytica.

The handwriting in both diseases may also show changes. The neurasthenic may omit words or syllables, or use words incorrectly, but he amends his errors without hesitation; while the paralytic, if his attention be directed to them, is either unable to do so or asserts that there is no mistake. Again, the pronounced saw-edge tremor of the paralytic's handwriting is also wanting in its characteristic features in the neurasthenic, the tremulous character of the latter's script showing nothing beyond uncertainty. Sleeplessness is common to both maladies and cannot be made a point in differential diagnosis, but the paralytic is liable during the daylight hours to become very drowsy in the presence of company—a sign that the neurasthenic rarely shows.

Besides the pupillary phenomena, retinitis, gray atrophy, papillary œdema, injection and congestion of the retinal veins, with narrowing of the field of vision in permanent form, are accompaniments of paresis; while, on careful examination, the neurasthenic never shows anything more than anæmia, with perhaps photophobia, asthenopia, and may complain of ocular neuralgias.

Headache is common to the early stages of both affections, but the rise in temperature, which in paresis constantly accompanies it (Krafft-Ebing), should serve to differentiate. In both affections there is frequently a decrease of virility, but in paresis this amounts to an entire loss of potency, and is often preceded by a stage of violent sexual excitement. Epileptiform and apoplectiform seizures, so prominent in paresis, are not found in neurasthenia. The deep reflexes alone offer no certain differential feature. In neurasthenia they are normal or slightly elevated. In paretic dementia they are often above the normal, but may be subnormal. Should there be

absolute and permanent loss of the knee-jerks, the case is not one of the functional malady.

Cerebral Syphilis.—It is here necessary to distinguish two conditions. In the one we may encounter symptoms approaching the neurasthenic complex in persons who have had an antecedent history of specific affection, and in whom the indications are due to weakening of the nerve powers through the influence of the virus. In the other, we may have to deal with a true neurasthenia occurring in syphilitics, but in which the stigmata have no direct relation to the original malady, but are accidental.

In a certain number of luetic patients, headache, insomnia, emotionality, muscular asthenia, various pains in the limbs and back are noticed, but to these characteristic indications of neurasthenia a new symptom is not infrequently added. The patients, who may be afflicted with secondary or tertiary syphilis, have cephalalgia, that does not diminish as the day wears on but increases toward night in paroxysmal fashion, is often beyond endurance, and is unrelieved by ordinary therapeutic measures. There may be also local anæsthesias, loss of control over the sphincters, epileptiform and apoplectiform attacks, transient in their nature, and progressive dulling of the faculties, none of which occur in neurasthenia. Pupillary phenomena on the order of those occurring in paresis are quite frequent, and hypochondriacal states of great intensity are noted in the syphilitic, but not in the neurasthenic cases.

In the other series the patients have constitutional syphilis with neurasthenia, and the virus may be considered as a provocative agent, but the poison does not affect their mental integrity nor induce symptoms of organic nerve lesion. The patients, therefore, have had syphilis, but except for the mental impression left by the knowledge that the loathsome disease has been in the system, it in no wise affects their nervous functions, and, beyond a certain deleterious action upon the general nutrition, plays no part in the production of the symptoms of nervous exhaustion.

Tabes Dorsalis.—The differential diagnosis from this organic affection is not difficult. In spinal forms of neurasthenia the patients may complain of lancinating pains in the lower limbs, gastro-intestinal crises, uncertainty of locomotion, weakness of the leg muscles, loss of virility, perhaps spermatorrhœa, and may even show the Romberg symptom when standing with closed eyes. But here a diagnosis of tabes can readily be thrown out, if there are no oculo-motor symptoms, no atrophy of the optic nerves, no diminu-

tion of the deep reflexes, no anæsthetic patches on the soles of the feet and skin of the legs, and if the loss of power is functional, not actual. Furthermore, the neuralgias and gastro-intestinal crises of the neurasthenic have not the fulminating character which belongs to posterior spinal sclerosis.

Other organic maladies of the nervous system that might occasionally be simulated in the comprehensive symptom-complex of neurasthenia are mild cases of *transverse myelitis*, and the Erb type of *syphilitic spinal affection*, which are easy to differentiate by the constant character of the loss of muscular power, the bladder troubles, and, in the latter disease, by the anæsthesia.

In *disseminated sclerosis* the exaggeration of the tendon reflexes is greater than is usually seen in neurasthenia, the character of the tremor is entirely different, and the diminution of muscular power is constant.

The constant cephalalgia of the cerebrasthenic may give rise to suspicions of *intracranial tumour*, but the pain in the head is not so steady, nor is the vertigo so intense. Again, the asthenic also exhibits other characteristic symptoms, of which anxiety, preoccupation, gastro-intestinal disturbance, motor feebleness of a general character, and numerous others, do not conform to the symptomatology of the intracranial affection. Nor is there the progressive mental dulling, hebetude, and somnolent states so often seen in brain tumours.

The nervous manifestations arising in the course of *gout* often bear a strong likeness to those of pure nervous debility. Indeed, Rockwell and Vigouroux detail the similarity in symptomatology at some length, and the latter author considers that the two affections are of a similar nature, and may coexist. The arterial state gives the best distinguishing indication. In neurasthenia the pulse rate may be either abnormally high or unusually slow, in either case, however, there is subnormal tension; while in uricacidæmia there is always increased tension, with a hard, incompressible, throbbing pulse, and the præcordial impulse, combined with exaggeration of the second sound of the heart, is abnormal. Albumin may be present in the urine of gouty patients, but only rarely occurs in pure neurasthenias.

Among mental affections, neurasthenia is most frequently confounded with melancholia simplex, with hypochondria, and with hysteria. The mild melancholia of the chronic masturbator, and that consequent to states of intense physical depression, have many

points of similarity with cerebrasthenia. The depression, the difficulty in concentrating the thoughts, the nuchial pain and nervous irritability, are common to both, but the dominating delusions of self-abasement, overshadowing all other signs, is usually sufficient to allow of a differential diagnosis. Hallucinations are not found in simple neurasthenia, neither are imperative ideas in the form of phobias part of the clinical picture of melancholia. Hypochondria sometimes bears considerable resemblance to neurasthenia. In both, numerous morbid fancies, fear of disease, sleeplessness, pains in the head, and inefficient will-control, are encountered, but the symptoms of hypochondria are more changeable than those of neurasthenia, and comprise a host of minor troubles that are detailed by the patient with painstaking exactitude, which is foreign to the ordinary habit of the nerve-exhausted, who are word-penurious about their mental symptoms.

Hysteria and neurasthenia are combined in exceptional instances. The pure neurasthenic exhibits none of the characteristic stigmata of hysteria—the convulsive crises, the regional anæsthesias and hemianæsthesias, the hysterogenous zones, the dyschromatopsias and narrowing of the visual field, the paralysis and contractures of the extremities; hence the cardinal distinctive symptoms between the two affections are entirely definite.

The Blood in Neurasthenia.—In the uncomplicated cases of the malady the blood seldom offers to microscopic or chemical examination any grave departure from the normal in its constituent elements. On the other hand, in the vast majority of all forms of asthenia numerous smaller deviations are demonstrable, but whether they are primary, or are induced by gastro-intestinal indigestion, or by habits of life antedating the asthenic symptoms, remains undetermined.

The fresh-drawn blood is rarely of the normal deep-red tint, but is paler, more watery, and if allowed to stand in a glass vessel the separation of the plasma from the red elements takes place very slowly. Its coagulative properties are also deficient. The blood when spread on a plate does not solidify firmly, but remains watery and half fluid. This is owing to a decrease in the amount of fibrin in the serum, which, according to Biernacki, is almost constant, the opposite of what is met with in hysteria. Blood counts show a varying number of corpuscles, from the normal to considerably below it. The hæmoglobin varies greatly, but in hereditary asthenia is always less than normal—from sixty to ninety per cent, aver-

aging about eighty per cent. The microscopic investigation of the dried, stained, and unstained blood shows sometimes natural conditions, but more frequently there is pallor of the red corpuscles, a few microcytes and macrocytes, with a slight excess of mononuclear or polynuclear leucocytes. The eosinophiles are rarely increased above the normal, although in some instances they are present in excessive numbers. This finding is more common in neurasthenics below the third decade of life than in older individuals. The polynuclear elements sometimes look as if they were old and about to break down, the mononuclear forms at the same time being present in decreased numbers. These changes, while slight in themselves, would indicate that there is a defective process of nutrition carried on by the cellular elements and plasma.

The Urine in Neurasthenia.—Several theories have been built upon the varying presence of certain organic derivatives of tissue metamorphosis, and upon an excess of oxalates and phosphates resulting from an insufficient oxidation of azotized elements of the food in digestion. But although there may be some basis for these theories, it must be admitted that excess or diminution of the products of oxidation of nitrogenous substances in the urine may be frequently noticed without the attendant symptom-complex of neurasthenia, and, as Roberts long ago observed in his studies on oxaluria, the nervous condition is common without the deposits of calcium oxalate. It is true that the urine of neurasthenics frequently contains abundant deposits of oxalates, and more frequently, even in acid urine, of earthy phosphates, but their presence signifies little more than defective digestion and deficient oxidation; and when these subside under medical treatment or by natural processes, the oxaluria and phosphaturia cease, even although some of the neurasthenic symptoms may still remain.

A second and even more frequent irregularity in the oxidation process is shown by the presence of indoxyl potassium sulphate in the urine. This is almost constantly present in quantities above the normal, varying from an amount sufficient to render the urine blue when passed, to only a little more than a trace. There is some constancy in this instance between the mental symptoms and the increased amount of indican, hypochondriacal and confusional indications mingling with those of purely nervous exhaustion. The atony, dilatation of the stomach, and slowness with deficiency of digestion, are here quite sufficient to account for the presence of the ethereal sulphates.

The last of the products of defective digestion and incomplete oxidation is observed in studying the elimination of the uric-acid derivatives. Vigouroux, as before mentioned, places neurasthenia on the same ground as the uric-acid diathesis. Huchard and von Bechterew found a constant increase of the acid urates, and the latter author noted an equal diminution of urea, an observation which I can substantiate.

These changes in the total quantities of azotic substances in the urine, resulting from a deficiency in the stage of digestion oxidation that changes oxalic and the fatty acid series into carbonic acid (oxaluria and phosphaturia), are only coefficients in the etiology of neurasthenia; underlying them is usually the constitutional inability of the entire central and sympathetic nervous systems to keep up to the work that Nature foreordained for them, owing to the fact that our forefathers have, by excesses, degraded them from their high position.

Treatment.—Were we to begin the therapeutic consideration of nerve exhaustion with Gerhardt's maxim, "The medicine does not heal this disease, but the physician," the error conveyed would, I believe, be greater than the truth. While it is true that certain neurasthenics are not bettered by carefully considered therapeutic measures, a much larger proportion are, if not cured, made much happier, and their life is rendered more comfortable by them. Each case must be studied for itself, and careful consideration be paid to the degree of hereditary weakness. Or, if this be not constitutional in the exact sense, we have to determine how much of the symptomatology has been induced by past acute diseases; how far the present severity of the symptoms has been influenced by excesses in alcohol, in venery, and by masturbation; and, further, whether the patient be now indulging secretly in narcotics, opium, cocaine, ether, or drugs of the coal-tar series.

The treatment of neurasthenia might accordingly be divided into four sections: hygienic, dietary, moral, and medicinal. The Weir Mitchell treatment is founded on the first three methods.

Hygiene.—The surroundings at the home of the patient should be carefully looked to. The drainage, the ventilation of the bedrooms, the drinking water, from chemical and bacteriological standpoints, should all meet with the requisite attention. Bathing at proper times should be insisted upon, and the temperature of the bath and manner of taking it should be minutely detailed to the patient. Some neurasthenics brace up wonderfully under the ton-

ing influence of a cold sponge, needle, or plunge bath in the early morning; others become more exhausted by them, and require lukewarm or even hot baths. In other instances the warm bath at night has a quieting influence, promoting rest, and lessening the force and duration of the insistent ideas that flood the patient's brain when daylight has lost its correcting influence. In certain cases, on the other hand, the warm bath increases the tendency to the cardiac throbbing and unpleasant sensations about the head, and prevents sleep. A choice can often be made only after experimentation. The loss or addition to the weight under the influence of systematic bathing should be noted from time to time, and our procedures regulated accordingly.

The climate in which the neurasthenic lives has also to be considered. Excitable, emotional individuals usually do better at a considerable altitude; those with slow, imperfect digestions, as a rule, find the sea level more congenial. A change from the city to the country, the free life in the woods and fields, hunting, fishing, loafing with a pleasant companion, or the interests of a farm, may do more for the nerve bankrupt, especially one that has become so through protracted mental over-exertion and anxiety, than months of treatment in the city. Variations from the society of his own household to that of strangers, trips to the sea-shore, to the mountains, any place which affords quiet and at the same time some distraction, are most desirable. The daily life of the patient should be blocked out as a checker-board. Every hour, every minute in the day, should have something of interest or service in it. If it does nothing more, it will give a stimulus to his flagging energies, and strengthen his will power by making him methodical, even though the habits become semi-automatic.

Dietary.—The alimentation should always be a matter of concern. The majority of the nerve-exhausted are actually anæmic and weak, and require a surplus of food. This arises partly from loss of sleep and partly from the frequent digestive difficulties, which are always aggravated by anxiety and the neglect to provide a diet suitable for the individual case. While in some patients with slow digestions three repasts a day are a sufficient allowance, and nothing is gained by forcing food into the stomach, many gain flesh and are more comfortable if they take some simple aliment between each regular meal. Atonic dyspepsia is not always an indication that food should be exhibited at long intervals; numbers of cases affected by digestive troubles do better and regain their health more

rapidly if they are fed regularly every three or four hours with simple foods that require little digestion—milk, koumiss, egg-nogs with a limited amount of alcohol—than if put on regular meals. As a rule, it may be stated that when patients with severe neurasthenic symptoms seek the advice of the physician, it is better, at least for a time, to take them off their previous diet, feed them with liquids and semi-solids, and little by little add one food stuff at a time—a vegetable, bread from whole wheat or Graham flour, some kind of meat—until we have ascertained what best agrees with them, and then allow a more liberal variety. Over-feeding should be tried whenever experience has shown that it agrees with the patient. Only the very indigestible foods, the salted meats, the vegetables of the cabbage and turnip family, very starchy foods, pastries, and an excessive amount of sweets, should be absolutely prohibited. Milk, eggs, and their combinations in all forms, a moderate amount of fresh beef, lamb, chicken, turkey, fish, bone-marrow, all the garden stuffs (potatoes excepted), especially those rich in chlorophyl, as spinach, with a suitable bread, may be gradually taken. Fruits of all kinds, with the exception of bananas, perhaps also strawberries, and those which have been proved to disagree with the individual patient, should be allowed, but the acid and subacid apples, cooked or raw, are the best. The water supply should be carefully regulated, and a sufficient amount for the physical needs insisted upon. Many neurasthenics do not take enough water, or take it only at their meals, when it delays digestion and increases the flatulency. Tea and coffee, especially the latter, are to be avoided, as they have a tendency to increase intestinal indigestion. Chocolate, cocoa, broma, are usually unobjectionable, and are nutritious. Cocoas, with a portion of the fat extracted by means of pancreatin, are the best; those in which soda has been employed for the same purpose are to be avoided, as they decrease the acidity of the gastric juice, even though their alkalinity be minimal. A glass of hot water half an hour before each meal is unobjectionable, and helps to promote secretion. Malt extracts, in doses of two to four ounces, assist somewhat the digestion of starchy foods, and in this way add to the nutrition. Bedford, lithia, or pure spring water should be given between meals, the amount taken being varied according to the effect produced. A useful means of quieting nervousness and inducing sleep is the administration of some liquid nourishment—broths, milk, or cocoa—just before retiring. It does not agree with every patient, but the effect with some is surprising.

Moral Treatment.—The moral influence that the physician, by the exercise of unremitting care, tact, and attention, is able to obtain over the patient is of the utmost importance to both. Too often in the family the neurasthenic is not considered as a sick person, and his depression and feebleness of will-power are derided and made fun of. As a rule, the lack of sympathy, which he believes due to him, far from stimulating him to increased efforts at self-control, makes him even more miserable, and he allows himself to sink still farther into the slough of despair. In no class of patients can the medical attendant do so much good as with the nerve-suffering class. A little sympathy judiciously administered has often a most happy effect. Too great leniency is to be avoided; kindness should always be combined with necessary firmness, and insistence upon the rules of the plan of treatment decided upon. The "golden mean" is what is needed.

Hypnotic suggestion has been advised by many of the German writers in the treatment of nerve exhaustion, but experience has shown that its employment only tends to further weaken the already deficient will-control. The best sort of suggestion, and the most efficient, consists in fortifying words and actions which will impress upon the slack attention of the patient the fact that he is not an incurable subject, that the malady is purely a functional one, by no means dangerous to life, and that his ultimate recovery rests largely in his own hands. In this way much can be done to support and add virility to his waning will-strength, as well as to alleviate his mental sufferings. The pathogenesis of the phobias and other imperative conceptions should always be carefully explained to the intelligent patients, and their aid and assistance sought to overcome them.

In a considerable number of cases of the severer types it is absolutely necessary to take the patients away from their surroundings, and to place them under the care of a nurse who should have full control, subject, of course, to the direction of the attending medical man. The Weir Mitchell treatment in full, or in modified form, is now often of the utmost value. This consists of isolation, enforced repose, massage, electricity, and over-feeding, the details being modified according to the nature of the particular case. Complete isolation is needed in only a few instances, but the repose, massage, and alimentation make up the essentials of the method. The ethical influence of being under a firm but sympathetic mind is very great with the subjects of this affection, and the qualities of the nurse employed should be fully ascertained before the treatment is

begun. It is especially adapted to such cases as cannot be readily managed at home, but has many disadvantages in its practical application, chief among these being the expense, which none but the well-to-do are able to afford.

Therapeutic Measures.—One of the troubles with which the physician has to contend in this particular form of neurosis consists not in forcing medicines upon the patients, but in preventing an overindulgence in them. As every new symptom arises, the victims besiege the apothecaries' shops, take any remedy suggested by acquaintances or strangers, and fall easy victims to the quacks. Numbers become alcoholics or acquire some drug habit, and thus add a second trouble often more difficult to deal with than the primary one.

Repose is essential to successful treatment even in the mildest cases. The neurasthenic has no reserve of nerve force laid by for service, and he must acquire some modicum from which to draw upon. The rest in bed may for a few days be absolute, due attention being given to the bodily necessities; then, if there are signs of improvement in energy, the patient should be made to take walks for a limited number of minutes, or longer carriage rides, the duration of these being carefully regulated and gradually increased. With a few chronic invalids prolonged rest in the recumbent position is inadvisable, owing to its tendency to confirm their valetudinarianism. On the contrary, such cases should be gently forced to take an interest in affairs other than those immediately concerning their own health. The cultivation of quiet hobbies leading to outdoor interests should be always encouraged.

With the milder forms of neurasthenia, entire withdrawal from contact with the world is not to be advised. In cases of cerebral exhaustion from overwork, more especially, after a few weeks of rest, partly in bed and partly with gentle massage and carriage exercise, the patients should be encouraged to take up new interests, to cultivate golf, tennis, or the moderate use of the bicycle, and to meet their fellow-men on equal terms. An hour or two of rest in the afternoon will often help to shorten the tedium of the day, and aid the restoration of the strength for the evening hours.

Some form of massage is nearly always advisable during the time the patient is confined to bed. Occasionally, however, we meet with patients upon whom it exercises a distinctly debilitating effect, and in whose cases, therefore, it is contra-indicated. It is equally useful in those having good nutrition, and in those suffering from

gastro-intestinal atony. In this last type of cases especial attention should be directed to the abdomen, since the kneading promotes and stimulates the peristaltic movements. Massage may be given in the evening or morning, according to the patient's peculiarities. If, as not infrequently happens, it has a soothing influence and conduces to sleep, it should be given shortly before bedtime; but if it makes the patient restless, the morning hours should be chosen.

Electricity is only an adjuvant to massage. Faradization of the entire muscular system may be employed, or, as a substitute, an electric bath may be given. Beard recommends the galvanization of the nervous centres, but from the liability to over-stimulation of exhausted cells the procedure should seldom be used. Franklinization has a moral effect that is sometimes useful. The chief application of electricity in neurasthenia is in faradization of the muscular layer of the stomach and bowels. For this it is best to employ very broad sponge-covered electrodes dipped in salted water, one resting over the vertebral skin, while the other is slowly moved over the region of the stomach and small and large intestines. Specially constructed metal electrodes may be used in faradization of the lower bowel for obstinate constipation. Galvanization of the head with weak currents, for cephalalgia, the negative pole being applied either to the neck or opposite side of the cranium, and the positive slowly moved over the painful portion of the head, is sometimes of distinct service.

Hydrotherapy.—In combination with friction or kneading, various baths are of service in neurasthenia. Extremes of hot and cold are to be avoided, as well as too prolonged baths at any temperature. Wrapping the entire body in a wet sheet for from fifteen minutes to half an hour, the person maintaining the recumbent position while the procedure lasts, is soothing and grateful. When the wet cloths are removed, the body is quickly dried and rubbed with a coarse towel or flesh brush, to promote the cutaneous circulation. A temperature of 85° or 90° is generally the best to begin with, and the water may be cooled or heated as the reactions indicate. Tepid full baths may be used for their quieting effect, although this is very evanescent. The hour for retiring is the best time for their employment. Cold douches and very hot full baths are to be avoided. A sojourn at a bathing establishment is at times useful, especially if the place be located in the country, where quiet, with suitable food and exercise, can be obtained.

Medicinal Agents.—The headache, the vertigoes, the insomnia, the pains in the limbs and back, seminal emissions, and the host of trivial, but to the patients impressive, symptoms, render them urgent in their desire for relief from drugs. Nearly all show indications of physical weakness, and it is desirable to keep them on a tissue-building tonic, given at fairly frequent intervals, and provide some harmless sedative, as the tincture of valerian, or spirits of ammonia, rather than permit them to send to the druggist as each new crisis arises.

Among the drugs that exercise a decided influence over the malady, iron is *par excellence* the most efficient, but some choice should be made of the form in which the metal is to be administered. The peptonates of iron and manganese from a reputable pharmacist are easily assimilated, and do not disturb digestion, while their constipating effect is very slight. They give a certain stimulus to the appetite, are miscible with milk or sweet wine, and are in many ways better than other preparations. Next in applicability is the subcarbonate of iron, which in capsule form may be combined with gentian, cinchona, and nux vomica, according to the indications.

Preparations of phosphorus—Freligh's tonic or Fraser's tincture—are useful as adjuvants to iron. The glycerophosphates of lime may also be used for the same purpose, and when the stomach tolerates cod-liver oil they may be taken in combination, with good effect. Somatose may be substituted for cod-liver oil, if the latter is not well borne.

Strychnine in small doses is of service as a general tonic to the vascular and nervous system, and may be combined with phosphate of quinine and the ferruginous preparations. It is particularly useful in gastro-intestinal atony. With certain patients it disagrees, and should then be discontinued.

Arsenic is of less service than the iron preparations, and has a tendency to irritate the stomach.

Caffeine, administered in the form of the citrate, has often good results in migraine, rachialgia, and general depression, but tends to cause wakefulness.

Opium and alcohol, while often giving immediate relief from some of the most distressing symptoms, should always be avoided, for if the patient comes to rely upon them, the degrading effects of either drug are far worse than the original disease.

Among the sedatives and hypnotics there are some that are of more distinct service than others. The bromides of potassium and

sodium are useful in allaying cerebral excitement, genital irritation, migraine, headaches, and neuralgias, as well as insomnia. They may be combined at pleasure with valerian, hyoscyamus, or the sulphate of codeia, according to indications. The various preparations should always be well diluted in order that they may not irritate the stomach. Asafœtida is of distinct service as a calmative agent, and in lessening disagreeable borborygmi. It sometimes promotes appetite and helps digestion.

Among the hypnotics, the bromides, trional, sulfonal, methylal, and paraldehyde are the best. Chloral should rarely be given. Ten or fifteen grains of trional or sulfonal, in warm milk or soup at night, are quite as efficient in inducing sleep as a much larger quantity, and the smaller doses leave behind no perceptible after-effect for the succeeding day. It is desirable to give these agents only every second or third night, especially in the case of sulfonal, since its calmative effect is continued over thirty-six hours. Brandy and whisky sometimes succeed as sleeping potions when other remedies fail, but they should only be used in cases of actual necessity. Sulfonal acts more promptly when dissolved in spirits than when given in powder or in milk.

Hydrochloric acid, alone or in combination with pepsin, is always indicated in fermentative dyspepsia. It supplies the place of the deficient gastric acid, stops fermentation, and promotes assimilation. It should be administered in small quantities well diluted. Stomach lavage is necessary only when there is considerable dilatation of the viscus, with retention of the ingesta for many hours. When used too frequently, it has a tendency to increase the atony and aggravate the indigestion. Combinations of salol, belladonna, and gentian, are of efficacy in preventing fermentation in the small bowel.

Constipation is to be treated with the sodium salines, especially the Rubinat Condal water, sodium phosphate, Rochelle salts, preparations of senna and aloes, cascara, compound extract of colocynth with hyoscyamus, and more rarely calomel or a dose of blue mass. Enemata have some advantages over the ordinary laxatives. Their effect is in some cases distinctly tonic to the intestine. Plain water, water and glycerine, or water with soap and oil, may be used. Of peculiar efficacy are the injections of four to six ounces of warm olive or cotton-seed oil, every second or third night, continued for several weeks. Given through the long rectal tube the oil penetrates high up in the large intestine, preventing decomposition,

cleansing the mucous membrane from decomposing matter, and toning up the muscular layer. It should be followed on the second day by small doses of Rochelle salts, as the oil has in itself but slight effect as a laxative. The warm oil is distinctly soothing, and the patient often falls asleep immediately after the injection. The advantages of abdominal massage have already been detailed.

Prognosis.—The perfect cure of any case of neurasthenia is always problematic. The majority improve up to a certain point, and sufficiently to enable them to take an interest and a part in active life. Relapses are frequent. The ultimate outlook is better for nerve exhaustion following mental overwork, shock, fright, and in many post-menopause cases in fairly stable persons, than in the pronounced hereditary *déséquilibrés*.

II. The Neurasthenic Psychoses

The mental side of the neurosis being always uppermost, it is remarkable how few among the great mass of neurasthenics overstep the boundary line into the psychoses.

As might be expected in conditions characterized by a debility of the brain centres, when psychoses are met with, they are most frequently of the asthenic type with indications of cerebral anæmia and vaso-motor spasm. Maniacal states are accordingly rare, the amount of energy sufficient for the motor agitation not being stored in the nerve cells of the neurasthenic. The majority of the psychoses occur at the climax of an exhaustion paroxysm, are benign in their course, and quickly respond to rest, feeding, and induced sleep. A few, more protracted in their course, and influenced by the underlying feature of grave hereditary instability, may result in a permanent dementia. Allied to these are certain paranoia-like forms, having for their basis the sensorial hyperæsthetic disturbances.

Melancholia is the most frequent form of psychosis accompanying neurasthenia. The patients have the ordinary symptoms of a simple melancholia in addition to those of neurasthenia, and their delusions are mainly based upon imperative conceptions. Under strict roborant treatment, with rest and attention to diet, they usually recover within a few weeks.

Acute stupidity of short duration is next in frequency to melancholia. There are anxiety, dreamy and delirious states, with widely dilated pupils reacting slowly to light, and arterial spasm. The condition usually comes on suddenly, following some enforced ex-

ertion, physical and mental, and under favourable circumstances may pass off after ten days to two weeks. During the first stages of recovery the mental exhaustion is most apparent. The patients are extremely slow in ideation, the voice is weak, and the footsteps uncertain. One of my patients, in a letter written after she had quite recovered, thus describes the onset of the psychosis: "A horrible, black darkness came over me; I could not shake it off; it seemed to grow thicker and thicker, denser and yet more dense, until I was lost to everything and everybody; and yet I knew there were people near, but they seemed not to be able to get to me." Recovery in this instance was almost complete in two weeks, and the patient was sent into the country to recruit her physical health.

Masturbation is not an infrequent cause of more protracted forms of stupidity. The exhaustion of the sexual powers, and the physical effects attributable to continued losses, induce psychical degradation and irritability of the peripheral nervous system, combined with mental confusion even to stupor, to be eventually succeeded either by permanent reduction or melancholic states, with feelings of self-depreciation. Delusions that everyone regards him as an onanist, and that he bears in his face the signs of his secret vice, are customary. The prognosis is not very favourable.

Constant impellent ideas occasionally lead to bitter outbreaks of despair, mental agony, and nervous crises, with trembling, attacks of unconsciousness, and vascular spasm. Everything in life is embittered by the lack of will-power, and the approach to a psychosis is very close. These forms are only noticed in those heavily burdened with a neurotic ancestry.

The debilitating influence of protracted masturbation and other sexual excesses, and in women the instability belonging to the climacteric, may induce a paranoia-like state, which is distinguished from the true form only by the character of the sense deceptions. These are of a purely neurasthenic cast. The digestive disturbances, the paræsthesias, neuralgias, headaches, difficulties in cerebration, are attributed to inimical influences wielded by unfriendly persons, or ascribed to poisons administered to the patients through occult agencies. The height of the disease is only reached after years of incubation, and hallucinatory voices conveying imprecations are then added to the delusional ideas. Transformation into an ambitious form is common. The treatment is unsatisfactory. Morphine lessens the hyperæsthesias, but has no influence otherwise

upon the course of the disease. The frequency of auditory hallucinations renders it unsafe for these patients to be at large in the community.

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PSYCHOSES ACCOMPANYING HYSTERIA

From the stand-point of pathogenesis hysteria and neurasthenia are upon the same footing, an incomplete or faulty development of the higher cortical centres concerned in cerebration being the important factor in both maladies. From a clinical aspect, however, their cardinal features are widely different. The two neuroses may be, and frequently are, found in the same individual, the combination leading to further complexity in symptomatology and increased difficulty in diagnosis.

The brand-marks of hysteria are: the convulsive crises, the hemianæsthesias and segmentary anæsthesias, the contractures and paralyses, as well as narrowing of the field of vision with dyschromatopsia. Those of neurasthenia are: the constant dull headache, the motor asthenia, the rachialgia, the gastro-intestinal dyspepsia, insomnia, and numerous symptoms arising from imperfect vasomotor innervation. The mental attitude in the two diseases is also entirely dissimilar. In hysteria there is a morbid reaction to emotion of such a pathological character as to result in histrionic displays, or simulation from auto-suggestion or extrinsic suggestion of paralyses and contractures. Defects in the psychic co-ordination and nullification of the will power render the attention of the patients difficult to hold. The moral sense is depraved to a deep degree, and the word of the hysteric is unworthy of confidence. Pronounced amnesias are an ever-present factor, and may be either general or partial.

In neurasthenia we have constant depression of a mild character, not a true melancholia, a degree of ego-centrism that renders the subjects irritable and morbid, and a host of impulses and imperative conceptions that make their lives unhappy, besides various defects of memory that are transient and can be corrected when attention is drawn to them. Intense morbid emotionality, the entire incapacity for fixing the attention, and the obliquities of the moral sense are not pathognomonic of neurasthenia.

Charcot has well defined hysteria as a "moral malady." Its etiology must be sought in an hereditary taint handed down from previous generations, the offspring of the impulsive, emotional mother, and the alcoholic, neurotic father, being frequently hysterical, if, indeed, no graver psychoneurosis in the child result from such a union. Defective education, lack of control at home, the indulgence in early life in passions either emotional or sexual, may later evoke the disordered psycho-motor display. The unrepressed emotional nature of women renders them the most frequent victims. To use Gowers' words, "Some disposition to hysteria is inherent, if not in all women, at least in the vast majority"; and, indeed, certain characteristics of hysteria appear to be only exaggerations of well-known feminine traits.

No age and neither sex is free from hysterical manifestations, but there is one period of life which especially favours their development. At the post-pubescent age, when the natural longings that follow the change from an incomplete to active development of the reproductive organs, psychical disturbances are apt to be especially dominant, and may easily overwhelm the small balance of equilibrium of an unstable organization. The sudden limitation put upon the normal physical activity that so often obtains with young girls at this period, and which acts as a shock more especially to those who have hitherto been allowed to live an untrammelled outdoor life; the strict housing; the ever-recurring "Thou shalt not," taught in every conceivable way, in season and out of season; the repression of their natural emotions—all such restrictions at the period of greatest mental and muscular activity have the natural result of concentrating the girl's attention upon herself, and very often upon one portion of the body, the organs lately sprung into functional being. Hence arise perverted outbreaks of emotionalism, perhaps originating from auto-suggestion conceived in the dream-sphere. The same states are noticed in boys too much restricted from outdoor sports and pampered by over-solicitous mothers. More than one half of all forms of hysteria commence about the age of puberty.

While the deviations from normal mentality are frequent and sometimes profound in hysteria, those properly belonging to the malady are mainly of a transitory type and immediately follow the convulsive crises, being in direct relation with them. Whether there exists an unequivocal hysterical mania, continuous and not

transitory, is somewhat doubtful. It is true that many cases of maniacal exaltation, accompanied by certain of the stigmata of hysteria, are found in young women; but it seems more reasonable to ascribe these psychoses to one of the many forms of insanity in the degenerate, that are so very frequently encountered, than to impute the alienation to the foundation of a previously existing hysteria. In a similar way the cases of prolonged sleep, especially in young males, who after a psychical shock exhibit emotionalism lasting for two or three days, and then fall into a dreamy, half-comatose state, unreactive to ordinary stimuli, with widely dilated pupils, lowered temperature, and fast-decreasing weight, would seem to call for a diagnosis of acute stupidity (amentia) rather than of hysteria. Both of these illustrations belong to one of the forms of insanity of the psychical degenerate of a deeper tone than appertains to the hysterical type, and both may be, and not infrequently are, succeeded by a profound and enduring derangement of the faculties. Ballet and others do not consider that melancholia and mania, as independent forms of psychoses, belong to hysteria, but look upon their occurrence here as accidental. Melancholia, when there is actual mental pain, is not related to the hysterical state, and although many hysterical individuals are passive and apathetic, they do not have self-condemnatory ideas. The approach to an actual psychosis in conjunction with hysteria is often very close, and, as Preston remarks, "hysterical mental symptoms are often intricately blended with symptoms of pure insanity."

The mental phenomena of the hysterical may be considered from two points of view: that of the interparoxysmal period, and that immediately succeeding the attack.

1. The characteristic stigmata of the interparoxysmal period are amnesia, loss of will power, difficulty in concentrating the attention (aboulia), besides mental insufficiency, great lability in the emotional sphere, and excess of reaction to suggestion. Furthermore, two forms of mental deportment are seen. In the first the patients are gay, active, mischievous; in the second, dreamy, passive, and apathetic to their surroundings.

Amnesia is an exceedingly frequent symptom, as all recent writers agree, and is one of the causes of the mendacity and constant alterations or contradictions so frequently noticeable in the statements of the patients. It may affect the present or past life of the individual, and is in a measure permanent. It extends, in well-developed instances, to an inability to recall proper names, dates,

even single words, the facts of the birth of a child—an event which may have been completely forgotten. Sometimes the patient has lost the power to write, or fails to remember the names of articles in daily use, such as dress, linen, or tableware. In other instances only certain periods of the life of the person are in oblivion, especially those during and immediately following an hysterical attack. Again, as the result of a series of attacks, the patient may lose the remembrance of all the past events of her life, and only recollect them during another paroxysm. These are the so-called cases of double consciousness. While these graver forms of loss of memory are rare, the milder types are relatively frequent.

The weakening of the will power and of the moral tone, the difficulty in concentrating the attention, all comprehended under the general term *aboulia*, although to some degree characteristic of hysteria, are found in other mental states, notably morphinism and etherism, as well as in true psychoses of certain types. Uncertainty may take the form of the *folie du doute*, in which every object must be reasoned about in a minute and unsatisfying manner; more often, however, it assumes some other aspect.

This enfeeblement of will power may be shown by an increased general disability. Speaking, writing, walking, eating, answering questions, become difficult; or the patient may become unable to carry on his profession, or, if a woman, to perform the ordinary duties of household life. It is not that these persons are at the moment perverse or wilfully obstinate; rather is it that they cannot will to do these various acts. Sometimes they may tell you that they have really struggled to make up their minds to walk, for instance, but that the effort to overcome the mental hesitation and inertia was futile, and that they could not do it. This mental attitude is the antithesis of the powerlessness arising from fixed ideas of repugnance to certain actions, so frequently seen in neurasthenia. The loss of the power of fixing the attention is also noticeable in the majority of pronounced neurasthenics; even when they have had the will power to begin an act—for example, reading a book—the effort is soon abandoned, because the same passages are gone over and over again, and before the meaning of a few lines is grasped their connection with the remainder of the passage is forgotten, the amnesia and aboulia in this example being closely interconnected.

Mental hysteria may be defined as a sub-type of the malady unaccompanied by the physical stigmata, but retaining certain of the

psychical characteristics. It is more common in this country than the graver types of hysteria, and is characterized more especially by the presence of an emotional element, which is always in the foreground. The instability is shown by capriciousness, sentimentality, irritability, and frequent alterations of the mood, which at one moment is joyous, the next tearful. A chance word or some trivial action, without any malicious intent on the part of some one present, is sufficient to elicit the kaleidoscopic change. Such persons have little power of self-control; they torture themselves and others with their morbid nervousness, and, though frequently quick in repartee and conversation of a superficial kind, are lacking in judgment and incapable of carrying out any intricate or extended study. They stand on a plane only a little above that of the higher types of imbeciles, and are subject to the same psychical disorders that afflict this class—loss of ethical tone, depravity in sexual life, and a tendency to the elementary forms of the periodic insanities.

A pathological reaction to suggestion is one of the characteristic marks of hysteria. Many, though not all, of the paralyses, contractures, and convulsions are directly traceable to suggestion, and, where this is not direct, the elaboration of a dream-idea, associated with the defective capacity for co-ordination of the psychic processes, may cause such phenomena. To avoid error, it is ever necessary to bear in mind the dictum of Charcot, "Hysterical patients are hysterical because they are mentally degenerated."

2. The second point of view from which the mental phenomena of hysteria are to be considered is their occurrence as a sequence to the hysterical paroxysm. These manifestations are very numerous, and comprise various states of exaltation and depression, of anxiety, of persecutory and erotic delusional states, stupidity even to lethargy, and somnambulism. All of these are usually transitory, but occasionally are of more prolonged duration. Characteristic of the whole class is the faultiness or entire absence of after-remembrance, and the clouded consciousness of the patients at the time of the alienation. Some of these states are not necessarily preceded by a seizure (somnambulism and lethargy), although the psychical equivalent, as in epilepsia larvata, undoubtedly is present instead. These conditions are indeed strikingly similar to the post-epileptic mental states, and present few distinguishing features in their lighter grades.

The ordinary duration is a matter of a few hours, more rarely days, except as regards the lethargy. An almost constant symptom, though one frequently overlooked, is to be found in the hallucina-

tions of sight and hearing, which are frequently of a terrifying character. A mystic or erotic colouring rules the scene (Magnan).

The dream-states, with imperfect consciousness, are among the most common. The patients are anxious, timid at the approach of any person, have extravagant delusions, beatific visions, or see awesome forms of men or animals. Driven by these terrible sights they wander hither and thither, and retain but a minimal after-remembrance of the occurrences during the time of the trouble.

In the delirium of hystero-epilepsy, consciousness is in absolute abeyance; the patients are vociferous, singing, dancing, and being at one moment difficult to restrain, while immediately after they are sunk in deep confusion. Through the entire course of the delirium the active hallucinations are dominant, and exaltation and distressing visions are mingled with cataleptic manifestations and hystero-epileptic convulsions.

A mania-like delirium may supplant or alternate with the hystero-epileptic seizures; the flow of language is now great, but there is a constant tendency to the repetition of single words and set phrases, which renders it unlike the logorrhœa, mingled with singing, laughing, and dancing, of the true maniac. The patient is apparently conscious of these acts, but close observation shows that they are partially automatic, and afterward the subjects have but slight recollection of what they have been doing.

The ecstatic mystical visions of the hysterical woman are well known and recognised. The patients appear to be in a deep dream, in which the only noticeable movement is the occasional quivering of an eyelid. In this trance the heavens open, visions of God, of Christ, and of the Holy Virgin appear, conversations with the prophets and saints are held, oracles are enunciated in unknown languages, and miracles are predicted. The hysteria of the Middle Ages assumed this form more frequently than that of the present day, and the trance visions of hysterical nuns are recorded in the archives of many European convents. Gilles de la Tourette has chronicled the autobiography of Sister Jeanne des Anges, a case of this description, in an extensive treatise, and numerous other examples could be cited. The recollection of what has occurred during the trance state is never very clear, but sufficient may remain to build upon it an extensive series of erroneous conceptions for the edification of a superstitious people.

Hysterical lethargy may either follow a severe seizure or come on without warning. The duration may be from minutes to weeks.

In the latter instance it would appear to be the psychical equivalent of a severe seizure. The persons affected appear to be in a profound sleep, lying quiet, but occasionally showing muscular twitchings and quivering of the eyelids. Cataleptic conditions of the muscular system have been observed. The pulse maintains its normal rate; the temperature is natural or slightly lowered. The pupils may be either dilated or normal. If the condition lasts for any considerable time there is marked emaciation.

Mutism is occasionally observed either after the fit, or in exceptional cases of hysteria in which the symptoms assume a purely mental character.

In some instances the delirium succeeding an hysterical attack does not cease within a short period, but is prolonged over an indefinite time; it then assumes the nature of a chronic hallucinatory insanity, not unlike that of an exhaustion psychosis, and has the same intermittent, exacerbatory, character. The alternations of confusion, of stupor, with hallucinatory ecstasy, are extremely characteristic, and hysterical convulsions may break in upon the mental phenomena. The sense deceptions are sometimes erotic, sometimes religious or persecutory in character, mingled with outbreaks of laughing, ecstasy, and cataleptic manifestations.

As stated on a preceding page, it is somewhat doubtful if true mania and melancholia ever arise upon a hysterical foundation. The hysterical mania is of sudden onset, has no prodromal stadium of a melancholic nature, is characterized by extreme lability in the emotional sphere, and by erotic religious delusions; the logorrhœa, when present, is deficient in ideation, and some of the stigmata of hysteria, as anæsthesia or globus, usually accompany it. The melancholias are rather phases of stupor following hallucinations or demoniacal visions; the senses are obtunded, and the psychical pain and introspection of true melancholia are not observed.

A form of paranoia following hysteria, described by Krafft-Ebing, must certainly be exceedingly rare, and its existence is even doubted by Kraepelin and other writers.

Suicide in motor-hysterical and hysterical mental affections now and then occurs. Janet and de la Tourette have called attention to the danger, but, as Preston has observed, in many instances in which the attempt is made it is simply either for theatrical effect or to excite sympathy.

The *treatment* in the hysterical psychoses is essentially the same as in those arising after neurasthenia—rest, quiet, moral impressions,

good food, baths, and tonics, particularly iron and manganese, with sedatives as required. Opium is, as far as possible, to be avoided, as it has a directly weakening effect upon the already debilitated will.

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GROUP IV

STATES OF ARRESTED PSYCHICAL DEVELOPMENT

IDIOCY AND IMBECILITY—CONGENITAL AND ACQUIRED

I. IDIOCY

By the term *idiocy* is understood a condition of mental deficiency, either inherited and recognisable in the first few years of life, or occasioned by cerebral injury at or immediately after birth, or consequent to brain disease acquired in infancy or early childhood; accordingly, it may be the result of any injury sustained before a considerable development of the brain cells and association nerve fibres has taken place, by which the further progress toward a complete evolution of the function of the encephalon is hindered, or the natural changes are brought to an absolute stand-still.

As might have been expected, with such a long array of possible causes one finds a vast number of grades of mental defects, so varied, indeed, that not one of the numerous attempts made by authors has ever resulted in a successful classification of the types. Each idiot must be studied for himself, and his degree of mental ability having been ascertained, he should be graded according to his individual capability for the attainment of knowledge which may prove useful either to himself or to the community.

Probably the broadest classification comprising all forms would simply differentiate the *congenital* from the *acquired* idiocy. This separation, however, helps but little, for in their symptomatology the groups overlap each other, and the congenital are frequently indistinguishable from the acquired types, since it is often impossible to ascertain, after the lapse of time, whether certain defects have originated in fœtal life or in the period immediately following birth.

Sollier, one of the most recent writers on the subject, classes all idiots into three categories, according to the development of the faculty of attention: (1) idiots with complete absence of, and inability to fix, the attention; (2) idiots in whom the fixing of the

attention is difficult; and lastly, (3) those in whom there is instability of attention.

While in man, as in any of the lower animals, the faculty of attention is absolutely necessary for the acquirement of useful knowledge of any kind, the basing of an entire system of diagnosis upon a single symptom is unsatisfactory. It certainly would be preferable to include with it the broader test of susceptibility to education, in order to insure a firmer foundation for description and diagnosis. For general clinical purposes we would, then, divide idiots into:

I. Absolute idiots, in whom there is found entire insusceptibility to education of any kind, and in whom the faculty of attention is wanting beyond momentary attraction by loud noises, bright lights, and similar exciting objects.

II. Those presenting the ordinary types of idiocy, being capable of a limited amount of articulate language, and of conducting themselves with decency, but in whom it is difficult to hold the attention for any length of time, and who are insusceptible of education in any form.

III. Idiots in whom the attentive faculty is fairly well developed; who are capable of attaining a limited education, particularly in manual labour; who have a fair command of language, and can apply the words in a correct sense, but yet are incapable of learning to read or write.

IV. Idiots approaching the mental plane of the imbecile. Such individuals are capable of considerable attention, and even of learning to read and write, although always in an imperfect and fragmentary manner.

Furthermore, for clinical purposes it is necessary to subdivide these main groups into smaller categories, according to the presence or absence of certain well-defined signs or symptoms. Thus, by putting in one class the large number of idiots that have skulls in all diameters below those of normal individuals, or with diameters normal in some and deficient in other directions, we have the *microcephalics*. The *macrocephalics*, on the other hand, are characterized by overgrowth of the cranium (from hydrocephalus, excessive development of the skull bones, or of the brain substance).

Certain other types of idiots attract attention by their extremely dwarfed stature with the relatively abnormal breadth and thickness of the trunk, but more particularly by the excessive breadth in proportion to the length of the long bones, as well as a doughy, yellowish skin. These idiots always present, on examination, more or

less pronounced abnormalities in the growth of the thyroid gland, and are designated as *cretins*. Still others, showing deformities of the skull and long bones, due to improper or insufficient nutrition in infancy, are termed *rachitic* idiots.

Again, quite a large class of idiots present monoplegias, hemiplegias, or diplegias, from congenital or acquired defect in the brain substance—the *paralytic* and *porencephalic* idiots. The true and false porencephalic forms predominate over those in which the paralysis is the result of traumatism or hæmorrhage into the brain tissue occurring a considerable time after birth.

Pathogenesis.—Féré has recently performed upon embryo chicks a number of experiments that are of extreme interest to the student of idiocy. He found that by injecting a few drops of an alcoholic fluid beneath the shell, or by exposing the egg to the vapour of alcohol, he could produce monstrosities almost at will. Ethyl alcohol was found to be the least constant in causing deformities, while absinthe and the higher alcohols, as methyl alcohol, greatly increased the proportion of monsters. The injection of physiological salt solution in corresponding quantities did not increase the number of the degenerate beyond that normally obtained after the process of artificial incubation.

The lesson taught by this study is of much practical interest in demonstrating that drugs, particularly of the ethereal alcohol series, may exert an undoubtedly deleterious influence upon the embryo during the period of gestation—an influence that in the human being should be carefully shunned if the future of the race is to be regarded.

The influence of alcohol upon the normal development of the fœtus has been recognised and commented upon in various classic works (Plutarch *et al.*). "A drunkard is unprofitable for any kind of good service," says Plato—and least of all in the begetting of children. Intemperance in pronounced degree on one side of the family usually results in mental feebleness of the children. When both parents are equally at fault, the progeny usually show well-defined brand-marks. It is a well-recognised fact that drunkenness at the moment of copulation is frequently responsible for the lowest forms of congenital idiocy.

In 1,000 cases of idiocy in the Bicêtre, Bourneville found a history of alcoholism in 620, or 62 per cent of the whole number; on the part of the father in 471; on that of the mother alone in 84; and in both parents in 65 examples. In one half of the remainder no

family history of any kind was obtainable; but since parents naturally do not desire to attribute the mental defects in their children to their own sins, it is presumable that in a considerable proportion of these 380 cases the existence of alcoholism in the ascendant was more than probable. In 57 cases, intoxication at the time of conception was ascertained with certainty.

Statistics on the influence of drunkenness in the production of idiocy vary greatly. Kind, for example, found among 923 idiots only 105 with chronic alcoholism in the parents—a percentage of 11.38, which is manifestly too low.

Hereditary influences, other than alcoholism, supply factors of extreme importance in the etiology of idiocy. In the majority of neuropathic families, when the retrogressive tendency is uncorrected or ameliorated by intermarriages with families having a more stable nervous organization, the tendency is always downward, until the idiots appear and the house becomes extinct. This end is greatly hastened by the abuse of alcohol, or by any unhygienic manner of living on the part of the progenitors. Likewise, intermarriages of blood relations, or of individuals having the same neuropathic tendencies, will always show a larger proportion of descendants of low mental development than is found among the children of ancestors of different strains. Tuberculosis, syphilis, and more particularly epilepsy in the parents, are etiological factors of moment, syphilis being the least important of the three, as it is difficult to pick out many cases of the low grades of idiocy that present the characteristic stigmata of the disease (Savage, Bury). In the past two years I have seen only four cases in which there was an indubitable history of syphilis. The luetic poison, however, shows itself in many forms of nervous disease, and is more frequently an indirect than a direct factor in the causation of idiocy, since it may not be until the third and fourth generation that the mental disability becomes prominent.

Difficult delivery, with compression and injury of the infant's skull at the time of birth, is the cause of a certain proportion of cases. It seems to be a well-established fact that the first-born children are more prone to be idiotic than those immediately succeeding them, and for this reason. Piper found, in an assemblage of 416 cases in the Dalldorf Asylum, that 32 per cent were first children. Wulff, however, in a very much larger material (1,436 cases), could only determine 11.9 per cent to be due to injury to the skull at or about the time of birth—a much more reasonable figure. The use of the forceps in delivery apparently plays a very

unimportant part in the cephalic injuries, long-continued compression being far more deleterious to the child than properly conducted artificial extraction.

Injuries received in the first few years of infant life are responsible for only an inconsiderable number of idiots, for the reason that the skull bones, from their soft character, readily yield to slight blows, and are therefore not easily susceptible to an injury, unless it be severe enough to greatly damage the brain or to destroy life.

Maternal impressions, though popularly supposed to be one of the sources of idiocy, must be considered of minor importance.

Imperfect nutrition in the early months of extra-uterine life is probably a more frequent cause than has been usually supposed. In communities in which the children are supplied with improper food, the number of idiots is beyond the proportion found in other localities. The defective nourishment of the cerebral substance, at the time when it is at the period of greatest development and expansion, must inflict serious detriment upon the after mental health of the child. Very many of the idiots of the microcephalic and macrocephalic classes will show on close examination the evidences of antecedent rickets.

Probably next in etiological importance to hereditary alcoholism, ancestral defects, and the birth injuries, are the infectious fevers, measles, scarlatina, typhoid fever, as well as meningitides of varied bacterial origin. These infectious troubles may result in injury to the brain directly, by occasioning various local or general inflammations of the pia mater combined with vascular lesions ; or the mischief may be brought about by the injurious effects upon the nerve elements of the toxines, engendered by the specific organisms ; or in occasional instances by the direct lodgment of the organisms themselves in the brain (colon bacillus, pneumococcus, or diplococcus intracellularis meningitidis in cerebro-spinal fever). Again, indirectly, these diseases may act by lowering the vital powers to such an extent during the illness that the child remains ever afterward stunted and mentally inapt.

In rare instances the cystic formations in the brain substance found in the false porencephalia may be due to the lodgment of bacteria in the white substance of the hemispheres, abscess formation of a strictly localized nature, and final resorption, with the formation of a defect in the tissue surrounded by a capsule of fibrous material.

The origin of many of the varied conditions found at the autopsy

table in the brains of paralytic idiots is extremely uncertain. Apoplexies are by no means so uncommon in the first two or three years of childhood. They result from vascular disease induced by inherited tendencies to imperfect development of the arterial tubing dependent on syphilitic and alcoholic taints, bad and insufficient nourishment, as well as acute febrile processes.

At the necropsy in the case of such a brain there will be found, depending on the length of time that has elapsed since the injury, the evidences of antecedent hæmorrhage in the form of rust-brown deposits of blood pigment, shrunken, brownish stained tissue, together with general atrophy of the surrounding parts, or cystic formation with the lining membrane stained slightly brown with *débris* of hæmatoidin.

Another condition is, however, more frequent. The whole or a part of the territory supplied by the Sylvian or other large artery may show a gelatinous atrophy of the convolutions confined to the distribution of the artery, the entire region being reduced to one half or one third of its natural size, and presenting a striking contrast with the surrounding normally developed gyri. This condition can be referred to one cause only: stoppage of the nutrient artery, either by embolism or by endarterial alterations with development of thrombosis. The latter is certainly the more frequent, and arises usually in the course of the eruptive fevers; the former can only follow a valvular lesion. It is readily seen that when destruction of a considerable portion of the cortical areas in the growing infant has once taken place we soon have not only stoppage of intellectual development, but, in many instances, retrogression from former attainments, while at the same time there remains no possibility in later life of the correlation of association tracts.

The acute encephalitis of Strümpell, the analogue of the spinal infantile paralysis of childhood, is a factor of comparative infrequency in idiocy. It is not to be denied that such a condition is sometimes noted, but it is clinically indistinguishable from the more frequent occlusion of the cerebral arteries.

All these several morbid processes tend to the formation of the cystic and other degenerations of the brain substance, with depression and imperfect development of the convolutions. Very small defects are occasionally met with, as in the accompanying figure, where an irregular opening, 3×3 centimetres in its greatest diameters, beneath the base of the second frontal convolution, was found in a young man physically well developed, but whose mental aver-

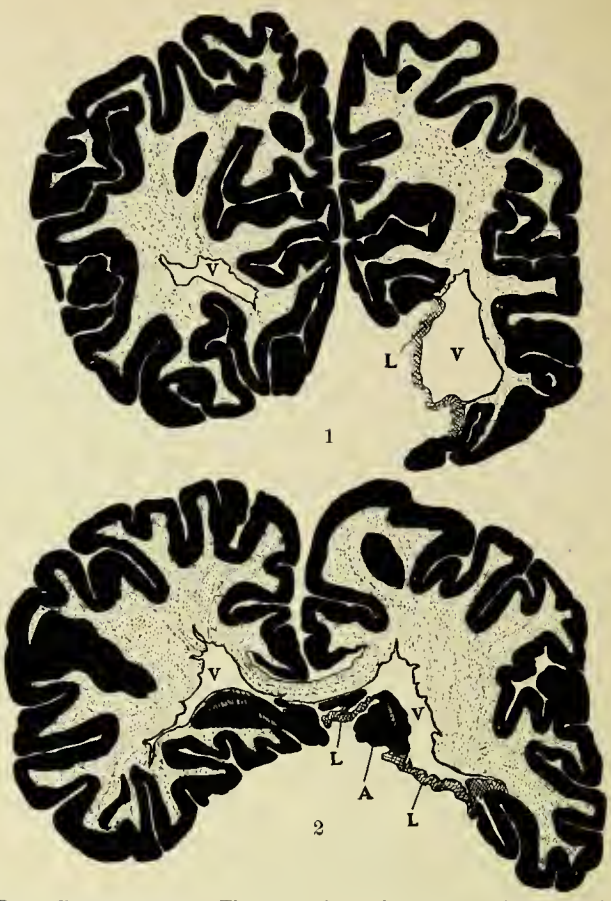

Fig. 37.—False Porencephalia. The person from whom this specimen was obtained was a medium-grade imbecile who had lived to reach the age of fifty-eight years. He was tall, with fairly well-developed musculature, and without marked cranial deformity. At the autopsy the brain weighed 950 grammes. The convolutions on the external aspect of the hemispheres were without marked asymmetries, but the right half of the brain was considerably smaller than the left, and when taken out of the bony envelope flattened perceptibly. On closer examination a defect was found on the median-inferior aspect of this hemisphere, measuring 4 centimetres in its greatest length by 2 in its greatest width. The anterior margin lay considerably forward of the splenium of the corpus callosum; the posterior end stopped 3½ centimetres before the tip of the occipital lobe. The defect was separated from the ventricle by a leathery substance, from 1.50 to 1.75 millimetres in thickness. This showed no trace of cerebral tissue. The lesion formed a pocket below the level of the surrounding convolutions, and was filled with a gelatinous material containing few blood-vessels. The gyri involved in the defect were portions of the posterior end of the convolution of the corpus callosum, the anterior and middle parts of the lingual convolution, the innermost aspect of the occipito-temporal gyrus, and a part of the convolution of the hippocampus. The cuneus was not disturbed. The foot of the hippocampus was not entirely destroyed, its anterior portion containing some nerve elements. In the posterior portion of the hippocampus the traces of an old hæmorrhage were found, showing that the lesion had originated in the rupture of a blood-vessel. The corpus callosum throughout its whole extent was poorly developed, but the posterior half was notably thin—an evidence that the injury to the cortex had taken place in early life, and that the hemispheres had not fully developed thereafter. When the right and left halves of the corpus callosum are compared in the cross sections, the left side is seen to be smaller than the right. There were no indications of a localized cerebral lesion evident during life. 1. Transverse section of the hemispheres 4 centimetres anterior to the occipital pole. 2. Transverse section of the hemispheres anterior to the splenium of the corpus callosum. *L L.* Lesion.

age was not above that of a five-year-old child. The other portions of the hemispheres showed no ascertainable lesion.

The etiology of idiocy is not complete without a word as to the effects of the administration to infants of opiates in the form of paregoric or soothing sirups, alcohol, as in gin and whisky, and the essences of peppermint and anise, to allay colic or to induce sleep. Féré's experiments, already cited, show the effects of some of these substances

FIG. 38.—FALSE PORENCEPHALIA. The individual from whom this brain was obtained was a medium-grade imbecile who had attained to a very moderate primary-school education. There were no indications during life of a focal brain lesion, nor could any cause be assigned other than the usual diseases of childhood. The examination of the left hemisphere at the autopsy showed the absence of the calcarine fissure, a rudimentary cuneus, and four imperfectly developed occipital convolutions. On the right side there were no deviations from the normal in the infoldings of the gray matter. The left hemisphere also had, on section, a defect beginning 4 centimetres back from the pole of the lobe of an irregular shape, averaging 3 × 3 centimetres in its greatest diameters, situated under the foot of the second frontal convolution, and reaching backward as far as the anterior edge of the ascending frontal gyrus. This cavity was so situated as to intersect the callosal fibres passing from the left to the right hemisphere. The walls were lined with a thin felted neuroglia membrane, were stained with hæmatoidin, and contained a few blood pigment crystals. The interior of the right hemisphere was in all respects normal. *A*, Lesion.

on the embryo of the chick, and the nerve tissues of infants in the first few months of life are, probably, hardly less susceptible to their deleterious influences. Numerous instances are on record in the literature in which alcohol has produced idiocy, usually with epilepsy, and probably, were the subject more closely investigated, this result would be found to be more frequent than is generally suspected.

Over-heating of the head from too heavy clothing, or placing the children too near a fire, is also an ascertained cause of mental inaptitude.

Male children are more prone to be feeble-minded than female. Piper found a proportion of two to one in Dalldorf, and Wulff of about five to three in Langenhagen. Possibly the circumstance that there are more first-born males than females may partly account for the discrepancy between the sexes, first labours being more prolonged than those succeeding. The relatively larger size of the male head at birth may also be an element.

THE FORMS OF IDIOCY

The human infant at birth, except in rare instances of endemic cretinism, never shows indications of inherited psychical defect. Only as the weeks pass by, when with the bodily growth a natural definite increase of mental capacity and power of fixing the attention is to be expected, do the parents notice that in some way their child is different from other infants. The ordinary stimuli from bright objects or loud sounds pass unnoticed. Attempts to attract the attention by the voice or by toys are in vain, and the child is brought to the physician for advice. Many of these cases in the early years of life pass for blind or deaf, and only as they grow older does the mental incompetence become so apparent and finally so obvious that the parents can no longer hide from themselves the fact that the child is mentally different from its fellows.

A predominating number of all adult idiots observed have crania below the average in size. The heads vary from 50 to 48 centimetres in circumference, and are equally deficient in the length, breadth, and height of the cranial arch; or they may be too small in some of these measurements and normal in others. In the usual acceptation of the term, these idiots are not microcephalics, that designation being confined to the mentally defective with heads having the low circumference of 43 centimetres and under (Ireland); but these last are exceptional instances, and in a broad sense small-headed children of medium grade belong to the same general class, and are to be arranged under the same category.

Microcephalic idiocy, the term being employed in this modified signification, does not constitute a distinct pathological entity, and accordingly the designation only serves us clinically to distinguish one broad class of cases.

The causes of microcephalia are extremely varied, depending upon the etiological factors at work in the months of early development, extra-uterine and intra-uterine. Thus there may be a defective inherited organization, leading to early ossification of the cranial sutures with corresponding retardation of cerebral development, or porencephalic states preventing full growth of the hemispheres. Again, arterial and febrile disease may have hindered or retarded development; or, finally, the vital powers inherited from immediate or remote ancestors may be of such a character as not to admit of complete and full differentiation and perfection of the protoplasm.

In a small number of microcephalics the cranial development is perfectly symmetrical, the two halves being equal, but the growth is insufficient and mental evolution is retarded. These instances are mainly of the congenital type, the intellectual faculties developing fairly well up to three, four, or five years of age, when they are outstripped by the growth of the body, and remain stationary or retrograde.

No plan for ascertaining the cubic capacity of the skull during life is sufficiently accurate to enable us to estimate with any degree of certainty the amount of cerebral substance within the interior of the cranial cavity, the thickness of the bones varying to such a degree as to render all such calculations uncertain. We know, however, that it requires a certain quantity of brain substance, capable of functioning actively, to produce a normal mind, and this quantity seems to be lacking in the microcephalic idiot.

Other idiotic microcephalic individuals present asymmetries of the cranial bones in a minor or major degree. These result from early synostoses, as well as from local or general hypertrophies of the bones, instances of the latter type being rare. The wedge, tower, quadrangular, and keel-shaped heads are frequent in this sub-class. The generic type of skull may also vary greatly. The majority of idiots of this sub-group have crania of the dolichocephalic type, while in a smaller number meso-brachycephalic and brachycephalic skulls are seen. The orbits, facial bones, palate, and extremities also present deformities, those of the facies usually being limited to the upper and lower maxillæ. The most frequent of these are the palatal anomalies, the high-arched and flat palates (see Plate VI, etc.). Little bony projections along the line of the central suture are frequent, together with irregular elevations of the borders of the median suture (torus palatinus). The

FIGS. 39 AND 40.—CONGENITAL IDIOT BOY, aged twelve years, who still shows the so-called swimming (pre-natal) movements of the hands and feet. He is incapable of speech, but utters wild, inarticulate sounds. Height, 116 centimetres. There is no trace of a thyroid gland, but a myxœdematous condition is lacking. The larynx is entirely undeveloped. The ears are above the natural level. The palate is high-arched. The head is almost quadrangular. Measurements (tape): circumference, 48; over arch, 32.2; antero-posterior, 30 centimetres. With the calipers: antero-posterior, 15.75; transverse, 14.5; giving an index of 92.

teeth may also be uneven or deficient. Next in frequency are abnormalities in the development of the external portions of the auditory apparatus, the helix, tragus, anti-helix, or lobe being deformed; or the whole ear may be too large or too small. Common sensation is not usually disturbed to any considerable degree, though

FIG. 41.—MICROCEPHALIC TYPE OF IDIOCY WITH LOCAL MYXŒDEMA. The woman, aged twenty-one years, is able to speak coherently, though slowly, and has considerable power of attention. The height is 165 centimetres; the osseous system is well developed. The skull is doliehocephalic and trigonocephalic; the circumference 48.5 centimetres; the cephalic index 76.2. The measurement over the vault is 31 centimetres; over the antero-posterior diameter 31 centimetres. The skin contains swellings of a firm, jelly-like character in the occipital, malar, and clavicular regions, and to a less degree about the legs. The hair is coarse. The thyroid gland is not palpable. There is considerable arteriosclerosis of the peripheral arteries. The palate is flat, with a well-marked torus of the knob form.

this point is hard to determine accurately from the difficulty experienced in making the patients understand what is wanted of them. General cutaneous analgesia is fairly common. Heat and cold sensations, in the majority of instances, are fairly accurately recognised. The deep reflexes show various changes in idiots having no brain lesion ascertainable during life. Complete abolition of the knee-reflex is by no means uncommon. A small percentage have the deep reflexes increased. In still other cases there are perceptible differences between the two sides. Only in comparatively few instances are they quite normal. Wildemuth found in 23.5 per cent

of his cases the patellar reflexes completely abolished. The superficial reflexes offer similar anomalies.

Deficiencies in the eyesight, especially hypermetropia (70 per cent, Wildemuth), are extremely frequent; dulness to the reception of auditory impressions is almost as common. The long bones are usually fairly well developed.

Careful examinations of the thyroid gland have been more particularly recorded for cretinism than in the other forms of idiocy. In this type there is always defective growth of the gland, either in the form of atrophy or hypertrophy.

The only kind of examination of the thyroid possible, except at the autopsy table (and here statistics are lacking), that by palpation, is manifestly inaccurate, since, from the structure of the parts involved, it is impossible to determine whether or not small portions of the gland lie to the side of and behind the trachea. Nevertheless, some approximation to accuracy may be obtained if careful search be made, and in my clinic a considerable percentage of cases of microcephalia have been found to have the thyroid abnormally small, or hypertrophied. In one instance no sign of a glandular structure could be discovered at the side of the trachea, and not the slightest trace of the isthmus existed, although the boy was so meagre that there was no difficulty in recognising each individual portion of the anatomy of the neck. It is worthy of note that in this case no myxœdematous condition was present (Fig. 39).

Mordert found by palpation, among 151 imbeciles and idiots of all grades, a proportion of 22 per cent with defective thyroids.

The intellectual development of the microcephalic idiot varies with every individual, and is not always in relation to the cubic capacity of the skull, showing that mental powers are largely dependent upon the quality of the inherited protoplasm. A few never develop an intellectual capacity beyond that of an infant a few weeks old, though the physical growth attained may be equal to that of a child of ten years or older. In one remarkable example now in my clinic, the early purposeless movements (fœtal survival movements, Monford) are partly retained, the boy at the present time being twelve years of age and an absolute idiot. He shows exquisitely the flipper-like movements of the hands, and constant alternating motions of the limbs, as if in swimming (Fig. 39).

Other patients of the microcephalic type are by no means so deficient as the above example. Many learn to speak with consid-

erable facility, have the faculty of attention fairly well developed, and are capable of a certain amount of education. The capacity for anything more than a superficial training is never found, as such individuals learn only by force of example, and inasmuch as the memory and capability for associating facts is imperfect, what is once acquired, unless in constant application, is soon forgotten and the individuals retrograde within a short period when left to them-

FIG. 42.—PHOTOGRAPH OF A HIGH-GRADE IDIOT OF THE MACROCEPHALIC CLASS, aged fifty-two years; able to read and cipher a little. There is a moderate command of language, and she is fairly attentive. Measurements (tape): height, 147 centimetres; circumference of head, 48.5; over arch, 29.4; antero-posterior, 28.2 centimetres. With calipers: antero-posterior, 17; transverse, 13; cranial index, 76.47. The palate is flat, thyroid normal.

selves. What mental power they possess is usually one-sided and incomplete, corresponding, probably, to the absence or development of individual centres. The power of imitation is ofttimes developed to a considerable degree in these idiots, every collection of them possessing one or more who can imitate the actions of their fellow patients and attendants to the minutest detail.

Microcephalic idiots are universally restless, with the exception of the lowermost grades. They are difficult to control, irritable, pecvish, have no affection for their nurses, are constantly in motion, at all times passionate, and liable to fits of violent and uncontrollable temper and of continued causeless screaming. Probably about

one third of all cases of this type have epilepsy, either dating from birth or acquired as the result of some infectious process.

The stature of the microcephalic class of idiots differs considerably. Many are below 145 centimetres in height, others attain to 180 centimetres or even more, but the majority are considerably below the average. The size of the head is apparently independent of the stature: dwarfs may have skulls up to the mean in size, while others, although tall, may have very small heads. At a recent autopsy upon a man having a body 182 centimetres in length, the circumference of the skull taken over the soft tissues was only 45 centimetres.

The *pathology* of microcephalic idiocy varies considerably. The majority of cases that come to the autopsy table show no gross defect in the internal formation of the cerebral hemispheres, corpus callosum, ganglia, or of the cerebellum, but the convolutions are either too broad and very simple in form, the secondary and tertiary furrows absent or rudimentary, or, on the contrary, they are too small and intricate, especially toward the poles of the hemispheres, where they frequently assume a circular or vertical direction. Exceptionally, also, there may be abnormalities in the formation of the five primary fissures. *Plis-de-passage* between the convolutions are of common occurrence. The cranial bones are often comparatively thick in proportion to the size of the skull, the basis cranii is frequently narrowed, and signs of early closure of the principal sutures, especially the frontal, sagittal, and occipito-parietal, are often noticeable.

The brain weight, though varying with each individual, may be only a little over that of the new-born infant (300 grammes), as in the instance, cited above, of the man whose height was 182 centimetres, and whose brain, inclusive of the pia mater, weighed only 480 grammes. Seldom, however, is so low a weight met with, from 800 to 1,000 grammes being much closer to the average. This diminution shows clearly that the lack of mental capacity is due to imperfect growth of the later differentiated regions of the brain. Especially is this noticeable in the frontal lobes, which almost without exception are feebly developed. The size of the head and the degree of mental development do not always accord with one another. In Fig. 39 is shown the photograph of "Charlie," a boy aged twelve years, an absolute idiot, incapable of walking without support, incapable of any approach to articulate language, whose actual mental condition is that of an infant a few weeks old. This child's head has a circumference of 48 centimetres, an antero-poste-

rior measurement of 15.75 centimetres, a transverse diameter of 14.5, with measurements over the arch in the long diameter of 32.2, and in an antero-posterior direction of 30 centimetres. In Fig. 42 (Thompson) is reproduced the photograph of a woman, a fairly high-grade idiot, capable of considerable fluency in speech, of reading and writing to a limited degree, and even possessing the ability to perform simple sums in addition and multiplication; yet the cranial circumference is 48.5, the measurement over the arch in the short diameter being 29.4, and in the long diameter 28.2 centimetres.

As already stated, gross imperfections of the cerebrum are somewhat rarely recorded. Defective growth of a hemisphere, one side being out of proportion to the other, leaving the cerebellum uncovered, is now and then seen, or true and false porencephalic defects are found (Fig. 37). The corpus callosum may be congenitally rudimentary, but is rarely absent in its full extent. Postnatal defects of the cortex or white substance nearly always conduce to a faulty development of the corpus callosum, the extent of the mal-developopment depending on the location and size of the hæmorrhagic or other lesion. Despite the small size of the head, the ventricles may be enlarged and filled with fluid, leaving only a narrow rim of gray matter—hydrocephalus with microcephalia.

Among the most frequent of the macroscopic lesions seen at the autopsy table are the chronic leptomeningitides, with or without serous accumulations in the subdural space. These conditions follow the infectious diseases, particularly typhoid fever, cerebro-spinal meningitis, scarlatina, measles, and small-pox, when the damage done to the tissues has been insufficient to occasion anything further than a subacute inflammation localized in the meninges.

Comparatively few idiots have crania in size fully up to the requirements of the normal man. In such rare instances we may reasonably postulate a later date for the action of the causes leading to the mental weakness (traumatic shock, or a fever, as typhoid), for although these individuals may present all the signs of mental incapacity similar to those found in the idiocy of congenital types, they belong to the class that have been arrested in their mental development, and which are designated as *accidental* idiots. Severe traumatism during childhood often produces a profound disturbance of the functions of the brain, and afterward retrogression to a merely vegetative life. On the other hand, if the injury is slight—for example, a simple depression of the skull from a blow—the damage is soon compensated for by a corresponding development in the

still growing bones, the result being a pronounced inequality in the contour of the cranium.

The *macrocephalic* idiot, while not uncommon, is by no means so often encountered as those showing the moderate grades of microcephalus. The skull is larger than natural, but ordinarily

Fig. 43.—An Idiot of the Macrocephalic Class. The head is large, symmetrical, though the cranial arch is unusually high. The circumference is 58; the antero-posterior measurement (with tape) is 35; over the arch is 36 centimetres. With the compasses the measurements are: antero-posterior, 21; transverse, 16; giving an index of 76. Articulate language is limited to a few simple words. The bones of the inferior extremities show a number of posture distortions. The thyroid gland is palpable.

remains well proportioned in the several diameters. There is an entire absence of unnatural bosses, nor are there indications of early ossification of the sutures, or any upward projection of the region of the fontanelles which would point to the existence of pressure exerted outward by fluid. The skull is ordinarily of the dolichocephalic type. The facial bones, in marked contrast to those of the cranium, are small, the eyes are deep-set in the orbits, the inferior maxilla is retreating. The hard palate, while small, is usually perfectly formed.

Except as regards the cranium, the physical development in these individuals is stunted, the growth is feeble, the limbs are incapable of supporting the weight of the body, the hands and feet are infantile. The skin, especially of the face and hands, is wrinkled, giving to the macrocephalic idiots the appearance of advanced age. The somatic functions are usually normal, and instances are not rare in which numbers of this class have lived to be quite old. As a consequence of the feeble bodily development, they are prone to take tailor-like and other forced sitting positions, which, when assumed in early childhood, result in distortions of the long bones of the legs, and posture lordoses and kyphoses.

FIG. 44.—AN IDIOT OF THE MODERATE MACROCEPHALIC CLASS, CAPABLE OF ASSOCIATING A FEW WORDS INTO SIMPLE SENTENCES. The body is short and thick-set. The circumference of the head is 55 centimetres. There are no well-marked cranial deformities. The antero-posterior measurement (with tape) is 33; over arch, 35.5 centimetres. The antero-posterior diameter with the calipers is 18.25; the transverse, 15.5; giving an index of 84.9. The height is 147 centimetres. The thyroid gland is very small. The palate is high-arched, with elevation of the median suture.

In contrast to the previously described type, these idiots are peaceable, very timid and tractable, and sit quietly by the hour, making slow, automatic movements of the fingers and hands.

Speech, when acquired, is curiously deliberate, and accords fully with the cautious walk and slow, hesitating movements in eating. Articulate language is confined to a few words or sentences. When a question is addressed to him, the macrocephalic will often make slow movements with his lips, as if in speaking, but no sound issues

Fig. 45.—Photograph of a Congenital Absolute Idiot of the Macrocephalic Class. Epileptic. The girl is unable to speak, but utters plaintive, inarticulate sounds. Measurements (tape): circumference of head, 55 centimetres; over arch, 35; antero-posterior, 33 centimetres. With compasses: antero-posterior, 17.5; biparietal, 14; cephalic index, 85.2. The skin is thick, though not myxœdematous; the nasal root is broad; the ears are projected forward; the palate is flat; the thyroid gland rudimentary.

from his mouth. If frightened, he utters wild, inarticulate cries, and it is usually quite a little time before he can be appeased and induced to leave the protecting arm of his nurse or attendant.

The macrocephalic condition arises from hypertrophy of the brain parenchyma, especially the white matter, in which the neuroglia is particularly at fault; more rarely from hyperplasia (heter-

ectopia) of the gray substance. In some instances nothing but a hydrocephalus internus, with expansion outward of the cortical matter and overgrowth of the cranial bones, equally in all diameters, is to be determined. The cause of the hypertrophy of the neuroglia of the white medullary substance is unknown, but it is supposed to originate during the time of intra-uterine life, and then continue for a while in the postnatal period.

Closely allied to the true macrocephalic idiocy are those forms consequent upon an inflammatory process terminating in an ordinary *hydrocephalus*. The skull is here even larger than in the last class, and has a globular form; the region of the fontanelle is often raised, the forehead is prominent, the eyes are deep-set and fairly wide apart, the forehead is rounded and prominent, with numerous veins showing distinctly through the skin. On examination the sutures are found to be wide, and numerous supernumerary bones are found in them. The face, by contrast with the enormous head, looks small; the bones are feebly developed, but the palate seldom presents signs of deformity.

While marked hydrocephalus is not inconsistent with considerable mental development, the majority of those afflicted with it are idiots of low grade. They are inattentive, indolent, sitting quietly, amusing themselves with picking at their clothing, or in making slow movements of the fingers, rhythmical in character. Their vocabulary consists of a word or two, and is rarely much more extensive. Besides the limited articulate language they may possibly learn a simple tune; they are docile, and affectionate toward their fellow patients and attendants, but are incapable of any notable degree of education.

Somewhat akin to the macrocephalics are the cases of idiocy due to *true porencephalus*. In this condition there is always present a defect in the formation of the cerebral tissue, sometimes single, sometimes multiple; the portion of the brain substance remaining undeveloped is compensated for by a diverticulum from the ventricle filled with serous contents, forming a sac-like arrangement retaining its connection with the parent cavity. Sometimes the ends of the lateral horns, sometimes the anterior and posterior regions of the ventricles, are affected. The result is necessarily a retardation of the development of the entire brain, disconnection and incomplete evolution of the association fibres between the different areas, and consequently an incompleteness in the functioning power of the organ. The malformation begins in early fœtal life,

and is usually unaccompanied by any indication of inflammatory trouble.

The pockets formed by the ventricular sacs may be so large as to comprise half a hemisphere, or even more; when there exists a sac of considerable size it is always accompanied by a deficiency in the growth of the corpus callosum, and usually of the ganglia, in particular the corpus striatum and lenticular nucleus.

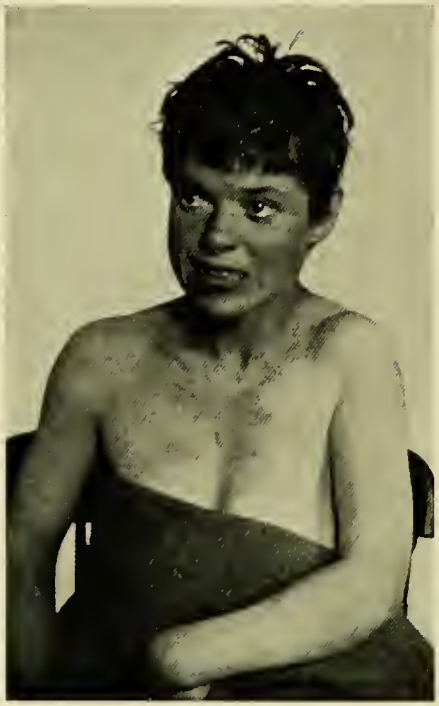

FIG. 46.—PHOTOGRAPH OF AN ABSOLUTE IDIOT OF THE BIRTH-HEMIPLEGIC TYPE WITH SPASTIC RIGIDITY OF THE ARM. There is also a staphyloma of the left eye. The lobes of the ears are confluent with the skin of the cheek. Palate normal in curves; the thyroid gland is palpable.

The *symptomatology* is strictly in accordance with the character of the cerebral lesion. In instances in which the defect is considerable in size and located in the mid-regions of the hemispheres, there are the customary symptoms of gross brain lesion in childhood, monoplegias, hemiplegia, usually of the spastic type, retardation in development of one or more of the extremities, athetoid movements of the fingers and toes, defects in ordinary sensation, hyper-excitability of the reflexes, anomalies in the functioning of the special senses, and mental obtuseness varying from simple dulness to complete idiocy. When the defects are situated toward the posterior and anterior poles of the brain, the motor symptoms are absent, though the degree of mental feebleness may be quite as great as in the former instance. Incoordination of the muscular system is a striking feature in many of these cases.

Clinically these are hardly distinguishable from the much more numerous class of false porencephalics.

The larger proportion of the true porencephalic class have epilepsy. Many of them can with perseverance be taught to be cleanly in their habits, to feed themselves decently, and now and then one is encountered who is capable of learning to speak with fluency and accuracy, though slowly. They are quite tractable, and, in contrast with the microcephalics, give little or no trouble in the ward. Masturbation is frequent among the lower degrees, and would seem to be a reflex rather than a voluntary act.

The various forms of idiocy resulting from *false porencephalus*, which in its turn comes from thromboses, embolisms, extravasations of blood into the meninges, local inflammation from compression of the head during protracted labour, or from the too severe or prolonged application of the forceps, with consequent brain atrophies and scleroses, may be grouped together under the general designation of *paralytic idiocy.*

False porencephalus is the name applied to cystic imperfections on or near the surface of the cerebral hemispheres, usually communicating with the epicerebral space, but not with the interior of the ventricle. The cavity formation may be either single or multiple, the former being the more frequent. Except in the rather rare instances in which the defect can be directly traced to hæmorrhage resulting from injury at birth, the pathology is not well understood. A large proportion of these defects must be due to localized hæmorrhages into the brain substance, as is shown by the fact that the walls are found stained with blood pigment. In the example from which Fig. 38 was drawn, the cavity was lined with a thin membrane, stained brown, and hæmatoidin crystals, with *débris*, could be definitely demonstrated both in the borders and lying free within the cavity.

While there is no anatomical evidence to support the theory, there is good reason to believe that in other instances of false porencephalus thromboses of the smaller veins in the white substance and cortex may occasionally have taken place. It is well known that thrombosis of the sinuses in childhood is not an unknown event in scarlet fever (Mony) as well as in other febrile affections, and, when this does occur, resorption of the necrotic material may take place, precisely as after hæmorrhage, and cavity formation and retraction of the surrounding tissues result, but the blood pigment is not found. In Osler's autopsies upon hemiplegic children, numbering in all ninety, there were twenty-four cases of porencephalus, including both the true and false forms.

Porencephalus in any form is probably, however, not present in more than twenty per cent of all cases of paralytic idiocy. The remaining four fifths of the paralytic cases are, anatomically, based upon a number of etiological factors. Of these, the principal are, in order, arterial obliteration from syphilitic endarteritis; thrombotic processes after infections diseases, or after embolic plugging following valvular lesion; meningeal hæmorrhage compressing the cortex; or, in rare instances, polioencephalitis as the result of an acute infectious process. The existence of a localized polioencephalitis acuta (Strümpell) as a distinct pathological entity is still in dispute. It is nevertheless true that in certain instances a febrile disturbance of mild character is now and then noticed in young children, which is followed in the course of a few days by paralysis, hemiplegic or paraplegic in character, at first flaccid, later with contractures and exaggerations of the reflexes. As the child advances in age, deficiencies in the mental qualities are discovered by the parents, and after a time the development of both body and mind comes to an end. I have carefully followed one case of this type, a boy, in whom the above train of symptoms occurred at the age of two years, my observations extending from the date of the lesion until the patient was fourteen. The educational development proceeded slowly until he was about nine years of age; then it came to a standstill and remained stationary.

Although the condition is of uncertain etiology, it is quite probable that in these instances we have to deal with an infection by an unknown micro-organism, the stress of the deleterious influence falling directly upon the cerebral tissues, and in particular upon the blood-vessels, inducing localized thrombi in the small intermediary arteries or veins of the cortex, or more widespread inflammations. A localized acute polioencephalitis as a result of alcoholism is rarely met with in the adult, but does occur, as in a recent autopsy, at which an acute inflammatory process confined to the base of the first frontal and superior portions of the ascending frontal convolutions was found. Clinically the symptoms were identical with those described by Quincke as due to a condition termed by him *meningitis serosa*. Though the weight of pathological evidence is not yet positive, there is good reason to believe that polioencephalitis of the cortex may take place in childhood (*vide* Oppenheim, *loc. cit.*; also Wiener, Brain, Spring number, 1898) and be followed by physical and psychical deficiencies.

Obliteration of the cerebral veins in infancy has been noted in a

few instances, but is certainly uncommon. Plugging of an arterial vessel in the brain from a granulation detached from a heart valve after measles or scarlatina has also been recorded, and, when the resulting lesion is severe, idiocy may result.

In a large number of cases of paralytic idiocy that have come to the autopsy table an atrophic condition of the convolutions has been found. The area affected may be a portion of one convolution, a group of convolutions, or, more rarely, an entire hemisphere. The gyri are diminished in size; they are firm, and have a leathery feel to the finger; they are of a whitish-gray colour, and depressed below the level of the surrounding tissues. The soft meninges are either readily detachable, gelatinous, milky, and somewhat thickened, or firmly adherent, with occasional spots of brownish discoloration visible in the thickened area. The region of the Sylvian artery and of its branches is especially wont to be the seat of this type of sclerotic atrophy of the convolutions, and, accordingly, it is supposable that thrombosis is the primary cause of the defect. In one case, upon which I performed the autopsy, the lesion corresponded in the most intimate detail to the distribution of the middle cerebral artery, but, unfortunately, the case had been of too long standing to admit of a localization of the thrombotic plug. In other instances it is probable that the occlusion is in a vein and not in an artery. Primary thrombosis occurs in children, sometimes associated with the circumstances under which infantile hemiplegia comes on (Gowers). Embolism is to be excluded when there is no definite evidence of lesion of the cardiac valves. It is probable that there is also another condition which sometimes occasions atrophic scleroses of the brain tissue—namely, hæmorrhage upon or beneath the pia at the time of birth. This we know is not an infrequent accident in difficult labours, and the subsequent compression of the cortical substance by a large clot, should the infant survive, would be liable to cause depression, and consequent atrophy of the convolutions. In a case in which there were indubitable signs of paralysis of the left leg, the child dying at the age of two months, I found an immense meningeal hæmorrhage, the thickest portion of the clot, which was in process of resorption, being situated over the upper half of the right Rolandic area. Underneath it, the convolutions were deeply depressed, and, had the infant lived, they would in all likelihood have become sclerotic. The theory that meningeal hæmorrhage is a factor in the etiology of the sclerosis is supported in some instances by the brownish-red colour of the membranes and the

appearance of hæmatoidin crystals under the microscope. Meningo-encephalitis, with consequent defect in the convolutions, may also result from the irritation caused by a meningeal hæmorrhage. The blood may come from some of the dural or pial veins, or from rupture of some other blood channel, particularly the longitudinal sinus. Pachymeningitis may also follow the extravasations.

For the purposes of this article, the clinical symptoms of the infantile hemiplegias, diplegias, and spastic paraplegias may be considered in common. All have the cardinal signs of paralysis with mental deficiency.

Boys seem to be more commonly the subjects of paralytic idiocy than girls, a fact which indicates the frequency of injury at birth as a cause. The diplegias and paraplegias date from birth more frequently than the hemiplegias, which are wont to come on in the early years of childhood, up to the age of six, though examples appearing at a later age are not lacking. In the paraplegic forms, convulsions of an epileptiform nature at first call the parents' attention to the fact that there is something unusual the matter with their child. When it should begin to walk the infant is unready; the limbs are not freely used, and are stiff and rigid. Often the head is not well supported by the neck muscles, and the child lies passively on a pillow when it should be learning to crawl and walk. The stiffness is rarely so well marked in the arms as in the lower extremities. Finer co-ordinated movements of the fingers are learned slowly or not at all. Constant irregular vermicular movements of the fingers and toes are common, as is also a peculiar slow choreiform motion to which the name "athetoid" has been applied. The muscles of the extremities, when brought into action, show a peculiar spasm that is highly characteristic of the condition, and from which the name has been derived. The mental state is always far below the normal. The greater number of these persons are idiots of a low grade, incapable of education or of serial thought; rarely is one met with approaching the capacity of the imbecile in mental endowments.

The hemiplegic cases, usually beginning after the brain evolution has attained a higher degree of development, show a variety of mental defects according to the localization and severity of the initial lesion, and the degree of subsequent contraction and sclerotic change in the surrounding parts.

The onset of the trouble is usually sudden and severe. There is partial or complete loss of consciousness lasting over periods of

hours or days, attended by local or generalized convulsions, with slight indications of febrile disturbance. On awakening from the coma the child is found to be paralyzed, a condition that remains for the time stationary, or increases with subsequent convulsions. The right side of the body is rather more frequently affected than the left. The hemiplegia is commonly incomplete, as a certain amount of control over the muscles is ordinarily retained.

Considerable numbers of these cases show only a hardly noticeable paretic condition of the extremities after the lapse of a few years; in others the paralysis remains permanent, there being a distinctly hemiplegic gait with considerable wasting and marked contracture of the extremities—the late rigidity. In these instances the long bones of the affected side are shortened, a condition which augments the peculiarities of the gait. Sensation of the several kinds is not impaired, except in those cases in which the lesion has implicated the thalamic region. The reflexes are ordinarily increased to a notable degree, although in rather rare instances they may be absent. Involuntary and rhythmical movements of the fingers and toes (athetosis) are occasionally seen.

Motor aphasia is a not uncommon symptom when the lesion inducing the paralytic train of symptoms is located in the left hemisphere. It must not, however, be assumed that the region of the island of Reil is necessarily destroyed when disturbance of speech is present in diplegic and hemiplegic idiots. The false use of syllables and words, wrong accentuation, dysphrasias and lalopathias are much more frequent in these cases than a true aphasia, and result from the imperfect development of the whole cerebrum rather than of one definite area.

The hemiplegic idiots, the congenital cases being largely outnumbered by those that have attained some degree of cerebral development before the embolic or apoplectic insult has taken place, are not usually of an extremely low type, considerable numbers being capable of attaining to a fair degree of useful education, and even of supporting themselves by employment as messengers or by light housework. Such individuals belong rather to the imbecile than to the idiot class. If it were not for the frequency with which they are subject to convulsive seizures, education might be of more avail, but epilepsy invariably leads to a deeper degree of weak-mindedness as the years roll on, and no permanent self-reliance can be attained. The hemiplegics are more often the subjects of these epileptic attacks than the diplegics and paraplegics, though, unfor-

tunately, the seizures are somewhat common among all classes of paralytic idiots.

The form of idiocy known as *cretinism* is so rare in this country that it merits only a short notice. Osler, in his extensive monograph on sporadic cretinism in America, was able to collect only sixty cases, but thirteen of the individuals being native born. Two forms of the disease are described, the *endemic* and *sporadic*. The first form is known only in parts of Europe, and in the regions of the Cordilleras in South America; the latter, though rare, is universal. An extensive examination of the literature of the subject shows no important differences between the two forms, both depending essentially upon abnormal conditions of the thyroid gland, possibly also upon defects in the glandular structures of the hypophysis cerebri.

Symptomatology.—The cretin, like other infants destined to normal or abnormal after-growth, rarely shows any defect at birth, nor within the first eighteen or twenty months thereafter. In the exceptions to this rule there may be enlargement of the thyroid noticeable in the first few weeks of life.

It is only in the second year, when there is continued failure in corporeal development and inability to walk or talk, that attention is attracted to the child. Now, in addition to these signs, the infant loses its vivacity and becomes fat; the abdomen is pendulous, and the lax, yellowish skin acquires a peculiar gelatinous feel to the hand. The mouth remains constantly wide open, the tongue appearing too large for the cavity, and saliva flows from it freely. The child is usually dwarfish, with a thick neck; the arms and legs are short, the chest is broad and deep, and the nose flattened, with the root deep set. The long bones of the cretin afford perhaps the most characteristic sign of the disease. They show a breadth altogether out of proportion to their length, not from rachitic deformity, but from retardation of their growth in the long diameter with a disproportionate broadening. The head is usually too large for the size of the body, and the hair is scant and wiry. The bony deformities are associated with a boggy, thickened skin, firm and inelastic to the touch, non-pitting on pressure, which is universally present over the body, but is especially noticeable about the face, neck, and supraclavicular regions, where it may be raised from the subjacent tissues in great folds. The thickened skin gives the face a peculiar rounded, swollen aspect. The voice is high pitched, with a peculiar timbre. The thyroid, in a large proportion of cases of sporadic cretinism, is either absent or atrophic. A hypertrophic condition is

uncommon, and the atrophy forms the chief feature distinguishing this variety from the endemic form. In Osler's collection of 60 cases, only 7 had bronchocele, and in Beach's 116 sporadic cretins, an equal number had a similar enlargement of the gland.

A second, though very uncommon, form of cretinism, in which the patients are tall and well proportioned, has been described as existing in certain of the south Swiss valleys. The mental development is equally deficient. Some of the negro cretins present a similar appearance.

Differential Diagnosis.—It is undeniably the fact that in some other forms of idiocy the thyroid is defective in size, but the retarded growth and myxœdematous condition of the skin are lacking, nor do the long bones suffer as in cretinism. The skin, it is true, may be thick, but not in the characteristic manner, and the thyroid extract exercises here no beneficial influence. This condition is occasionally met with among idiots both of the microcephalic and macrocephalic type, particularly the latter form, the rounded head and moon face augmenting the likeness to cretinism (Fig. 45). Cases of fœtal rickets and some of the forms of infantilism may be mistaken for cretinism, the former by reason of the shortening with enlargement of the transverse diameter of the long bones, the latter from the diminutive thyroid and dwarfish stature; but the resemblance is only superficial, the diagnosis being readily made by the characteristic differences in the skin and facial bones.

Microscopic examinations of the thyroid gland have been made in only 10 cases—3 by Hanau, 1 by Langhans, 5 by Coulon, and 1 by Barker for Professor Osler. The anatomical appearances were essentially similar in all of them, after allowance for the circumstance that in several the cretin habit was not so well developed as in others. The principal alterations found in these examinations have been: Changes in the inter-alveolar connective tissue of the thyroid gland with undue prominence of the fibrillary elements; alterations in the alveolar cells and in their nuclei, shown by abnormal reaction to aniline dyes, and either too small, irregularly shaped forms, or a swollen appearance of the cells with almost hyaline contents. The colloid material contained in the alveolar spaces has also shown departures from the normal both in its chemical reaction to staining reagents and in its quantity.

Besides the regular forms of cretinism, individuals are occasionally met with that present some of the characteristics of the disease, but in whom the full symptom-complex is lacking—*cretinoid* idiocy.

These persons are usually of the defective class, with fairly large, rounded, dolichocephalic skulls, a mental capacity hardly capable of attaining to the rudiments of an education, but with the long bones well developed. About the scalp, face, neck, and clavicular regions are found areas of the skin presenting the doughy feel of myxœdema. The integument elsewhere has a normal appearance. The abdomen is usually somewhat pendulous. The thyroid gland is ordinarily very small, rarely hypertrophied. These cases are to be distinguished from certain microcephalic and macrocephalic idiots by the action of the thyroid extracts or of thyreoidin upon them. If the thickening of the skin is a true myxœdema, the tumefaction soon clears up under the action of the medicament, and the individual becomes for the time better and more mentally capable. When the extract is withdrawn the myxœdematous condition soon reappears. With the other class the administration of thyroid extract has no effect beyond, perhaps, producing a transient irritability.*

The *causation* of endemic cretinism is supposed to lie in certain unknown telluric conditions that apply only to the localities in which it is found. This much is certain: that when the land is drained and the inhabitants are supplied with pure drinking water, the disease disappears. The etiology of the sporadic form is not nearly so clear. Other conditions that result in the incomplete development or actual disease of the thyroid gland may now apply, and hereditary taint may be a possible factor. The occurrence of cretinism in families afflicted with goitre is suggestive. It is not essential that cretins should be of low mental development, as they vary all the way from the drooling idiot to individuals well endowed. These last seldom come under the notice of the physician, except to consult him about some other disease.†

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* The existence of cretinism in the negro has been denied by all recent authors who mention the subject. Nevertheless, an atypical form is not uncommon in the coloured race in this region of the country. Combined with mental defects are broadening of the long bones, an unusually short stature, masses of localized myxœdematous material about the head and neck, a pendulous belly, and a diminutive thyroid. The myxœdematous thickening of the skin is removed when the thyroid gland is administered for some weeks, and then slowly returns when it is withdrawn. Dr. M. A. Starr also records a case, included in Dr. Osler's collection, having an even closer approach to true cretinism in the negro than any I have seen. A number of the cases that have been under my care are reported in the *American Journal of Insanity* for January, 1898.

† One of the most striking instances of the effect of disease of the thyroid gland upon the mental evolution is recorded by Shields. The patient, the fourth child of healthy parents, developed normally in every way until the tenth month of in-

The *treatment* of idiocy is not strictly within the domain of psychiatrical medicine, but rather belongs to the scientific instructor, when the individual is at all capable of receiving any training, manual or mental. A very considerable proportion of the members of this unfortunate class are, however, incapable of profiting by any education, and must remain a burden to their families all their lives, or be sent to appropriate institutions for the feeble-minded of low grade.

Operative measures upon the cranial bones of idiots with microcephalic skulls have been undertaken, from the wrong conception that in all cases the retarded growth of the brain was owing to too early ossification of the principal sutures and a consequent non-development of the cerebral functions from compression of the brain, and that the condition could therefore be relieved by providing for expansion. Lannélongue's operation consists in the removal of one or several strips of bone from the parietal regions, but, being based on a hypothesis and not on fact (for the development of the hemispheres and that of the bones proceed with equal pace), no benefit could be expected from such procedures save that in rare instances they rid the world of troublesome and undesirable inhabitants. Likewise in hydrocephalic idiocy, operative attempts at the removal of the serous accumulation within the skull have not afforded any striking results, though here surgical interference may serve to relieve such distressing symptoms as are directly due to a steadily increasing intracranial pressure.

The results of the *therapeutic* treatment of sporadic cretinism, in strong contrast to those in other types of idiocy, are among the most brilliant of modern medicine. The administration of thyroid extracts, or of thyreoidin, is almost specific, changing one of the most revolting and disgusting of beings into an individual of human semblance, and reversing the doctrine of Plautus, "Keep what you have got; the ills that we know are the best."

Better than any treatment of idiocy itself would be an attempt on the part of the community to elevate the protoplasm of the pro-

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fancy; it then acquired an acute thyreoiditis, accompanied by fever and swelling of the organ. A complete atrophy of the thyroid gland resulted, and both the mental and physical growth came to a stand-still, the child soon presenting a picture typical of cretinism. At the age of nine years it was thirty-two inches high, weighed thirty-three pounds, and spoke a few simple words. Under the thyreoid treatment the bogginess of the skin decreased, the hair began to grow, and the intellect showed signs of awakening.

genitors, by the removal of the causes of physical decay, such as alcoholism, or the marriage of neurotics and epileptics, and above all by unsexing the numerous degenerates whose especial aim would seem to lie in further propagating a race even more deteriorated than the present generation. "Meet the disorder in the outset; the medicine may be too late."

The idiot is not subject to mental aberration, in strong contrast to his half-brother, the imbecile, the individual of unstable but not totally deficient nervous development. Some idiots of the microcephalic class are subject to periodic attacks of rage, that are uncontrollable either by themselves or by their attendants, but this is the nearest approach to a psychosis ever met with among them. Others, the cretins and macrocephalics, are notable either for their good humour or timidity, but mental disease, in the ordinary sense, is quite unknown among them.

II. IMBECILITY—CONGENITAL AND ACQUIRED

The dividing line between idiocy and imbecility has so many bridgings and side-paths that it is exceedingly difficult to determine where the one begins and the other ends. Were it allowable to resort to the obsolete English usage, and rely upon the test that a man who is able to correctly count twenty pennies has the capacity for a knowledge of the difference between right and wrong, a differentiation would be sufficiently simple to allow of precise definition, but such crude methods would hardly satisfy the present generation either of physicians or laymen.

Imbecility, like idiocy, is not a pathological entity, but rather the evidence of defective mental powers of various degrees, from pronounced enfeeblement to grades of intellectual development capable of fair education, but retaining a defect in some mental faculty, shown either by obtuseness or moral obliquity, the latter not necessarily being accompanied by other signs of weakmindedness. The imbecile is the victim of bad protoplasm received from ancestors, or in less frequent instances of the sequences of injuries to the brain sustained at birth, or in the subsequent years before the neural tissues have acquired even an incomplete development. To the psychiatrist, sociologist, or criminologist, the study of the imbecile outweighs tenfold in importance that of the idiot, for from the ranks of the half-witted are recruited the forms of degenerative insanities that throng in untold numbers the wards of our insane asylums, the

hereditarily unstable forming the bulk of the alienated, as would naturally be expected from their imperfect nervous organization.

To the sociologist the problem of imbecility is a crying one. The idiot by natural tendencies dies out in his generation; not so the imbecile, whose procreative instincts are not infrequently abnormally developed, and who, unrestrained by any moral code, not only begets his kind in ever-increasing numbers, but seeks and finds pleasure in the most disgusting forms of perverted sexual excitement, not only to the degradation of himself, but to a greater degree of those unfortunates whom he prostitutes to his pleasures. Passionate and unrestrained, when his lust is not appeased in less forceful ways, he hesitates not at indecent assaults, murders, arson, or whatever crime in the whim of the moment it suits him to commit. He is a vagabond, a thief, a drunkard, shameless, brutish, anything that is evil. A being beyond the pale of the law—a law he cannot comprehend or conform to—antisocial, fit only for the reformatory or asylum, he should be accounted at all times *homo alieni juris*, a creature unfit to properly care for himself and a menace to society. Even in houses of correction and reformatories he is ofttimes the terror of the keepers and officers. Unable to understand why he is made to work, or that he has done evil, and punishment has to be meted to him, he is mutinous, treacherous, and ever ready to injure or destroy life or property. Treated with care and individual consideration in insane asylums as a person mentally degenerate, he becomes quiet, and does not interfere much with fellow-patients, so that life becomes fairly supportable both for him and his attendants.

Fortunately the antisocial instincts are developed in only a certain proportion of the half-witted, and another class, dull, it is true, and incapable of any considerable attainments, comes into prominence. In these individuals the mental horizon is very narrow, but they are bidable, tractable, capable of learning something of manual labour, even some forms of artisan work, and are steady, to a degree responsible, to a certain extent affectionate to their superiors, and ofttimes capable, under the direction of others, of earning their own livelihood. Only under constant annoyance—for too often when at liberty they are the butts of better endowed but equally irresponsible companions—do they become irritable, and subject to outbreaks of violent anger, in which they may attempt to injure their fellows, or destroy furniture, clothing, or other inanimate objects.

It is customary, for the sake of simplicity, to separate the various forms of congenital and acquired imbecility into three classes, although one form often insensibly merges into the other without line of demarcation, and each imbecile, like the idiot, must be studied for himself alone. The epileptic imbecile must be excluded from this classification, for the reason that the epileptics are ever prone, as time elapses, to descend to a lower and lower grade of mental deterioration.

The *first* and lowest class comprises those individuals that approach most nearly to the idiot, but are able to understand simple commands and have some aptitude with hand and eye. Their linguistic attainments are monosyllabic, and they frequently resort to sign language to express their desires or intentions. They have only a small command of the faculty of attention, and are ordinarily incapable of constructing any simple sentence, or of ciphering, or learning to write, though some of them seem to derive great pleasure from drawing in outline figures of birds, houses, men, and other simple objects. In stature they are usually below the average height, loosely and heavily built, with coarse features and hands, and have many stigmata of degeneration, the high arched or flat palate, defective or irregular teeth, large and misshapen ears, epicanthus and irregularities in the ossification of the cranial bones predominating. Many of them belong to the group of moderate microcephalics, others have large heads, and in not a few there is a suspicion or history of gross brain defect—false porencephalic or meningitic lesion—not severe enough to cause paralysis, but sufficient to occasion a retardation of the cerebral development. Actual paralysis, usually in the form of a hemiplegia, is, however, frequent in this class of individuals. Occasionally, pseudo-muscular atrophies are found among these low-grade imbeciles.

When carefully trained they may be taught to do coarse manual labour, or to carry burdens, and are industrious, working satisfactorily under the guidance of a superior, but it is difficult to keep them neat and cleanly. The heterosexual instincts are but imperfectly developed; masturbation, on the contrary, is frequent, and difficult to control. When not subjected to annoyance by vicious and unthinking persons, they are quiet, inclined to be apathetic, and rarely give any trouble. If constantly teased and subjected to maltreatment, they become violent, often dangerous. True psychoses are not known among them.

The *middle* class comprises those that have reached a higher plane of mental attainments, that are capable of conversing correctly and formulating simple ideas into words, though the horizon of their vocabulary is narrow. The capability for the reception and retention of any considerable number of impressions and experiences is lacking, and they are without the power to co-ordinate and correctly estimate their experiences. Their knowledge is therefore extremely limited, reduction of ideas to a concrete form is impossible, and their ofttimes fabulous and impossible stories are the direct result of incapacity to properly assemble their thonghts. Speech defect in the form of stammering is common. The majority are not very teachable, but usually manage to retain sufficient of their schooling to read monosyllabically, and to scratch with pen or pencil characters that they designate as writing. Arithmetical problems of the simplest character are ordinarily too hard for them; a few are able to tell you how many apples, for instance, are in a row, but even here the results are often falsified, 1 and 1 often making 3. In speech they are quite frequently shrewd, and are quick in the observation and the application of trivialities.

Fig. 47.—A High-grade Negro Imbecile Girl Subject to Attacks of Great Irritability. She has a fair vocabulary. There is a well-marked epicanthus, giving her a Mongolian appearance.

They are vain, quarrelsome, easily irritated, incapable of joining in the family life, and are a constant source of annoyance to the household from their propensities to lying, thieving, vagabondage, and their general shamelessness and uncontrollable character. They cannot be made to do any regular work, but are perpetually changing from one occupation to another (*hyperkinesis*); they will watch others at work and join them for a few minutes, only to throw down their tools and flit to some new source of diversion.

The sexual instincts have a higher development in this grade, tending toward heterosexuality, and, especially in the case of women imbeciles, are an unceasing source of annoyance and disgrace to their parents, requiring constant watching to keep them from the machinations of evilly disposed persons.

Despite the apparent facility of language, thought is really slow. Patients of this class do not comprehend quickly, and there is a frequent tendency to the repetition of any question addressed to them (*echolalia*). In certain instances this inclination to repeat is so great that every sentence has to be reiterated and pondered over before any reply can be given. This defective memory separates them from close contact with their mental superiors, as it is only possible for them to retain the rudimentary events of daily life, and these only after constant repetition, until at last they have become mechanical. Any variation from the daily order brings instant disaster, since the patients are not capable of adapting themselves to altered conditions, and for the time their world is destroyed. While clinging with great tenacity to the minutiæ of life, they pass by matters of real moment as of no importance.

Owing to the narrowness of the circle of their ideas, the *ego* assumes the most prominent place. Vanity is extremely characteristic of these imbeciles; they are self-important, because they cannot estimate their incapabilities on account of the narrowing of the mental horizon. Their eating and drinking, the acquisition of trifling ornaments and articles of dress, are the central figures in their life, around which, to them, all the rest of the world revolves. On provocation they are cruel to those weaker than themselves, and occasionally commit crimes which have for their motive the possession of some trinket with which to adorn themselves, or the obtaining of money with which to satisfy the cravings for similar articles. No attempt is usually made to hide their crimes, nor do the guilty ones manifest remorse when arrested. Criminal assaults, while not very frequent, now and then occur, though this tendency to satisfy by force natural desires is much more frequently seen with the higher types. Even in the medium grades of idiocy this inclination is sometimes found, as, for example, in the individual whose photograph is reproduced in Fig. 44, who was committed to the City Asylum for an attempted rape upon his mother.

Cranial deformities, deviations from the normal in the palate and external ears, are still quite noticeable, but have not the same constancy as in the inferior types, bodily deformity and mental inca-

pacity often going hand in hand. The majority of the heads of the middle-grade imbeciles are slightly below the normal in size and show gross deformities somewhat frequently. Syphilis, judging from the Hutchinson teeth and other stigmata, is rather more common than among the lower grades, but is nevertheless infrequent. Insanity, in its strict sense, is not to be found among them. Some cases, it is true, that have been much subjected to annoyances, may develop fear lest harm should be done to them, but this can hardly be construed into a delirium of apprehension. Motived and unmotived attacks of rage are frequent enough, and, while uncontrollable, are hardly to be considered as coming within the strict limits of maniacal excitement, as they do not run the same protracted course. Psychoses are reserved for individuals of better developed though still unstable brains.

The *third* class, which comprises the most important and most numerous of the types of imbecility, is made up of all those examples in which the mental level is not quite up to the average intelligence. To it belong many of the "backward children" who fail to keep pace with their companions in school, whose memories are defective, and who do not retain from one day to another what they have learned with care and trouble. Weeks and months are spent over the alphabet before it is finally, and then only imperfectly, mastered: arithmetic, except in its very rudiments, is unattainable, and writing and reading are only acquired in the most imperfect manner. Arithmetical problems of a simple character are perhaps the best test of the mental qualifications of these patients. The majority can add short columns of figures correctly, but division and multiplication are within the reach of but a few. An entire system of classification might be built upon the capacity for arithmetical knowledge in the imbecile, and ofttimes such a test gives accurate data as to the mental powers of a patient, when the usual means of examination by conversation has revealed only an ordinary intelligence.

In another subdivision of this class the mental capacity is unequally developed. The patients may attain to a very considerable excellence as regards a single faculty, while in others they are notably defective. Thus one remarkable individual who came before me several years ago, while showing a decided faculty for language, since he could both read and speak English, French, and German, nevertheless spent his time chiefly in beating a bass drum, and in other respects presented the mental capacity of an

eight-year-old child, though at the time I saw him he was over twenty-five.

Some form of handicraft is, however, a much more frequent attainment than the development of a mental faculty—for instance, for arithmetic or languages—and very numerous examples are met that attain a proficiency in working with their hands.

Fig. 48.—Photograph of a High-grade Imbecile of the Criminal Class. The ears are below the natural level and set too closely to the head. There is a slight congenital ptosis of the left eyelid. The palate is normal, the thyroid well developed.

Two types of higher-grade imbeciles are thus presented to our notice, the one dull, deficient in many attainments, the other with one-sided but active mental development. The latter division affords a greater proportion of the criminal types than the former. These imbeciles possess a low cunning, a facility of language, and a sharpness of apprehension that is most misleading to those who are impressed by a torrent of language, which is not infrequently accompanied by an insinuating address. The class, as a whole, is defective in moral sense, has no conception of the difference between mine and thine, and is notorious for its propensity to mendacity, theft, forgery, sexual psychopathies, and general immoralities of every kind. It must not for an instant be presumed that every criminal is an example of the imbecile class. Unfortunately, "to err is human," and depravity of all kinds is frequent with persons possessing normal brains; but experience teaches us that a large proportion of the petty thieves, pickpockets, individuals convicted of indecent assaults and moral crimes, are of a low mental order, are deficient in cranial development, have not the capacity under the best of circumstances for taking advantage of a common-school education, and are ofttimes incapable of making a living for themselves, and eventually become a care and burden to the community.

The vast majority of the imbeciles of this higher order have inherited a distinctly labile nervous organization from their ances-

tors, who have themselves been of a low mental order. It is a fact too commonly lost sight of, that the degenerate can produce only degeneracy, unless the downward tendency is counterbalanced by crossing the breed with types having other characteristics. But in the present crowding into cities of untold multitudes to stagnate in the bad air of close streets and closer dwellings, often with insufficient and improper food, such a regeneration is well-nigh impossible. Again, the mental obliquity may be the result in the so-called better classes of society of a steady downward trend from a line of insane or alcoholic ancestors, whose excesses and delinquencies are but the beginning of the extermination of the family. Extinction of the race is much more frequently found in the children of the neuropathic than in those who for generations have had a vicious but not an insane ancestry. The tendency of the protoplasm in the one is to die out; in the other, unfortunately, the propagation of the brain monstrosities repeats itself over numerous generations, so that we have an increase rather than an extinction of undesirable progeny. The criminal inheritance in the latter seems based rather upon tendencies that beget a repetition of the type; in the former, senescence of the germ protoplasm results in physical and psychical weaklings who do not reproduce their kind.

Fig. 49.—High-grade Imbecile of the Prostitute Class, with Morel Ears, set at a Higher Level than is Normal. The palate is high-arched; the thyroid gland is palpable.

The high-grade imbeciles, therefore, while they approach closely to normal man, are defective in the reasoning faculty and in constancy of will power. Above all, their judgment is perverted, discrimination is wanting, their ethical code is marked by obliquity, and they are lacking in the many finer qualities that go to form the attributes of a sound mind. Interest in the social life of their fellow-men is absent, they are solitary in their habits, and their tend-

ency to shun the company of any but persons of their own endowments in itself fosters criminality; they are cruel, regard without pity the sufferings of other individuals, even of their own families; they do not understand the laws which they violate, and, as a consequence, are in continual conflict with the police, and a majority find their way into jails, reformatories, or eventually into the insane asylums.

Fig. 50.—Head of a High-grade Imbecile. Although the son of a wealthy family, he had been in a reform school, the House of Correction, and finally in public and private institutions for the insane. He was immoral, with perverted sexual instincts, and given to drink.

In their earliest years they are slow in learning to speak or to imitate, and so soon as childhood begins there commences with them an opposition to authority that only ends with life. At school they are dullards, untidy in their habits, in frequent conflict with their teachers and fellow-pupils, and attain only a certain superficial fluency in writing and reading. Spoken language, on the other hand, is often very voluble, although on closer examination it will be found that the vocabulary is limited, and the scanty ideas expressed are submerged in a torrent of ofttimes meaningless words. Mathematics are seldom mastered, with the exception of the rare instances in which the mental twist is toward arithmetical computations. Even in these individuals, though the power of memory for this single faculty may be marvelous, no application can be made by them of their remarkable endowment. They are simply incapable of furthering the natural attainment and making it of service. When the age of puberty is reached, the rise of the sexual instincts and changed conditions seem to aggravate all their propensities to evil, and excesses of all kinds, before kept in abeyance by the authority of parents and teachers, are entered upon. Thefts to obtain money to gratify their desires, and vagabondage, are frequent, so that children of respectable parentage will now be

found associating with thieves and criminals, to the scandal of their families and the detriment of themselves and of the community.

Not infrequently the defective inherited protoplasm comes to the rescue of the family. A few months of excesses, particularly *in vino*, and the mental weaklings become demented, and seek the sheltering walls of an asylum, there to remain for the rest of their days.

It would appear as if there were some natural law of premature senescence that affected the imbecile about the age of puberty, and rendered a further development of viciousness impossible. It will be remembered that puberty and adolescence are the most trying periods in the evolution of the higher cerebral association fibres; rapid growth of the body proceeds *pari passu* with maturity of the sexual system, and as the cytoplasm for successful development is deficient, a dementia follows from loss of brain vitality.

The psychoses, mania, melancholia, periodic or relapsing forms of insanity, delusional ideas having a more or less fixed character, and hallucinatory insanities, are of extreme frequency among the higher class of imbeciles. The moral insanity of Pritchard is only one of the characteristics of the subclass, and is simply an outcome of the defective nervous organization. It is so frequent and varied in its aspects that it is to be regarded rather as a symptom of nervous retrogression than as an especial form of alienation.

Manias are far more frequent than melancholias, particularly with the male sex. The morbid excitement is characterized by the sudden onset about the age of adolescence of violent and extravagant tendencies, logorrhœa with incoherence in the assemblage of ideas, and by the common occurrence of confusion with the excitement. The duration of the attacks is usually short, a few days or weeks, after which there is an apparent complete restitution to the degree of former mental integrity. Again and again the cycle is repeated, the intervals between the attacks becoming shorter, and after a number of them have occurred, a notable diminution in the patient's mental acuity is noticeable. Soon a true dementia follows, and gradually increases even to complete annihilation of the faculties. This dementia is ordinarily very rapid, running its course within a year or two, the patient then becoming quiet, fatuous, degraded, and absolutely apathetic.

After the maniacal seizures have once begun, a complete subsidence of the derangement is rarely seen before at least a partial dementia has sapped what mental vigour the patient may have at-

tained in earlier days. Inclination toward alcoholic habits augments perceptibly the tendency toward these attacks; indeed, intolerance of alcohol is one of the most characteristic signs of the high imbecile. Epilepsy beginning after the onset of a mania is of somewhat unusual occurrence, and spirituous indulgence should be suspected when it begins about the time of adolescence, though it is true that epilepsy in the ascendant may begin in the descendant at the age of puberty. Masturbation is also a frequent predisposing cause of the maniacal outbreaks, the pernicious habit being of extreme frequency among the weak-minded. Cold, clammy hands, pallid and pinched features, should always lead one to suspect the abuse, and to suggest any measures possible to prevent it. The vice draws so severely upon the small stock of vitality that these creatures possess, that the breaking up of the habit is of the utmost importance. But so many opportunities are feasible to induce the orgasm, especially at night, even with the hands encased in mitts, that the task in confirmed cases is well-nigh hopeless.

The *melancholias* in imbecility are notable, like the manias, for their sudden inception, short course, moderate severity, and comparatively rapid termination. Furthermore, there is the same tendency to a rapid dementia, already noted after a series of attacks of mania, and but few cases show the chronic delusional forms of insanity so frequently found after simple melancholia. Hypochondriacal aspects of melancholia are occasionally seen, but these follow the usual rule as regards the rapid annulling of the faculties, and do not remain stationary for years, as happens with the idiopathic varieties. The age for the development of melancholia is similar to that for the other types of insanity in the imbecile, about the age of puberty or toward the time of beginning corporeal involution.

Many feeble-minded women have, at the time of the menstrual periods, attacks of deep depression, within the border line of insanity, accompanied by delusions of a sexual character, especially that they are objects of regard for members of the opposite sex; in such cases their weak intellects may lead them to be readily deceived under promise of marriage, and unfortunate complications ensue. Religious perverted ideas are frequently intermingled with those of a sexual character. Persecutory types of insanity are also frequent among these higher imbeciles. These may arise primarily from the petty annoyances to which they are subjected by unfeeling persons, which tend to foster solitary habits and the rise of self-deceptions. Alcoholism also soon brings in its train persecutory

notions; that certain individuals are inimical to them; that they are followed by secret police; that their rooms are filled with mephitic vapours to steal away their minds, or that electric currents fill their bodies and torment them. Ideas of more expansive form, both in the simple persecutory or apprehensive delirium and the alcoholic class, are less frequent. Instances are, however, met among imbeciles of the development of delusions of pre-eminent self-importance: that they have become great men, of moment in the state or community; that they are sought after and admired for their mental endowments, and similar deceptions. Illusions and hallucinations are ordinarily found only in cases that have been addicted to alcohol. Masturbation tends to engender delusions of persecution, principally from the physical exhaustion entailed by it. These delusions are to a certain extent systematized in the sense that they are fixed, but they do not usually show the progressive character that is indicative of paranoia, the mental grade being one step lower; furthermore, the absence of sensory disorders is much more characteristic of the mentally debilitated than of the paranoiac class, which stands upon a higher plane.

The *pathology* of imbecility is rather in the general deficient development of the cranium, shown by the undersize, or less frequently the oversize, the defective evolution of one part and compensatory deformity of another, than in macroscopic malformation of the brain tissue itself.

Sollier, in 350 autopsies upon imbeciles, found no gross lesion of the brain substance in any of them, and such is the universal experience, in contrast to the porencephalia and other anomalies in the development of the brain of idiots. Slight meningitic thickenings, evidences of a long antecedent meningitis, vascular abnormalities and deficiencies, are now and then found, but not with sufficient frequency to be regarded as characteristic. Local atrophic conditions of the cortex from vascular rupture, embolism, or thrombosis, with evidences of antecedent encephalitis, are, of course, found in paralytics, but the proportion of this subclass to the whole number of imbeciles is small.

The usual findings at autopsies are: an infantile development of the fore-brain, and less frequently of the posterior lobes, sometimes with very simple gyri, broad in appearance, the gray matter being fairly deep; or the convolutions may be small, extremely numerous, the gray matter thin, the gyri lying in abnormal directions, being vertical or oblique instead of horizontal, while the fis-

sures are likewise altered, either in direction or by abnormal bridging with narrow or broad bands of cortical substance.

Corporeal deformities, while by no means so frequent as in idiocy, are met with in no unimportant numbers and are more usual than in the mentally sound. Bony ridges along the sutures of the skull, marking an unusually early ossification, are common, and narrowing of the skull base and deformity of the frontal, parietal, and occipital regions are found. Statistics on these points are unreliable from the small number of cases taken into account. Warner found a very considerable proportion of mentally dull children with coincident abnormalities in the skull, palate, and ear. After the defective crania, deformities of the palate and ear were next in frequency, but epicanthus was sufficiently common to attract attention.

The *urine* in idiocy and in imbecility shows nothing unusual. Oxaluria, and an excess of uric acid, are now and then noted, but albumin and casts do not seem to be more commonly present than in those better endowed.

The medical *treatment* of the imbecile is naturally negative. Craniectomy has been performed in a number of instances, in a very few with brilliant results, especially in cases of moral insanity, where the whole character of the individual has become altered for the better. *Similis simili gaudet ;* accordingly, defective development of the brain is compensated for by further injury.

Many of the cases of moral insanity, criminalism, and perverted sexuality might be bettered if the condition was recognised in early childhood, and the little patients were submitted to a training specially adapted to meet their psycho-physical defects. Except in rare instances I have never succeeded in impressing upon the parents of children with partial mental defect the fact that their offspring were different from other children, and consequently needed different training from them. Occasionally the advice has been heeded, when the time for remedying the evil had gone by forever.

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ADDENDUM

CRANIAL MEASUREMENTS AND STIGMATA OF DEGENERATION

The admixture of the blood from the many races represented by the present inhabitants of this country has produced numerous minor departures from the symmetrical formation of the bones of the head and face, and renders cranial measurements, though interesting, of comparatively little significance to the physician in the study of the normal man. While these slight asymmetries are so common among the sane as to be the rule, defects of a grosser character are found with equal frequency among certain classes of the insane, a recognition of which cannot fail to be of importance. At the same time it should be remembered that absolutely symmetrical skulls are more frequently met with in low forms of idiocy than in more highly developed individuals. In the production of cranial asymmetry, besides racial peculiarities, insufficiency of proper food leading to rickets, congenital syphilis, and heredity, are the most important factors for consideration.

The various diversities between the several types of skull are based upon the measurements known as the *cephalic index*, the relation of the greatest length to the greatest breadth of the cranium. These measurements are taken from the glabella to the occipital protuberance, the longest obtainable antero-posterior diameter, and between the tubera parietalia, the line of greatest transverse diameter of the skull. If now the longer be divided into the shorter diameter, the resulting equation will give the index cephalicus.

The results obtained from measurements, made in this way upon many thousand skulls of persons belonging to the present century, as well as to the earlier ages, show striking differences in racial types, some having a high, others a low index, while still others belong to a class midway between these two forms. The English and negroes, for example, are long-headed, the Germans short-headed, the Hollanders occupying a mid-position. The majority of

Europeans, and nearly all Asiatics, conform to the short or round-headed type, while the natives of Africa, America, and Australia are, as a rule, long-headed.

The diversities in shape have been designated:

Brachycephalic = short index.
Sub-brachycephalic = medium length of index.
Dolichocephalic = long index.

FIG. 51.

Cephalic indices above 80 belong to the brachycephalic, from 80 to 78 to the sub-brachycephalic, and below 78 to the dolichocephalic type. Normal variations range between 74 and 87, with a mean of 80.50. Variations beyond the physiological limits are frequent among the insane, particularly those of the imbecile class, with or without indications of rickets. Hyperbrachycephalic skulls of 90, 91, or even 93, are fairly common, while hypodolichocephalic indices of 72 or 70 are daily observed. The lowest known index is 51, and was found in an Italian. The brachycephalic heads are said to have a slightly greater cubic capacity than the dolichocephalic. In Figs. 51 and 52 will be seen the outline drawings of two high-grade imbeciles, with indices of 95.4 and 94.48 respectively. Fig. 53 shows a drawing of a hypodolichocephalic cranium, with an index of 67.4, belonging to a low-grade imbecile negro girl.

FIG. 52.

The greatest skull length to be determined for the index is

taken from the glabella to the point of the occipital protuberance. Variations in this measurement are very considerable, with a mean of about 18 to 17.5 centimetres for men, slightly less for women. The physiological limits are from 16 to 19 centimetres.

Fig. 53.

The transverse diameter is taken at the point of greatest width between the parietal bosses. The average for the normal skull is 14.5 centimetres, with a physiological variation between 13 and 16.5 centimetres.

The long and short types of skull further admit of subdivision, according to the size, defective development, or early ossification of the sutures, into a number of classes.

Microcephalus.—Smallness of the cranium is caused either by imperfect development of the brain (porencephalus, cerebral hæmorrhage in infancy, rudimentary evolution of the cortex and corpus callosum), or from the too early closure of the principal sutures.

Microcephalic skulls may conform to either the brachycephalic or dolichocephalic types, the latter being the more frequent. In the moderate forms of microcephalia, with a head circumference of from 49 to 47 centimetres, there is often no stunting of the physical development. For example, one man, six feet two inches in height, had a skull circumference of 44 centimetres, with a brain weighing 400 grammes. The bones were normally proportioned, the muscular development was fair, but the intellect had never progressed beyond the capacity to use coherently a very few words. In the extremes of microcephalus, below 44 centimetres, there is stunted growth, and ordinarily absolute non-development of the higher cerebral functions.

The crania of microcephalics may present a variety of deformities; on the other hand, they may be perfectly symmetrical, the latter being a type equally significant of a tendency toward inferior mental capacity, slight asymmetries being the rule in normal man, in whom, for example, one side of the forehead (the right) often projects slightly beyond the other half.

Macrocephalus is usually due to hydrocephalus in early life, less frequently to hyperplasia of the cerebral substance, or to thick-

ening of the bony envelopes. This type of skull is more symmetrical than that of the microcephalic, the over-growth being equal in all directions. It is much rarer than the moderate microcephalia. The facial bones, partly by contrast with the over-developed cranium, seem small and out of proportion to the rest of the head. The inferior and superior maxilla are frequently actually below the normal size. The members of this class are nearly all dwarfs, and often show marks of early rickety distortion of the long bones. The skull type is usually brachycephalic.

When early synostosis of the cranial bones takes place Nature attempts compensation, whence result various deformities of the cranium. The greater the effort to bring about compensation the greater the deformity. For this reason physiological limits are not to be defined (Peterson). Ill-shapen crania are, therefore, solely indicative of defects in later though still early development, the infant showing none of them; they afford no absolute proof of mental infirmity, though they are suggestive of it. Some of the most celebrated men in history have shown marked abnormalities in this respect. Thus, Kant's head was extremely large, hyperbrachycephalic, asymmetrical; the face was broad, the eye-sockets being extremely high. Raphael's head was extremely small, brachycephalic. Cuvier was a hydrocephalic; his brain weighed 1,861 grammes, and showed numerous unusual tertiary convolutions (Vierordt).

The too early closure of the cranial sutures induces a variety of deformities and asymmetries, which vary according as they implicate the base at the vault of the skull. Synostosis of the coronal suture and of the posterior portion of the interparietal suture leads to projection upward of the intervening regions, whence the terms "tower head," or "pointed head." This *oxycephalic* skull is characterized by its great height, disproportionate to the other measurements of the cranium. It is especially common among idiots and imbeciles. The circumference averages 51.94 centimetres for men and 50.35 for women (Meynert). Skulls of this type may be either brachycephalic or dolichocephalic. The height, measured from the superior edge of the auditory meatus to the extreme point of elevation of the parietal bones, is greater than the breadth. By reason of the unusual shortening of the anterior regions, the bulbi oculorum are projected forward on the plane of the sockets, making the eyes appear flat.

Premature closure of the frontal suture induces narrowing of the forehead and compensatory broadening of the posterior regions of the cranium. Skulls of this type are known as *trigonocephalic*, from their triangular shape, and are common in imbeciles of all classes. They approach more closely in shape to the fœtal skull than any other form. Ordinarily they belong to the dolichocephalic type.

A second variety of narrowing of the frontal regions (*leptocephalus*) is produced by early synostosis of the frontal and sphenoidal bones. This deformity is somewhat rare, and is usually not followed by a corresponding broadening of the posterior regions of the cranium.

Unilateral synostosis of one frontal with the corresponding parietal bone induces obliquity and projection forward of one half of the head, with a resulting *plagiocephalus*. Minor degrees of this deformity are frequent both in sane and insane individuals; more marked degrees are somewhat rare. The right side normally projects a little beyond the left.

Flat-headedness (*platycephalus*) is due to imperfect development of the parietal bones. It is frequently met with among epileptics and other classes of hereditary degenerates. In these cases there is a corresponding increase in size of the basal regions of the skull, from compensation, and the horizontal measurements are increased in all diameters.

Complete synostosis of the interparietal suture causes pathological dolichocephalus, with wedge- or keel-shaped formation of the cranium (*scaphocephalus*), or combinations of the two forms. The horizontal circumference is not below the normal, and the head may even be abnormally large. The height is greater than the breadth of the skull, and is above that of the average brachycephalic cranium.

The entire frontal region may be pushed forward, producing projection of the brows and increased depth of the eye-sockets. The occipital region may also be altered in the same way. Retroprojection of the occiput can occur alone without deformity of the forehead, closure in the posterior half of the sagittal suture taking place earlier than in the anterior portion. The deformity is now shown in attempted compensation from the lambdoidal suture backward, the form taken by the skull being an artificial dolichocephalus from the abnormally protuberant occipital bone.

Synostosis at an early age between the occipital and temporosphenoidal sutures induces deformity of the sphenoidal bones, a very common defect in some varieties of cretinism.

Minor anomalies in the formation of the skull, asymmetry, hydrocephalic and rachitic residua, according to Peli, are found in only 12.50 per cent of normal individuals, while 42.7 per cent of the insane and 64.3 per cent of hereditarily burdened persons, including both sexes, show deformities in some form. In men of the last class the proportion is much higher, reaching 88.5 per cent, according to the same author.

The average cubic capacity of the skull in the insane, as a result of compensation for deformity, is greater than in the sane individual (Meynert, Sommer, Amadei).

The principal cranial measurements to be taken to determine the cephalic index, deformities, and compensatory abnormalities are:

	AVERAGE IN CENTIMETRES.	
	Man.	Woman.
With the Compasses		
The long diameter from the glabella to the occipital protuberance	18.0	17.5
Greatest transverse diameter between the tubera parietalia	14.75	14.00
Distance between the edges of the auditory meatuses	12.5	11.5
Distance between the frontal bones at the level of the external angular processes	11.5	11.0
Distance from the auditory meatus to root of nose	12.0	11.0
Normal cephalic index, 74 to 87.		
With the Tape Measure		
Average circumference of the skull at the level of the glabella over the occipital protuberance	54.5	52.75
Average half circumference from the anterior edge of the meatus auditorius, over the glabella to the opposite side	29.0	28.0
Average half circumference from the anterior edge of the mastoid process of one side over the occipital protuberance to a corresponding point on the other side	24.5	23.75
Average biparietal measurement, from the upper edge of the zygoma (at the glenoid fossa) over the cranial vault to a corresponding point on the opposite side	36	34
Average long measurement from the glabella over vault of skull to occipital protuberance	35	33
Average chin line from the edge of the auditory meatus, over the chin to a corresponding point on the opposite side	30	28

The facial length from the root of the nose to the inferior edge of the mental process averages 12.35, with variations between 10.5 and 14.47 centimetres. The dolichocephalics have the longer and narrower, the brachycephalics the shorter and broader faces.

Additional Stigmata of Degeneration

The Ear.—The external portions of the organ of hearing present an almost innumerable number of variations from the normal form. Some of these, as the fusion of the lobule with the skin of the neck, are so common as hardly to be reckoned among the pronounced stigmata of degeneracy, being found in at nearly one third of sane individuals (Binder). Other departures from the normal in the form of vicious implantations, ears projecting too far from or set too closely to the head; ears inserted at abnormal angles, or implanted too high or too low upon the neck, as well as decided forms of asymmetry, may be considered as definite brand-marks. Likewise certain well-recognised deformities of the anatomical divisions of the ear may be placed in the same category. Here belongs the ear without lobules, or with unusual prominence of the antihelix, excessive length with narrowness of the organ, accompanied by distortion of the helix, antihelix, and antitragus; the Darwinian ear, in which the helix is interrupted by a tubercle where its transverse passes into the descending portion; or the Morel ear, in which the normal folds are obliterated, the whole organ appearing larger than normal, and projecting outward from the side of the head. Too large or too small ears may also be considered to be among the abnormalities.

Numerous other less marked stigmata may be included in the list of the signs of degeneracy, as, for instance, a broad, band-like, irregularly broken helix, the triplication of the crura furcata, unusual fissuring of the antihelix, a mal-developed helix, absence of the antihelix, and distortions of all kinds not induced by artificial agencies in infancy, which should be carefully distinguished from the congenital defects.

The Nose.—The nose may be oblique, the septum deformed, or the root unusually wide. In cretinismus the nasal bones are often too broad.

The Eyes.—The lids may be oblique, giving the almond eye of the Orientals. Epicanthus is frequently seen. There may be irregular pigmentation of the iris, congenital strabismus, coloboma, cloudy cornea, pigmentary retinitis, and total congenital blindness. Congenital ptosis is somewhat frequent.

The Skeleton.—Retarded development of the long bones is frequent in all forms of idiocy and imbecility, and results in a dwarfish stature. In cretinism the bones are abnormally broad. Con-

genital club-foot, club-hand, webbing of the fingers and toes, distorted and supernumerary digits, are to be included among the stigmata, as is likewise defective development of the muscles of the trunk and limbs.

The Mouth.—The interior of the mouth offers a number of prominent brand-marks of degeneration. The orifice may be disproportionately large or small, or there may be harelip or cleft palate. The soft palate may be long or thin, twisted to one side, bifid at the extremity, elongated and pointed, or rudimentary (Fig. 54). The alveolar processes may be too narrow or too broad, and

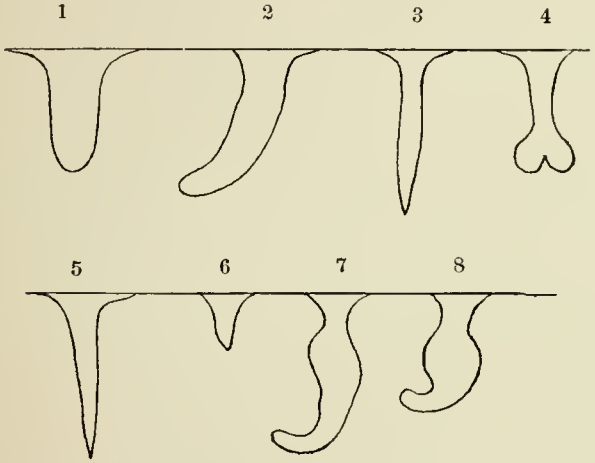

FIG. 54.—EXAMPLES OF ABNORMAL UVULE FOUND IN THE DEGENERATE CLASS. 1, Normal uvula; 2, curved; 3, long and thin; 4, bifid; 5, long pointed; 6, rudimentary; 7, 8, distorted.

retain teeth of the first dentition. It is, however, the *hard palate* that most frequently shows unequivocal signs of malformation, and must be considered as affording some of the most important brand-marks of degeneracy. Here abnormalities are found in nearly forty per cent of all degenerates, and are almost equally prominent among the higher and lower grades. While deformed palates are met with in some normal men and women, the proportion is by no means so considerable as among the degenerates, and the types of deformity are not so pronounced.

The normal palate in its lateral curves represents the segment of a low arch, having for its pillars the alveolar processes of the superior maxillary bone. Antero-posteriorly the arched form is not so pronounced. There is a rise beginning at the margin of the

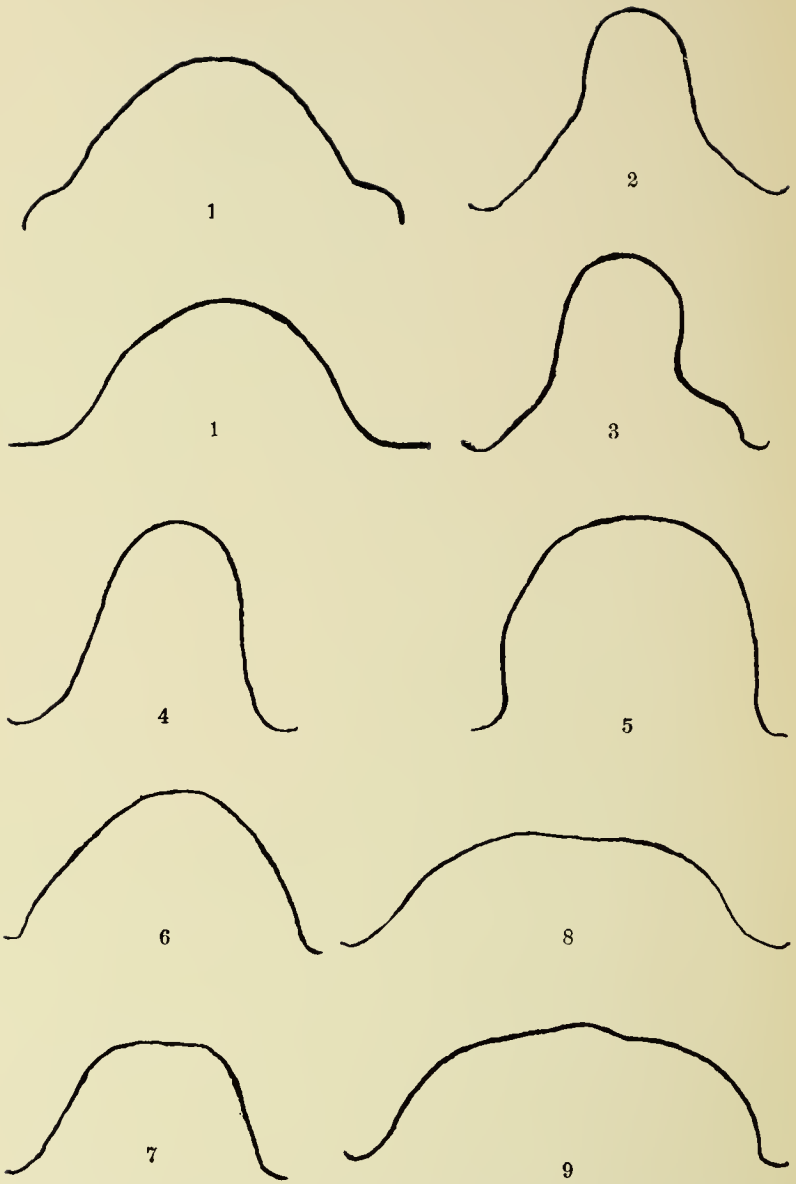

Fig. 55.—The Outline Curves of Normal and Abnormal Palates in Transverse Section. 1, 1, Curve of normal palates. 2, High-arched palate nearly symmetrical. 3, High-arched palate with marked asymmetry. 4, High-arched palate having more rounded curves. 5, High-arched palate with dome-like curves. 6, High-arched palate with curves more nearly approaching the normal. 7, High-arched palate with flat roof. 8, Transverse curves of a flat palate in which the outlines are almost symmetrical. 9, Flat palate with somewhat irregular curves.

teeth, but this soon vanishes into a nearly straight line running as far as the velum palati.

Departures from this primary form take place principally in two ways: The arch is either unnaturally low, or becomes abnormally high and vaulted.

An infinite number of variations are met with between these two types. Perfectly flat palates, normally vaulted palates with a V-shaped incision in the line of the central suture, or palates abnormally small in all diameters; others having the central suture ridged and prominent, and still others with little bony elevations, rounded in appearance, situated along the line of the suture, both forms representing varieties of the so-called *torus palatinus*, may be enumerated as among the most frequent of the abnormalities.

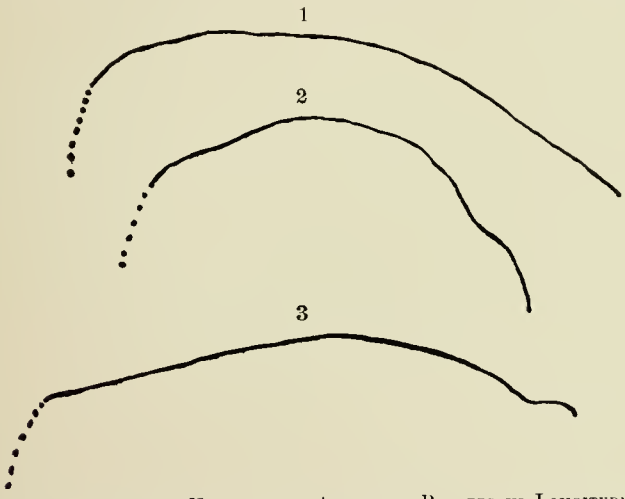

FIG. 56.—OUTLINE CURVES OF NORMAL AND ABNORMAL PALATES IN LONGITUDINAL SECTION. 1, Longitudinal outline curve of a normal palate. The dotted lines represent the uvula. 2, Longitudinal curves of a high-arched palate. 3, Longitudinal outline of a flat palate.

The torus has lately attracted a good deal of attention in Germany and Italy. Ferrari investigated 1,121 skulls of insane persons and found it present in 52 per cent. Näcke found it in 32.9 per cent of insane women. It is now and then observed in mentally sound individuals, but not with the same frequency as in the alienated. Palatal deformities have no relation to cranial types, being equally frequent in brachycephalic as in dolichocephalic skulls. It is doubtful whether cleft palate should be enumerated among the unequivocal signs of corporeal degeneracy, having been

found only once in personal examinations of 300 idiots and low-grade imbeciles.

During the winters of 1898 and 1899 I investigated the hard palates of upward of 700 insane and feeble-minded persons. It was unfortunately impossible at the moment to note all the individual peculiarities, and in order to avoid inaccuracies the mouths of 340 persons in the City Insane Asylum and adjacent Almshouse were examined serially for abnormalities of the roof of the mouth. One hundred and seventy persons were taken from each department for comparison. With the insane contingent all classes except the lowest grades of idiocy were accepted. With the pauper division nothing lower than an imbecile of medium grade was taken, but all those whose mental endowments were above those of the vagabond class were also excluded. The difference in the percentage of stigmata noted in the two groups investigated was not great, being 38.29 per cent for the insane, and 40.32 per cent for the pauper class. A considerable number of additional palates having very small tori of the knob form were discarded from the general list, the deformity being too slight to be called definitely pathological.

The principal deviations from the normal found in the palatal portion of the superior maxillary bones may be enumerated under seven classes. In this classification I have not used the term "Gothic" palate, employed by Clouston, Peterson, Talbot, and others, to denote a sharply vaulted deformity of the roof of the mouth, as the palatal arch very rarely conforms closely to the true curves of the Gothic arch. Instead, I have substituted the designations *high narrow* and *high broad* palates, as more strictly descriptive of the actual appearances (see outline drawings of palates). These varieties are the most frequent of all the pathological deviations. I have, however, adopted Clouston's term "neurotic palate" to designate a form narrow in all measurements, and of great frequency among the several grades of degenerates.

The classification offered includes all forms of any prominence.

Form I. *Normal Palate.*—The vertical-transverse curves approach those of a semicircle. The antero-posterior lines do not approximate in curve to a regular arch (see outline drawings, Figs. 55 and 56, 1, 1). The transverse diameter between the outer edges of the second molars is from 50 to 52 millimetres, and the longitudinal measurement from the edge of the front teeth to the anterior border of the uvula, following the curves, is from 65 to 70 millime-

tres. The are representing the outline of the front teeth should be a rounded one (see Plate VI, No. 1).

Form II. *High Narrow Palate.*—The vertical-transverse curve here approaches more closely the Gothic than the Roman type of arch, and is narrower than in the normal form, measuring 35 to 40 millimetres. The arch is ordinarily somewhat irregular in outline. The long measurement is from 80 to 87 millimetres, following the line of the curve. The front teeth with palates of the high narrow shape have a tendency to project into a wedge-shaped point (Plates VI and VI[a], Nos. 2, 3, and outline drawings).

Form III. *High Broad Palate.*—The vault of the palate now attains a considerable height above the normal altitude, but does not narrow to an apex, and the upper curves resemble those of a dome. Considerable variation is to be noticed in this form, and the height may vary within wide limits. The roof of the mouth in this variety of palate may occasionally be flat and high instead of high and rounded. The transverse diameter between the outer margins of the second molars varies from 38 to 48 millimetres, while the antero-posterior curve may be from 80 to 88 millimetres. The two varieties of this form of palate are frequent in degenerates of medium and high grades (Plates VI[a] and VI[b], Nos. 4, 5, 6).

Form IV. *Broad Flat Palates.*—The arc of the palate is now lower than in the normal, and much broadened, the limits ranging from 55 to 69 millimetres. The antero-posterior curve varies between 72 and 80 millimetres. The teeth are regular, well formed, and not very closely set together. This form is common in low types of idiocy (Plate VI[d], Nos. 9, 10).

Form V. *Palates Narrow in all Measurements.*—This variety is of especial frequency among the high class of degenerates, ranking next in order to the high narrow palates. Now and then there is a decided tendency to a basin-shaped depression at the highest point of the roof of the mouth. The transverse measurement between the outer edges of the molars varies between 36 and 44 millimetres, and the antero-posterior curve between 62 and 68 millimetres. Asymmetries and tendencies to the development of tori are far from unusual in this form (Plate VI[c], Nos. 7, 8).

Form VI. *Longitudinal Torus.*—This deviation from the normal in the construction of the palatine portions of the maxillary bones is of considerable frequency in the mouths of both sane and insane persons, if we include slight longitudinal elevations at the margin of the central suture; but well-marked tori were found in

only 4.7 per cent of my 340 tabulated cases. The contours of the transverse vertical arch may either be normal, or elevated, when tori are present (Plate VI[e], No. 11).

Form VII. *Palates with Knob Torus.*—This form is quite rare, having been determined in only 0.58 per cent of my tabulated cases. There may be a single bony projection from the central line of the roof of the mouth, or there may be two, three, or even four knobs ranged along the central region of the suture. When single, they may be as large as a split filbert or as small as a pea (Plate VI[e], No. 12).

Form VIII. *Oblique Palate.*—This variety is also rare. The deflection may be either to the right or left side, and is usually found with a moderately high-arched roof. Slighter asymmetries are exceedingly frequent (Plate VI[f], No. 13).

Form IX. *Elevation of the Entire Line of the Median Suture.*—This abnormality is occasionally seen in both normally curved and high-arched palates (Plate VI[g], No. 15).

Form X. *Normally Arched Palate with V-shaped Incision in the Median Line.*—A small narrow depression of 2 to 3 millimetres in depth was found in 1.4 per cent of the tabulated cases. In all the mouths in which it was observed there was a normal curve to the arch of the palate. Cartilaginous union of the two halves of the palatine portions of the maxillary bones is occasionally noticed (Plate VI[f], No. 14).

The appended table gives the relative frequency of the several varieties in three hundred and forty individuals from the insane and pauper departments of the city Almshouse.

Pauper Department

	Normal.	High narrow.	High rounded.	High flat.	Neurotic.	Flat.	Normal curves, V incision.	Asymmetrical.	Torus.	Total.	Percentage.	
Males ..	70	8	4	1	5	5	4	3	8	108	{ Normal, 70 { Abnormal, 38	35 % abnormal.
Females.	37	10	5	0	5	4	0	0	1	62	{ Normal. 37 { Abnormal, 25	42.32 % abnormal.

Insane Department

Males ..	44	9	8	0	9	4	0	1	1	76	{ Normal, 44 { Abnormal, 32	42.10 % abnormal.
Females.	58	6	4	0	13	7	0	1	5	94	{ Normal, 58 { Abnormal, 36	38.29 % abnormal.
	209	33	21	1	32	20	4	5	15	340	Total abnormal, 38.52 %.	

The Teeth.—There may be defective development, supernumerary teeth, or the second set may be absent, irregularly set in the alveolar processes, or imperfectly developed. Prognathism is quite frequent.

The Hair.—There may be an abnormal development of hair upon the body; it may be coarse, scanty, or completely cover the body. The hair may early turn gray, a sign of beginning involution and premature decrepitude.

The Genitalia.—Infantile uteri are common. Hypospadias, hermaphroditism, defect in the prepuce, non-descent or rudimentary development of the testicles, may be found.

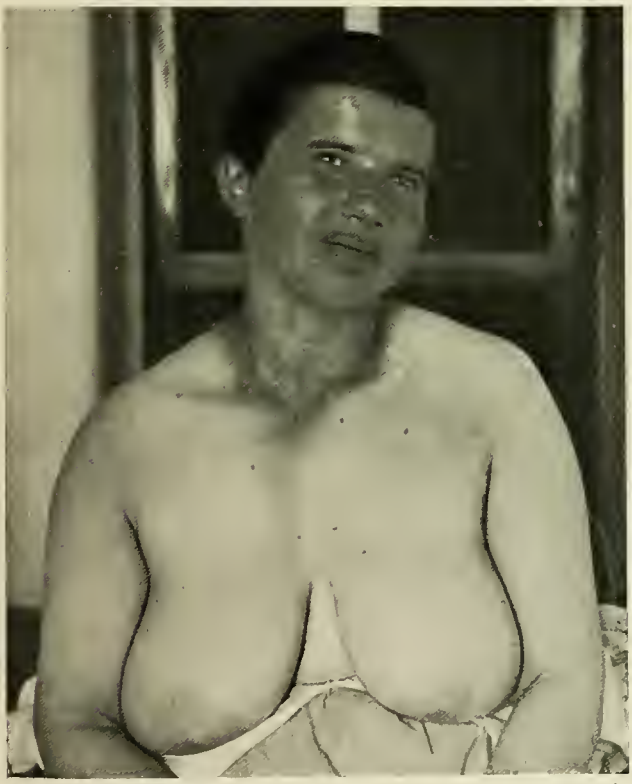

Fig. 57.—Abnormal Development of the Breasts in a Medium-grade Imbecile. She has never borne a child.

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PLATE VI

DESCRIPTION OF THE PALATAL CASTS

No. 1. Normal palate. The vertical-transverse and arc of the front teeth [illegible] corresponding to the segment of a Roman arch.

No. 2. High narrow palate, slightly asymmetrical. Y., aged twenty-eight years; male. Medium-grade imbecile. Has the correct use of a limited number [illegible] words. Marked frontal asymmetry.

No. 3. High narrow palate, slightly more [illegible] than the preceding one. B., aged twenty. Imbecile of medium grade. Has [illegible] with intelligent [illegible] manship is also present.

No. 4. High narrow palate of double curve, almost perfectly symmetrical. H., aged seventeen. Chronic delinquent and [illegible]. Neuropathic family history. Family intelligent.

No. 5. High broad palate of unusual shape. Perfectly symmetrical. D., aged thirty-eight; male. Dead at this age of senile [illegible]. Presented a copper-[illegible] of being eighty-five or ninety years old.

No. 6. High broad palate with flat roof. F., aged thirty-five; male. High-grade imbecile. Psychopathic family history.

No. 7. Typical palate, narrow in all dimensions. There is some tendency to [illegible] formation at the apex of the roof of the mouth. B., aged thirty-five; male; [illegible] and fifty pounds. Hereditary [illegible]. Developed [illegible] and a form of confused mentality.

No. 8. Less pronounced form of narrow palate. The basin-shape of the roof [illegible] marked. B., aged thirty-eight; weight, one hundred and fifty-seven pounds; female. High-grade imbecile. Capable of reading and writing in an [illegible] way. Has violent in temper and unsteady about working. Neurotic family history.

No. 9. Typical broad flat palate, symmetrical in all dimensions. M., aged fifty-three; female. Periodic insanity. Not a mental.

No. 10. Broad flat palate with long [illegible] as sides of central suture; otherwise symmetrical. S., aged forty-five; male. Alcoholic [illegible]. Typical family history.

No. 11. Low-vaulted [illegible] palatines. Palate fairly symmetrical. P., aged fifty years; female. Periodic insanity. Psychopathic family history.

No. 12. Double knob formed by [illegible] suture; palate otherwise normal. C., aged thirty-eight; male. Demented [illegible] a slight [illegible]. Strong [illegible] history of insanity in the family.

No. 13. Depressed palate. The twist [illegible] to the left, and the [illegible] of the front teeth is disturbed. V., aged forty-five; male. Idiosyncrasy followed by a mild dementia. Psychopathic family history.

No. 14. Distorted palate; twist toward the right side. A fine [illegible] is seen running along the roof of the mouth from left to right. B., aged [illegible]; male. Imbecile [illegible].

No. 15. Abnormal elevation of the center [illegible]; palate otherwise normal. B., aged forty-two. High-grade imbecile. Family history unknown.

PLATE VI

Description of the Palatal Casts

No. 1. Normal palate. The vertical-transverse and arc of the front teeth both correspond to the segment of a Roman arch.

No. 2. High narrow palate, slightly asymmetrical. V., aged twenty-eight years; male. Medium-grade imbecile. Has the correct use of a limited number of words. Marked facial asymmetry.

No. 3. High narrow palate, slightly more symmetrical than the preceding one. B., aged twenty. Imbecile of medium grade. Dumb, though fairly intelligent. A hare-lip is also present.

No. 4. High narrow palate of dome form, almost perfectly symmetrical. H., aged twenty-seven. Chronic delusional alcoholic insanity. Neuropathic family history. Is fairly intelligent.

No. 5. High broad palate of unusual shape. Perfectly symmetrical. D., aged fifty-eight; male. Died at this age of senile marasmus. Presented every appearance of being eighty-five or ninety years old.

No. 6. High broad palate, with flat roof. E., aged thirty-five; male. High-grade imbecile. Psychopathic family history.

No. 7. Typical palate, narrow in all diameters. There is some tendency toward a basin formation at the apex of the roof of the mouth. B., aged thirty-five; male; weight, one hundred and fifty pounds. Hereditary weakling. Dementia followed prolonged masturbation and a form of confusional insanity.

No. 8. Less pronounced form of narrow palate. The basin-shape of the roof is quite well marked. B., aged thirty-eight; weight, one hundred and fifty-seven pounds; female. High-grade imbecile. Capable of reading and writing in an imperfect way, but violent in temper and unsteady about working. Neurotic family history.

No. 9. Typical broad flat palate, symmetrical in all diameters. M., aged fifty years; male. Periodic mania. Not demented.

No. 10. Broad flat palate, with bony irregularities at sides of central suture; otherwise symmetrical. S., aged forty-five; male. Alcoholic pseudo-paresis. Psychopathic family history.

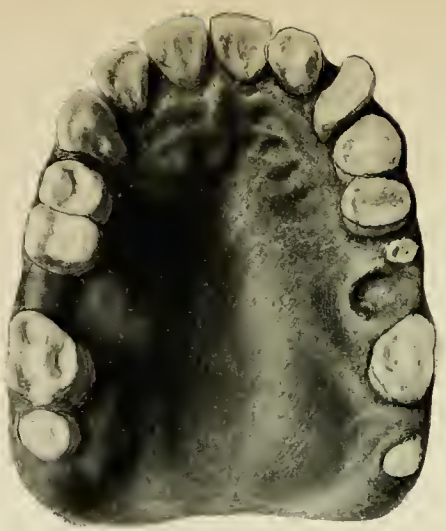
No. 11. Longitudinal torus palatinus. Palate fairly symmetrical. F., aged fifty years; female. Periodic mania. Psychopathic family history.

No. 12. Double knob tori along central suture; palate otherwise normal. C., aged thirty-eight; male. Dementia followed a slight cranial traumatism. Strong hereditary history of insanity in the family.

No. 13. Distorted palate. The twist in this instance is to the left, and the rounded arc of the front teeth is disturbed. V., aged forty-five; male. Adolescent insanity followed by a mild dementia. Psychopathic family history.

No. 14. Distorted palate; twist toward the right side. A fine linear V-shaped depression is seen running along the roof of the mouth from left to right. H., aged thirty-five; male. Alcoholic ancestry.

No. 15. Abnormal elevation of the central furrow; palate otherwise normal. B., aged forty-two. High-grade imbecile. Family history unknown.



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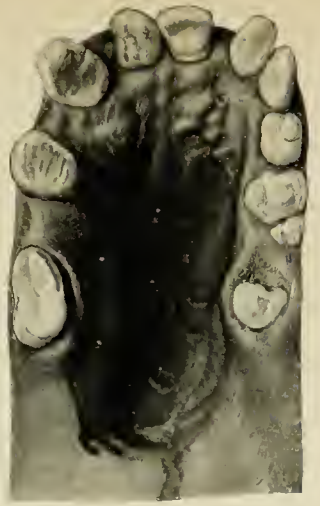

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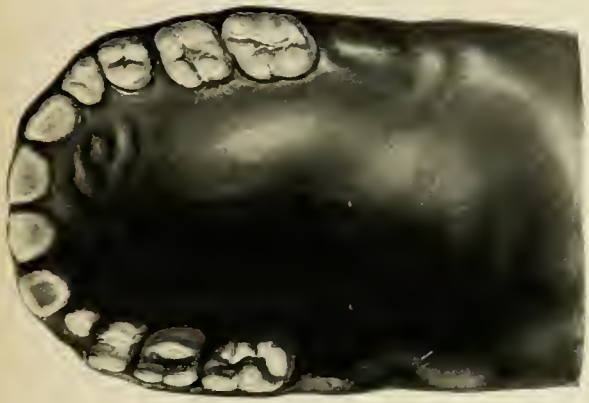
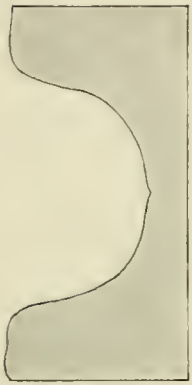
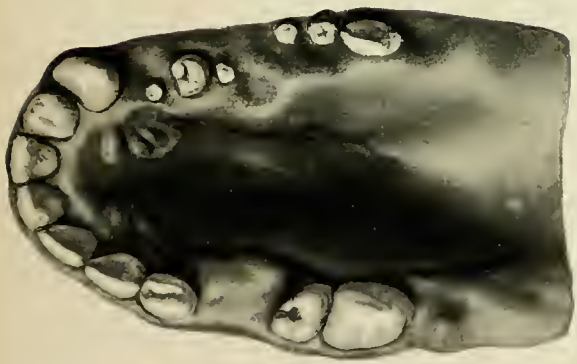
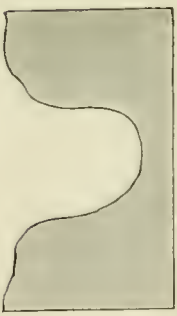
PLATE VI









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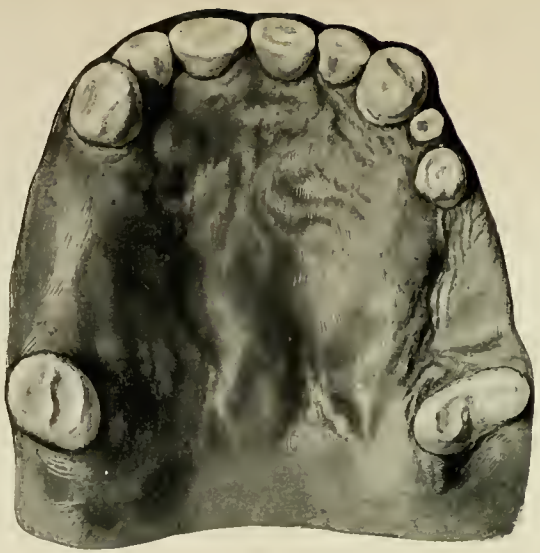

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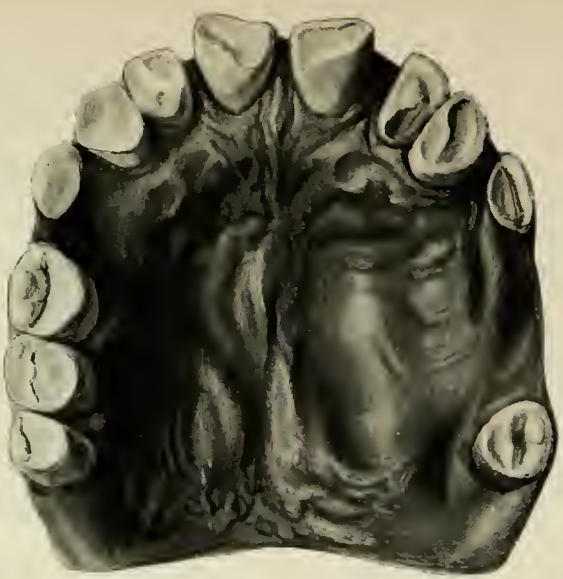

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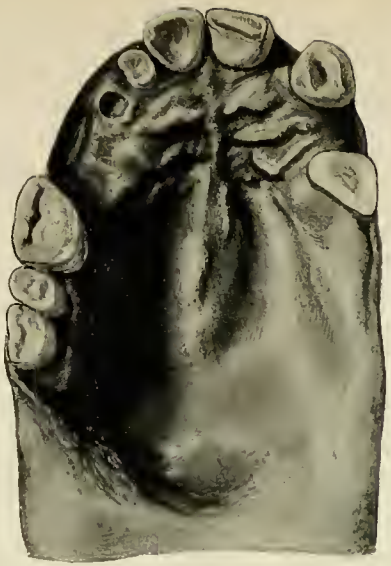
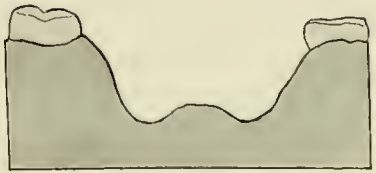
PLATE VIa





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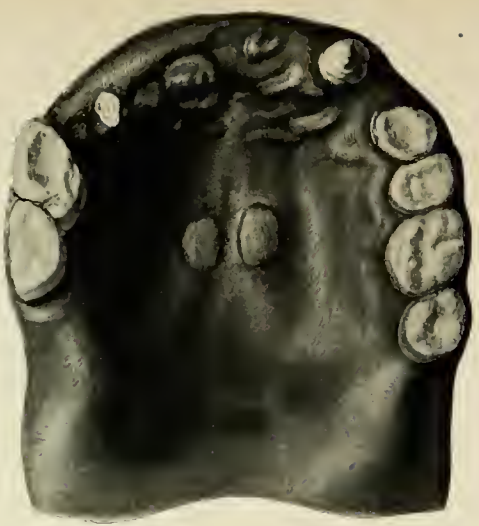
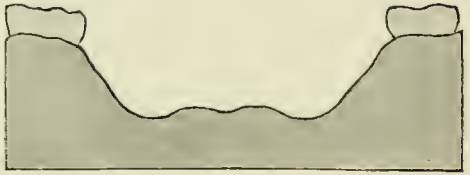
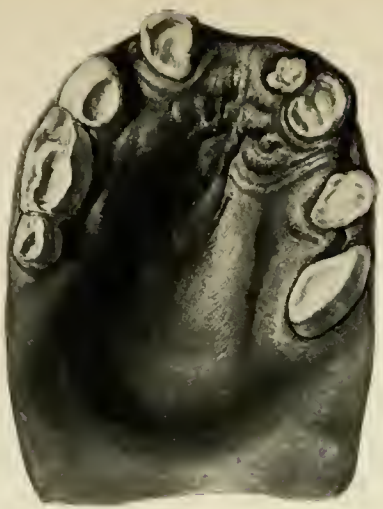




No. 12.

PLATE VI[e]



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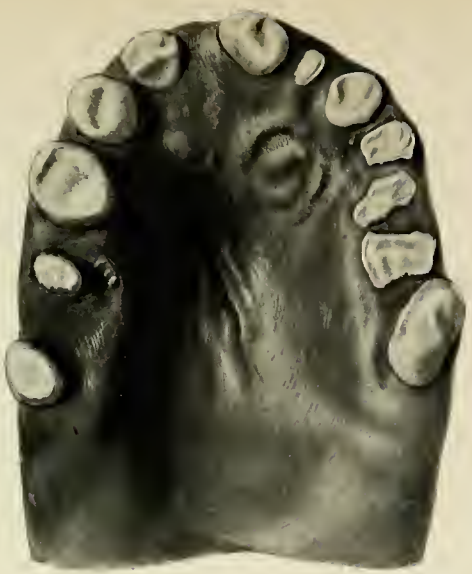

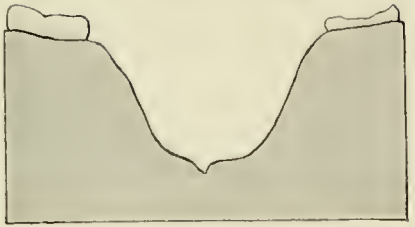

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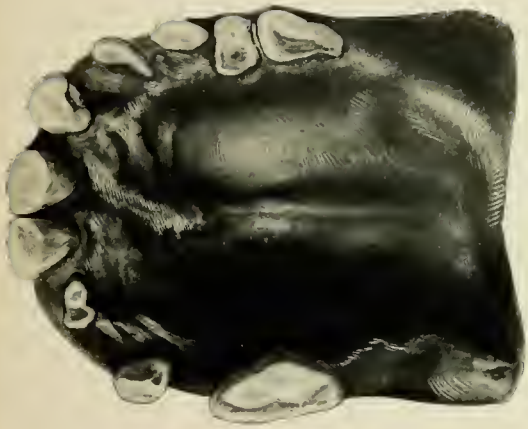
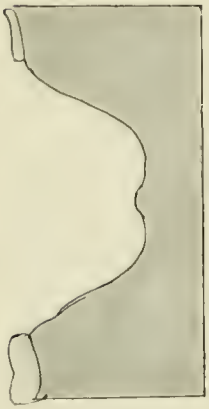
PLATE VI





No. 15.

GROUP V

THE PSYCHOSES OF CHILDHOOD

The term childhood will be regarded in this chapter as designating the period of life from the first to the twelfth or fourteenth year, before the sexual nisus has begun to play an important part in the organism. The psychopathies in children present certain wide variations from those observed in the adolescent or in grown persons. They are chiefly remarkable for simplicity in the character of the mental derangement. The recorded examples of psychoses in children are not numerous, but there has been a noteworthy increase in their number in recent years.

The numerous forms of idiocy have been already described; nor do they belong here, since idiots are not, properly speaking, subject to insanity. Their attacks of causeless rage are not to be regarded as a symptom of alienation, but rather as the result of lack of development of the cortical inhibitory centres. Alienation presupposes the development of these centres, and to be insane a child must have possessed them and have afterward lost control over them.

The earliest age at which instances of definite mental derangement occurring in children have been recorded is two years (Rush, Kalischer, personal observation). But even in tiny infants what may be considered as its equivalent has been noted in fits of prolonged screaming, motor restlessness, and sleeplessness. Before the age of two years the mental development of the average child is insufficient to allow him to connect ideas logically, and his linguistic attainments consist of a few words, used to make known his pressing needs, but hardly co-ordinated into distinct sentences. The child's world up to and a little beyond this time consists entirely of impressions received through the special senses, especially those of hearing, sight, and touch, and up to the age of four years any mental disturbances which occur are of a purely hallucinatory nature; in other words, the usual channels for the reception of external impressions become, for the time, perverted. Delusions at this immature age do not exist, the faculty for serial thought and reflection

not being sufficiently developed to allow of their evolution. The child's insanity, therefore, is distinctly an insanity of the senses, and cannot show much elaboration or complexity.

With infants in whom mental disturbances occur, even these perversions of the sensory apparatus may be practically so slight that the manifestations of the psychosis, especially in post-febrile states, are of an even more simple order, and consist in constant screaming, crying, motor restlessness, displayed in purposeless kicking and incessant automatic movements of the hands, with protracted sleeplessness. A few months later we find added to the other phenomena more purposeful movements—definite attempts to kick, scratch, or bite, with tearing of the clothes or running about incessantly. As the brain develops, and impressions are synthetically received and co-ordinated, the first sign of a complex insanity is forthcoming in the perversion of a sensorial impression. As the growth of the brain proceeds and logical thought becomes possible, we may have delusions, which are evolved, however, with but little elaboration; and still later, as the child advances in years and the cerebral centres become organized, the insanities encountered approach more and more closely to the adult types, and the ordinary forms of maniacal exaltation, melancholia, or paranoia are recognisable.

Accordingly, in the life of the child the several periods present noticeable differences in the form assumed by the insanity. The insane baby is the victim of motor agitation; the youngest children have delirium, nocturnal frights, quite often of an hallucinatory colouring, hallucinatory psychoses, and transitory maniacal attacks, accompanied by sensorial deceptions. In children between the ages of four and seven years the hallucinatory types of mental disorders still predominate, but are mainly induced by infectious and toxic maladies. Chorea, which may possibly belong to the same category of diseases, is also a frequent factor in the mental maladies of this period. Delusions, rudimentary in character (for typical delusions presuppose preformed ideas), which from the imperfect judgment and lack of experience are inclined to be extravagant and grotesque, may be occasionally noticed in the latter part of this epoch. From the end of the seventh year to puberty the more distinctive forms of adult insanity, modified by the as yet feeble development of the higher centres of the cerebrum, begin to come into prominence—melancholia, periodic manias, neurasthenia, or hysteria with distinct perversion of the intellectual faculties.

Etiology.—In the psychoses of childhood the sins and transgressions against moral and hygienic laws on the part of the forefathers, descending unto the third and fourth generations, occupy the place of primary importance as provocative causes. A family neurosis may reappear in the child under a new form, and a psychosis develop. The trend in an insane family is always toward the extinction of the house, and after one or several generations have passed the feeble-minded and idiots make their appearance, and the family name dies out. Exceptions are noticeable when the breed is crossed with others of greater nervous stability, this admixture of healthier protoplasm tending to bring about restitution to mental vitality. Alcoholism in the progenitor, while predisposing equally with hereditary mental disorders to psychical abnormalities, carries with it even greater tendencies to corporeal defects owing to which the extinction of the family is more rapidly reached.

Although the statistics available at the present time are hardly to be relied upon as furnishing any exact data as to the frequency of psychoses and allied affections in the offspring of alcoholic parents, it is a matter of every-day observation that the number of cases of nervous instability in such families is proportionately much greater than in those in whom there has been no alcoholic habit. Epilepsy is likewise a frequent source of psychopathies in childhood. Not only are epileptic parents liable to procreate children with a tendency to periodic nerve storms, but the actual psychoses are particularly frequent at and before the age of puberty in the children of such ascendants.

The rôle of syphilis in the production of the insanities of childhood is a somewhat uncertain one. Langdon Down, and others of the English writers, as elsewhere cited, find that indications of specific troubles are comparatively rare among the idiots and imbeciles of low grade, and this statement is in agreement with my own observations. But the rule does not necessarily hold good for the higher grades of imbecility, especially of the moral types, nor for the congenitally unstable who are so prone to insanity and the grave neuroses. In fact, neurasthenia and hysteria are particularly frequent in the families of those tainted with congenital syphilis, and insistent ideas and the *folie du doute* are occasionally found. I have notes made in the present year of two cases of impulsive insanity occurring in boys of eleven and twelve years of age respectively, in whom there were distinct evidences of congenital syphilis. In another family whose grandfather acquired lues, the daughter is

now an ataxic, after having had an iritis in girlhood, and her three children all bear the indubitable marks of degeneracy in high-arched palates, defective teeth, a tendency to catarrhal complaints, and stunted mental growth with slight speech defects.

When the parents live in unhygienic surroundings, and have improper or insufficient food, although there may be no heredity the offspring is liable to be unhealthy both in body and mind, the mental development corresponding with the stunted growth of the body. Such children usually present rachitic deformities and asymmetrical heads. This condition of affairs is noticed with great frequency in the children of negro parents, who receive but scanty attention and improper food. The majority of these children have some cranial deformity, the early closure of one of the several sutures of the skull conducing to later over-development of other regions. Thus the frequent too early union of the sphenoidal and occipital bones is compensated for by protuberance of the parietal regions. or, when ossification of the posterior half of the sagittal suture occurs, by the retroprojection of the occiput, giving rise to an artificial and extreme dolichocephaly.

Next in importance to heredity are the infectious diseases. Insanity may begin at the acme of the fever and continue after the defervescence, or may occur as an indication of post-febrile inanition. The psychosis is then usually, though not invariably, of an hallucinatory-confusional type, with much motor excitement. Acute stupidity, though not unknown, is rare. Influenza, scarlet fever, typhoid fever, cerebro-spinal meningitis, measles, are important factors in the production of mental disturbances; but, of all the diseases of childhood, chorea, more frequently than any other, is the immediate cause of alienation. Whether this disorder should be considered as belonging to the infectious diseases is yet uncertain; certain it is that following it mental symptoms of a definite order are of common observation, and this is equally true of the milder as well as the severer forms of the malady. Infections with the colon bacillus should also be considered as among the possible etiological factors in insanity.

The rôle played by intestinal intoxications in the evolvement of the psychoses of early years is uncertain. That such an origin is infrequent is probable, since no mention is made of it by the writers on insanity in childhood, but, nevertheless, cases are occasionally met with in practice. I call to mind one such instance in a boy of four years, with a history of profound nervous lability, who devel-

oped intense irritability, followed by hallucinations, and later by stupor, as the result of drinking some bad milk. An emetic, followed by a brisk purge, removed the cause of offense, but the psychical disturbance did not subside entirely for more than forty-eight hours.

The direct abuse of alcohol in the form of beer or spirits is rarely responsible for loss of mental equilibrium in childhood in this country, in strong contradistinction to the frequency with which this agent is known to act as an inciting cause of insanity in the adult. In rare instances in which children have had access to alcoholic drinks, transitory attacks of excitement, or dementia, may supervene, and delirium tremens is not unknown in early life.

Traumatism and sunstroke are occasionally agents in inducing insanity. The incomplete development of the brain of the child renders the nervous system particularly susceptible to any strong traumatic influence or other profoundly disturbing factor. It is not necessary that the phenomena of deranged mental mechanism appear at once; months, even years, may elapse before they become manifest. A change of disposition, irritability, as well as the loss of the faculty for the ready reception of ideas, occurring after insolation or traumatism, are all-significant of some profound alteration of the neural tissue going on within the cranium, and the outlook for the future mental health is ominous.

Ill-usage or frights are sometimes factors in the insanity of childhood, their ill effects culminating in sharp attacks of maniacal excitement or in acute stupor. The practice of shutting children up in dark rooms in solitary confinement for trivial offenses is most reprehensible, and in no inconsiderable number of instances has resulted in a delirious outbreak, or in suicide. Children universally fear the dark; they are impulsive, and, being incapable of analytic reasoning, may seek the readiest means to end a scene that to them is intolerable; or an overpowering fear overwhelms their perturbed faculties so that they do not understand what they are doing. A wholesome discipline can be maintained in other ways than in this most cruel manner.

In children of unstable constitutions bad bringing up is often in large part responsible for the production of mental obliquities and disturbances. A neurotic, pampered, over-indulged girl, whose developing erotic tendencies are uncontrolled by healthy exercise, proper restraint, and wholesome diet, not infrequently ends by becoming a sexual pervert or an unfortunate. It is she who pays the

penalty, when in reality the parents or guardians are the ones primarily at fault, and should bear the larger half of the blame. The youthful moral imbecile, it is true, is now and then found with whom no amount of good training and careful education will avail aught, but fortunately the individuals in whom the benefit derived from such training bears fruition far outnumber these cases. The city life of the present age is to some extent responsible for fostering deflections from morality, as little children are allowed, without the presence of adults to control them, to congregate together on the open streets, not always to play innocent games, but sometimes to imbibe perverted sexual ideas from older though still youthful companions.

The faulty, high-pressure, educational methods now in vogue in our ordinary schools are responsible for a large number of the mental breakdowns noticed between the ages of ten and twelve years, as well as later. Although the actual growth of the cerebrum at this period is quite advanced, and the size of the head approaches that of the adult, the tissues themselves are far from mature, and are totally unable to cope with the undue stimulation and pressure which false educational methods lay upon them. But when, as too frequently happens, no proper steps are taken to insure to the children a sufficient quantity of fresh air and outdoor exercise, which might go far to counterbalance the continued draft upon the activity and stability of the brain tissues, the strain becomes too great to be withstood, and neurasthenia, melancholia, or even a permanent dementia, is the result. The pity is all the greater when we consider that many of these children whose nervous systems are wrecked by faulty education, although possessing an inherited taint, might have grown up to be useful men and women. Many of them are bright, and capable of acquiring profitable knowledge without injury to their nervous systems were proper educational methods devised. The fault lies in the system which would treat all children more or less alike, and would not even attempt to divide them into separate classes according to their mental ordering. Thus it happens that these unfortunates—weaklings, so far as nervous stability is concerned—at the time when the growth and constructive metabolism of their brains are at their maximum, and when a permanent equilibrium is not yet established, are taxed and pushed to the uttermost to accomplish tasks beyond their powers, until the inevitable results, which is usually beyond the possibility of repair. On another page I have cited the instance of a boy (J. B.) of strongly

alcoholic ancestry, who at the age of eight years stood at the head of his classes, and was regarded as a remarkably bright child. Under pedagogic persuasion he strained his intellect to the utmost to retain his position, and even when he began to show signs of failing was nevertheless urged on with threats and promises of reward. The boy is to-day a hopeless and helpless dement, the innocent victim of a criminal lack of understanding of the requirements of childhood on the part of his preceptors.

The natural egotism of the children often helps to bring about such results. They may not themselves desire to study, but the picture of other better-endowed boys outstripping them and leaving them behind in lower classes, together with forcing on the part of the instructors during prolonged working hours, is an incentive to mental overstrain. All children entering the primary schools should be subjected to some expert medical examination, and assigned to their various classes according to their actual grade of mental acquirements and stability. This, it must be admitted, is most difficult, but is not impossible of attainment. A well-trained physician quickly learns to accurately gauge the mental capacity of a child. Education, as at present carried on, weeds out the unstable brains from those more stable, and in this way is a recognised cause of insanity.

Masturbation in early life is another factor in the production of alienation. Few healthy children at the age of six or seven years are given to this practice, but the contrary must be affirmed for those of neurotic parentage. The drain upon the imperfectly developed system, the moral effect, the efforts at concealment, all conduce to nervous outbreaks and mental debility. One child (J. S.), who began the secret vice at the age of four years, indulged in heterosexual intercourse from her ninth year, and graduated at puberty as a paranoiac with hallucinations principally of a sexual character. Of course no system of moral education would have availed with this pronounced degenerate, and fortunately such instances are rare.

Sex has little influence in the evolution of the psychoses of childhood, the procreative system being as yet undeveloped, and the peculiar disorders incident to its rise into functional activity being impossible. As a matter of fact, however, more girls than boys become insane.

CLINICAL EXPRESSIONS OF MENTAL DISTURBANCE

Among the disorders of the functional activities of the cerebrum occurring in childhood there are several that lie on the border line between sanity and insanity. Some of them mark merely transient lapses from psychical control, others are in a measure more permanent. To the former belong the "night terrors," and the delirium incident to inflammations, accidents, and surgical operations; to the latter, imperative ideas and the *folie du doute*.

Pavor Nocturnus.—Henoch's classic description of this disorder admits of little emendation. The subjects are rickety and neurotic children with digestive disturbances. The disorder begins during the first sleep, and very often originates from a heavy meal of indigestible food. The habit once started continues through the second dentition, and sometimes longer. The child, without apparent reason, will suddenly start up in bed and scream continuously for some minutes, and then, with outstretched hands, will convulsively grasp at unseen objects. The face shows a fixed stare, the pupils are dilated, there is an anxious expression, with trembling of the limbs. When the nurse or mother comes, the child grasps her frantically, and is difficult to soothe and control. During the delirium words and broken sentences are uttered that refer to some frightful hallucination, usually, that animals, elves, or goblins are seeking to seize and injure her. In a short time the child falls asleep again, but the delirium may be repeated several times during the same night, and the dream visions and hallucinations be recalled with their previous intensity. The attacks may come on every night, but are much more apt to recur at intervals of a few days. In the morning all recollection of the events of the previous night are a blank, beyond an occasional remembrance of having had a bad dream. The likeness to the nightmare of adults is very close.

Delirium in childhood is not unusual at the height of any of the exanthemata, typhoid fever, pneumonia, or catarrhal bronchitis. The greater the lability, the greater the tendency to delirium, which may begin even with a fever of 100° or 101° F. Two forms are met with in practice. In the milder type consciousness is only disturbed to the degree that the attention wanders, speech is not quite coherent, and imaginary conversations are carried on, but hallucinations and motor agitation are not prominent features of

the disturbance. Emotional pain is not present, and when spoken to, the child replies, smiles, and seems not uncomfortable, but immediately relapses into the mild delirium. The clinical picture in the severer variety is quite different. There is now an active hallucinatory delirium, with terrors and frightful visions, as well as imprecatory voices, from which the victim seeks to escape by rushing from the bed into the arms of the nurse, or hides trembling under the bed-clothing. In addition to the hallucinatory delirium, there is excited talk, screaming, and motor restlessness. The intellectual facilities are in a profounder state of inhibition than in the ordinary delirium. The attention cannot be attracted by ordinary stimuli, such as the mother's voice, and if answers are obtained at all they are irrelevant to the question, and refer only to the vivid hallucinations. This form of delirium is seen with inflammations of the serous surfaces, after severe burns, and following traumatisms in which there has been severe crushing of the soft tissues and the after-fever has reached a high degree. As bacterial and other toxines abound in such conditions, the delirium must be referred to the presence of a poison circulating with the blood, combined with the elevated temperature, while the direct shock to the nervous system adds another not uninfluential feature.

Imperative Conceptions.—Insistent ideas and compellent motor acts are by no means uncommon in childhood. The period of the beginning development of the sexual instincts is most favourable to their evolution, but they are not unknown at six and seven years of age. Their genesis is referable to any exhausting drain upon the general system, whether it be masturbation, chorea, epileptic seizures, or simple ill health after febrile affections and catarrhal diseases. Strain from mental overwork at school in close rooms is also an important factor. Disorders of the stomach, or disturbances of intestinal digestion, predispose to their development. Furthermore, when there is an hereditary disposition to neurasthenia, hysteria, or constitutional psychoses, as paranoia, imperative conceptions may arise upon this foundation. Quite a number of the phobias, such as a morbid fear of being alone, of the dark, of crowds, or of open spaces, develop out of the natural timidity of childhood, combined with the effects upon the immature nervous organization of the tales of goblins and imps related to their charges by nurses without due consideration of their effect upon unrestrained and vivid imaginations. Others are much more difficult to account for upon the same basis, as, for instance, the tendency to coprolalia in

well-trained children. Imperative acts, such as the absolute indispensability of arranging the pillows on the bed at night in a certain way, the necessity of assuming forced positions in studying lessons, as with the foot under the buttocks, without which no task can be learned, or putting dirt and stones in the mouth, are often begun unconsciously, and by repetition acquire such force over the character that they cannot be overcome without a severe struggle for supremacy. Such acts rarely lead to fixed ideas, unless the nervous lability is profound. Imperative ideas arising from organic diseases are now and then noticed. A morbid inclination to touch or disturb objects, usually of a certain character, as articles of leather or glass, is sometimes observed. This desire occurs with great pertinacity, and the habit can only be stopped by removing the child to new surroundings where the objects are inaccessible and can soon be forgotten.

Mania.—It is improbable that an idiopathic mania, in the sense in which it is considered to exist as a clinical entity in early adult life, has ever been witnessed in childhood. It is true that motor excitement may arise at any age from infancy onward, but the combination of motor-mental hyper-activity, with the simultaneous exhibition of delusions combined with incoherence and accelerated flow of ideas, can only begin after the brain has attained to almost adult maturity—from fourteen to twenty-six years of age. Indeed, from one stand-point the illogical acts of the typical maniac, with the intense egotism and automatic speech, are a reversion to what is physiological in the first two or three years of infancy. The infant is uncontrollable by direct moral suasion; his egotism is profound; he destroys for the sense of pleasure destruction brings; his speech is disjointed, rambling, and takes the form of a soliloquy; and were incessant and violent movements constantly present the picture would be complete. In certain instances following fright we find transitory conditions of acute motor excitement of very short duration that resemble a transitory mania, but these are among psychiatrical rarities. Transitory mania is not unheard of in the literature of children's diseases, especially among the French writers, but the majority of these seizures begin in the night season, without immediate ascertainable cause, and are much more reasonably referable to post-epileptic excitement, to which in their blind unreasoning nature they bear the strongest resemblance, than to true mania.

There now only remain for consideration the post-febrile and inanition psychoses, which usually assume the same type—a halluci-

natory-confusional delirium. After chlorosis, anæmia, the inanition following typhoid fever, scarlet fever, influenza, or kindred infectious diseases, an insanity closely resembling in its clinical aspects the exhaustion psychoses of adults may arise. The children change in character, become restless, and suddenly exhibit intense irritability. Then, after hours or days, hallucinations make their appearance, and we have again the customary animals, goblins, or shadows; or perhaps the house is in flames and the little patient is to be burned alive. The anxiety by this time is intense, and the disturbances produced by the appalling visions induce a profound mental confusion, in which the most simple acts of reflection are in complete abeyance. The child strikes at any one approaching it, or seeks to rush into the street in its night-clothes, or to dash through the window to escape the impending danger. The parent or nurse is unrecognised, and control is only to be obtained by force. Auditory hallucinations seem to be infrequent. The duration of the active symptoms is from forty-eight hours to ten days, after which restitution to mental health may proceed rapidly; or there may follow a stage of depression lasting for weeks, interrupted by exhibitions of anxiety and moroseness.

The rather common occurrence of psychoses after scarlatina, and the frequency of renal implication in that disease, would suggest a relation between the accumulated products of tissue waste in the system and the insanity. The mental disorders following scarlet fever are notoriously more fatal than almost any other form of post-febrile alienation. Furthermore, after influenza or pulmonary inflammations the presence of toxines in the body in all likelihood intensifies the effects of the already existing denutrition of the brain centres. These exhaustion insanities are not usually attended by any considerable elevation of temperature.

The exact rôle played by the disease known as Sydenham's chorea in the production of insanity in childhood is uncertain. We are aware, however, that there are few examples of even mild chorea that escape mental implication, though usually the degree is not grave. The character of the child afflicted becomes changed; there are lapses in the moral sense, mendacity, perverseness, emotional outbreaks, irritability, and the constant repetition of meaningless actions. Disturbances of memory and of the faculty of attention are also common. The child apparently loses what it has previously learned; reading and writing become difficult; and the impairment of intellect may proceed to a more distinct alienation—a transient

or permanent dementia. The graver disturbances in chorea minor comprise maniacal delirium, hallucinations (Marcé, Seglas), and melancholia (Leidesdorf, Marie), the last being somewhat rare. These occur in the course of and accompany the neurosis, and when it ceases they usually also disappear. The frequency of the excited form with hallucinations is attested by the number of the cases recorded in current medical literature. While chorea is not very fatal in itself, the mental defects sequent to it are often grave and irremediable.

The combination of this hereditary degenerative neurosis and the psychosis is most suggestive. Whether the imperfect neural stability of the victims is wrought upon and destroyed by some at present unknown toxine of bacterial origin, as is probable in chorea insaniens, is uncertain, but the hallucinations, mental confusion, and subsequent dementias all favour the theory.

Melancholia.—As might be expected from the buoyant nature of the child's mind, morbid depression is a far rarer mental disease than pathological exaltation. Emminghaus, in a series of 199 mixed cases of the psychoses of childhood, could only determine twelve per cent to have had melancholic symptoms, and nearly every one of these was approaching the period of puberty. Indeed, it is only toward this age that ideas of self-sacrifice could be expected, though in younger children false religious training may lead to over-conscientiousness, and thoughts of possible failure to perform religious and other duties may obtain. These, however, cannot be regarded as types of a true melancholia. The child afflicted with the genuine form withdraws from the companionship and games of his companions, neglects his lessons, becomes introspective, loses his interest in life and in his affections, and becomes gloomy and spiritless. Actual delusions are found only in older children. Hallucinations are exceedingly rare. The delusions appertain mainly to physical conditions, the dread of bodily disease, perhaps of death. Fear of being poisoned is not uncommon, and may interfere with the taking of a proper supply of nourishment. Suicidal impulses are ever present, and should be guarded against with the most painstaking fidelity. Suicide in childhood is always premeditated, and is often effected in ways that would be unthought of by an adult.

Stuporous melancholia has been observed in a few cases. It has been known to follow fright, but more frequently some of the exanthemata are responsible for the condition. Melancholia and hallucinatory-confusional insanity are in such instances likely to be confounded.

Acute dementia has followed a severe fright, but the children in every instance recorded have been well on toward puberty. The symptoms do not differ materially from those of the corresponding forms of the disease in the adolescent.

The periodic insanities, strictly speaking, are unknown in early childhood. At the same time premonitory warnings of the disease may be early apparent. The predestined child at school may be observed to have its weeks of brightness and succeeding ones of dulness, in which what has before been learned with ease and rapidity now becomes unattainable, and previous knowledge is forgotten. In the one period we have the analogue of the maniacal stage in which everything is taken up with avidity, despatched with ease, and in which the bodily endurance is at its maximum; while the other is in a measure the counterpart of the melancholic stage, in which there is mental inhibition, with psychalgia and inaptitude for mental or physical work, accompanied by various disturbances of the alimentary system. As the years roll on, the periods of depression and exaltation become more and more marked, until the case becomes one of a well-defined type of psychosis.

The Toxic Insanities.—Except in the nephritis following scarlatina and in ergotism (the latter being almost unknown in the United States), the insanities due to poisonous substances circulating through the system by way of the blood have not been sufficiently studied. In my personal experience two cases of auto-intoxication from putrefactive changes of food in the alimentary canal have been observed, both of which had a typical hallucinatory delirium, and were promptly relieved by appropriate therapeutic measures.

General Paresis.—A form of progressive paralysis occurring in childhood, though quite rare, is not unknown. Alzheimer, in reviewing this subject in 1896, could find the records of only forty-one undoubted instances of the disease in neurological literature, but since that date quite a number of others have been added. Nearly all the cases have an ascertainable history of hereditary lues, though a few have been due to traumatic influences. Girls seem to be more frequently affected than boys, and the combination of a paretic mother and daughter is not unknown. There are also several reports of the occurrence of the disorder in two girls of the same family. The youngest patient on record was six years old, but in quite a number the disease has begun from seven to ten years of age. The form assumed is customarily that of a progressive dementia unattended by extravagant delusions.

The earliest mental symptom is loss of memory, which progresses to a dementia; the intelligence in all its aspects decreases, but there is no evolution of ambitious ideas, nor do pronounced states of excitement occur. The physical manifestations consist in muscular tremor, articulatory disturbance, mydriasis with slowly reacting pupil, or spastic myosis. Accommodation is usually retained. In a large percentage of cases the reflexes are abnormally excitable, but occasionally there is lessening of their activity. In some instances pareses of groups of muscles have been noted. The average duration of the malady is about four years. The treatment by antisyphilitic, as well as other remedies, has proved futile.

Dementia.—An ordinary mental reduction in childhood is by no means infrequent. Quite a number of instances have followed trauma, typhoid fever, and cerebro-spinal meningitis. In the examples of the last origin there are apt to be local paralyses in addition to the mental incapacity. Many of these dementias are with difficulty distinguished from the more usual forms of paralytic idiocy; and if the original disease has made its inroads upon the nervous system at a comparatively early age, it is impossible to arrive at a definite diagnosis without a previous history of the case. All these several forms are produced by direct lesion of the substance of the brain, *commotio* or direct injury, from meningitic inflammation, or the lodgment of bacilli in the more internal structures of the hemispheres. If the damage occur in the first four years of life, a small local injury is sufficient to stop the aftergrowth of the neural tissues, and put an end forever to the intellectual life —an organic dementia.

In some bright but ill-balanced children, overstrain at school is sufficient to set up a retrograde movement that only stops with the destruction of their mental vitality. Sleep and the best of nourishment seem powerless to renew the exhausted nerve protoplasm, and when the vital energy is drawn upon too severely a restoration of the integrity of the cell cannot be brought about. The defect seems to originate quite as much from an imperfect supply of arterial fluid as from a defective organization of the cortical nerve cells. The vigour of life seems to be wanting. There are but few of these cases but are lacking in some evidence of a diffuse arteriosclerosis which is perceptible to the finger if it be carefully looked for.

Epilepsy.—The mental affections accompanying this convulsive neurosis have been detailed at length in another chapter. It is only requisite to add that the majority of transient attacks of maniacal

furor seen in childhood, excepting those produced by fright, are part and parcel of the primary epilepsy, and have the same characteristics that belong to similar insults in the adults. Dementia after years of *petit* or *grand mal* is exceedingly common. The degree and quality of the mental degradation vary with each case.

Neurasthenia.—The existence of this neurosis in childhood is still denied by some European authors, as Krafft-Ebing and Charcot, though numerous examples are recited by Emminghaus, Sänger, and Arndt. In this country there can be no doubt, unfortunately, of its frequency. It is by no means unusual between the ages of ten and fourteen years, but sometimes occurs much earlier. The form to which the attention of the practitioner is most often called is the neurasthenic asthenopia prevalent among neuropathic children of about this age. The forcing upon the youth and maiden of excessive mental labour at this period, when growth is rapid and the sexual life is beginning to bud, is to no uncertain degree responsible for the larger number of these cases. Hereditary instability may and does precede it; but were no undue pressure put upon these little victims of a false civilization, they would, as a class, be able to bear up against their hereditary burdens, and owing to the beneficent healing power of Nature might not lose their nervous strength and endurance until the beginning of the natural period of involution. It is during the three decennaries of active life, from twenty to fifty years, that the propagation of the race is accomplished, and the doing away with mental overstrain in childhood would have an excellent effect on the succeeding generations of the descendants of the nerve-burdened.

The symptoms of neurasthenia before puberty do not differ very widely from those of the form that develops at a later age. The children come to the physician, pale and anæmic; they complain of being constantly tired, that they do not feel well; they do not sleep, or they dream constantly, and the character of the dreams is unpleasant. Constipation is often present, and occasionally there are symptoms of some form of dyspepsia. Manifestations of depression, an inclination to weep readily, an unwarrantable anxiety, accompanied by trembling, palpitation of the heart and vertigo, are generally pronounced. Increased excitability of the heart and irregularity of the innervation of the blood-vessels are apparent on examination. More difficult to determine are the frequent phobias, of which agoraphobia and claustrophobia are the most common. Suicidal notions now and then occur. In order to find out accurately the

nature of these complex psychical phenomena, it is necessary for the physician to win the confidence of the child, who will then tell all his woes without reserve.

Hysteria.—In the hysteria of childhood the train of symptoms is very similar to that in the adult. The disorder, though not quite so frequent as neurasthenia, is far from uncommon. Innumerable analgesias, narrowing of the visual field, and loss of the conjunctival and deglutitory reflexes have been noted. Single symptoms, as nervous tics, torticollis, blepharospasm, ptosis, or amaurosis occur. Attacks of hysterical convulsions, followed by a clouding of the senses and irritable states, are the most common mental indications. Combined hysterical and neurasthenic phenomena are also encountered. Hallucinations may occasionally attend the neurosis.

The early form of *paranoia* has already been described under that title.

Prognosis.—The outcome in the majority of the forms of insanity in childhood is favourable, provided proper attention and surroundings can be obtained. In the acute forms of mental disorder a fairly complete recovery is the customary result. One should be careful, however, in giving a favourable prognosis in the psychoses following typhoid fever, the cerebro-spinal or other forms of meningitis, as some organic brain lesion may be left behind rendering a full recovery impossible. The outlook in some cases of dementia from mental overstrain is not good, and a progressive downfall may be expected. Everything depends upon the quality of the protoplasm and the degree of defect inherited from alcoholic or psychoneurotic progenitors. The prognosis in progressive paralysis is always bad, and in epilepsy almost equally so, though exceptions are now and then noted in this latter malady. A great amelioration can be effected in the condition of the neurasthenics, provided a total change is made in their manner of life, and the influences to which they have been subjected have not rendered a recovery impossible by paralyzing the vital energy.

Therapeutics.—It is unnecessary to detail *in extenso* the treatment of the insanities arising in childhood, inasmuch as, so far as therapy is necessary, it does not differ from that of similar affections in the grown man or woman. It is obligatory, though, to write at some length of the preventive and after treatment.

Children with a psychoneurotic ancestry should have the most careful attention from their infancy up, in respect to their food, drink, exercise, education, and surroundings. No doubt this is im-

possible in the majority of instances, but under favourable circumstances a great deal may be accomplished even in families of moderate means. It is the first duty of the physician, be he general practitioner or specialist, to warn and instruct the parents in the case of any nervous child that may come under his charge, (1) of the possible results of neglect of the laws of hygiene, as well as the tendencies arising out of the hereditary psychoses; and (2) as to the proper training, educational and hygienic, for such a child. He will meet with many a rebuff, for there are none so blind as those who do not wish to see, but now and then some seed may fall on fertile soil that will bear fruit tenfold.

The diet of nerve weaklings should be given the most careful attention. It should be unstimulating, but at the same time nutritious and fattening. A layer of fat beneath the skin is a resource of untold value in times of stress, since it supplies a food reserve upon which to draw. No meat at all should be allowed very young children, and with older ones the amount should be most moderate. White meats are in some ways preferable to the red as being less stimulating. Milk is the most appropriate nourishment for the infant up to and beyond two years, perhaps with, toward the end of this time, a little malt food or wheaten bread. The milk diet in modified form holds good throughout all the rapidly growing years of childhood, as it is the best means of supplying to the body the tissue-building lime salts. Milk also holds a large proportion of fat, and, if for no other reason, would be valuable on this account. Eggs are the second most valuable animal food, and contain practically all that is necessary to nourish the body. In anæmic children the albuminate of iron contained in the yolk is of importance. In older children, in addition to these, fish and broths may be allowed, with bread and butter in abundance, and most of the vegetables and fruits. Pastry and confectionery should be sedulously avoided, as well as all condiments. Let the parents try to cultivate in their child a taste for simple, unstimulating foods, and later he will not acquire a desire to indulge in unwholesome spiced dishes. Sugar should be allowed in moderate quantities, but in neurotic children, who too frequently have a craving for meats and sweets, such a tendency should be repressed, not by denying them to the child when they are upon the table and are being partaken of by others, but by their disuse at mealtimes when he is present.

The modern practice of bolting out of our chief cereal food all the portions containing the phosphatic salts, which Nature supplies,

principally in this form, as brain and nerve builders, may be in a measure responsible for the increasing tendency to nervous breakdowns in the present generation. The superfine white flour of to-day contains little else than starch, and does not supply the kind of nourishment which might justly be demanded from the "staff of life." The growing child must have, at least part of the time, a bread containing the wheat grain in its entirety. This flour is readily obtainable, and although it does not make the pretty white, albeit innutritious, bread that the other does, is far more nourishing and strength-giving. The modern use of whole-grain breakfast dishes has many advantages and is to be commended. Bread should never be made with tartaric-acid-soda-carbonate baking powders, but only raised yeast bread should be allowed. The constant use of sodium tartrate is injurious to the system, and occasions a train of dyspeptic indications when its employment is prolonged.

Fats in the form of butter, cream, a moderate amount of salad oil, and cod-liver oil, if necessary, should always be given to the growing child. The central nervous system, as well as the peripheral nerves, contain an immense quantity of a fatty substance (the myelin) which is derived from the food supply, and fat is, accordingly, requisite to the brain growth.

Overfeed rather than underfeed any little patient threatened with a nervous affection; so long as they are gaining in weight there is little danger of the malady becoming serious. When a superabundant diet is advised, see that it is combined with plenty of exercise in the open air, and overfeeding will never do harm. See also that the food is of proper variety and of suitable quantity as well as quality, that the nitrogenous foods, while not used too sparingly, are not allowed in excessive amounts, and that due proportions of starchy substances and carbohydrates are admitted to the diet list. If we have reason to believe that the little patient is not assimilating from the food a sufficiency of phosphatic lime salts, or of the metallic salts peculiar to the red blood-corpuscle, supply their places artificially.

The drink taken by the neurotic child should be sedulously inquired into. Tea and coffee should not be allowed under twelve years of age. There are objections that apply to chocolate and cocoa, but the amounts of the alkaloids contained in them are much smaller than those found in coffee, and the objection is in a measure outweighed by the fact that the chocolate preparations are very nourishing, and are fairly readily digested when not too concen-

trated. They also contain but little tannin, and do not form an insoluble, and hence indigestible, combination with the casein of the milk.

The water supply should also be considered. A pure water is of the utmost consequence. It should not contain too great a proportion of lime and sodium salts, nor yet be entirely free from them. The quantity taken during the day should be ascertained, and if too low in amount should be increased. Most neurasthenics take too little water. Wines and beer should be avoided by the nervous child as vile poisons. Even in the form of tonics any form of alcohol is inadmissible, and as a beverage should never be touched. Its only place is as a stimulant to brace the flagging powers during and immediately after a serious illness, and then only in combination with albuminous foods over a short period.

Exercise.—All children of neurotic ancestry should be sent away from the city to live on a farm and grow up in the unpolluted air of the country, there to enjoy the pleasures of the woods and fields. Some light duties in the line of attending to the domestic animals and fowls should be assigned to them in order to afford interest and amusement. This course of treatment is often not practicable, but certainly it might be possible in some degree to save these children from the foul atmosphere and long hours of the schoolroom, and yet enable them, by proper selection, to obtain a suitable education, without forcing and pushing them until they fail mentally and physically. Two or three hours of study in the morning should be the limit, and even this amount should not always be advised in children under ten years of age. On the other hand, all healthy outdoor sports, from marbles to baseball and tennis, should be encouraged, and those children who are shy and cling to the home should be gently driven to associate with other healthy-minded companions. The arranging of this outdooring process is in a measure more difficult with girls than boys, and some difference in the daily life of the two sexes must necessarily obtain. Should the parents be well-to-do, a horse and carriage will afford a means of diversion unobtainable in any other way. Horseback exercise is excellent, but unfortunately expensive. The bicycle may replace it to a certain extent, but this form of exercise must be carefully guarded from abuse, as enthusiasm is liable to lead the young girl to overtax her strength. In the summer the seashore, or the mountains, may be visited with benefit, but the plain wholesome life and food obtainable on a large farm are far better for the

little ones than the rich viands and continual excitement of huge caravansaries.

The bedrooms of the children should be well ventilated, and even in the depth of winter a window should be left partly open to admit the fresh air. Too frequently this important matter is neglected from ignorance and fear of taking cold, whereas a plentiful supply of oxygen affords one of the best ways of doing away with the susceptibility. The bed-clothing should be warm, but not sufficiently heavy to induce perspiration.

Baths.—As a means of medical treatment suitable bathing has much to recommend it. When properly applied, water stimulates the circulation, promotes nutrition, lessens the tendency to constipation, and acts beneficially in many other ways. The kind of bath to be used must be chosen according to the requirements of each little patient. When the circulation is feeble, too great a chilling should be strictly avoided, and tepid water should be used, combined with vigorous after-rubbing. As a rule, a full tub bath, at a temperature of about 90° to 95° F., is most suitable; the addition of sea salt to the water adds greatly to its invigorating effects. Colder baths may be suited to the more robust patients. Occasional moderately cold douches, given for one minute, stimulate the circulation. The coarse towel affords the readiest means of bringing the skin to a glow, and should be employed for several minutes. After the bath a rest for an hour in bed, well covered up, should be insisted upon.

Rest.—In the nervous, weak, and debilitated, from one to two hours' rest during the early afternoon is a necessity, and during this time the body should be entirely free from any confining clothing. The lessening of the pains in the back and limbs obtained by this simple procedure is often very remarkable.

Medicines.—Drugs are best avoided, with the exception of the tissue-building ferrous, manganese, and phosphatic salts. Food medicines, as cod-liver oil, with such preparations as the glycerophosphates of lime and iron, are often needed. Many nervous children come to the physician in consequence of the attendant anæmia rather than the nervousness, and straightway begin to mend when a suitable tonic is advised. Hypnotic drugs should never be given if their use can be avoided. When, however, they cannot wholly be dispensed with, the best of all, and the one least likely to do harm, is the bromide of potassium in combination with hyoscyamus and perhaps a very little belladonna. Next in

efficiency is trional. Digestive disturbances require a suitable regimen, rather than treatment with drugs.

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ADDENDUM

I. The influence of tropical climates upon neurotic individuals.
II. Psychoses peculiar to tropical regions.

I. The Influence of the Tropics upon Neurotic Individuals

Although there are very few articles in medical literature dealing with this subject, it has long been held as an incontrovertible fact that neuroses and psychoses among Europeans and their descendants in the hot countries are frequent, and that the climate is an essential factor in their development.

The average white man who goes to reside in the Indies does not change to any material degree his manner of living. He drinks his ale, strong wines, or liquor, eats an abundance of animal food, and pursues his business avocations with a zeal and energy that is in strong contrast with the placid inertia of the native. But as a consequence of high living and high pressure, he soon becomes a victim to a more or less aggravated form of dyspepsia, and when this condition becomes chronic, the subject is afflicted further with a train of attendant nervous symptoms that may pursue him for years after he has altered his mode of life, or even until death. If the unstimulating and alcohol-free diet of the natives were followed by the Caucasian, these disturbances of bodily and mental equilibrium would be much less frequent. That the high temperature is undoubtedly also a factor of no inconsiderable importance in the production of the several maladies, might be accepted as an *a priori* fact when we consider the fairly frequent examples of insanity occurring at home in persons who, by reason of the nature of their occupations, are exposed to excessive temperatures, although the several conditions are somewhat different. In the tropics the temperature, after all, does not range so extremely high. Even in Bankok, one of the hottest places on the face of the globe, the mean temperature observed for a period of seven years (Rasch) was 83° F., with variations between 54° and 97° F., the latter point

being reached only four times during that period. Despite this fact, however, when we consider that for months there is no break worthy of mention, the thermometer varying little day or night during the summer season, and when, as an additional trying element, we have the excessive atmospheric humidity, which is rarely lower than 74, and may reach a maximum of over 82 per cent, it is hardly to be wondered at that individuals coming from temperate and drier climates find their surroundings insupportable. Constant heat, combined with constant humidity, is extremely hard to bear, and even the man of robust constitution must be considered lucky if he comes out of the trial unscathed.

Däubler and Rasch have described, as among the most frequent of the troubles that afflict the white man under these circumstances, a persistent and intractable *insomnia*. When this has lasted for any considerable length of time the individual becomes overwhelmed with sensations of utter exhaustion, and a prey to intellectual indifference as well as to an unconquerable disinclination for corporeal and mental exertion. All energy is lost; the man is no longer able to bear even the small ills of life with his accustomed equanimity; there is dulling of the intellectual faculties, weakness of memory, irritability and depression, and finally an ever-increasing excitability, sometimes culminating in explosions of open violence. Alcohol and quinine, both of which are so generally used to excess, go a long way toward emphasizing the inclination to this condition.

Other more ordinary forms of psychoses are encountered with frequency, maniacal exaltation predominating over the depressive forms. General paralysis, which is unknown among the natives of the East, is not rare in Caucasians inhabiting the tropics.

II. Psychoses Peculiar to Tropical Regions

Since so many of the noxious customs of the East have been imported into Europe and the western hemisphere, with the exception of the "running amuck" and the "sleeping sickness," mental disorders peculiar to the tropics can hardly be said to exist. It might be supposed, from the nature of the diseases, that leprosy and beri-beri would be productive of alienation, but in the works of Scheube, Rasch, Plehn, and others, references to any form of insanity accompanying or consequent to them are rarely found; indeed, Scheube explicitly says that brain manifestations are rare in beri-beri. When psychoses do occur they assume chiefly the hallucinatory-confusional form and are of short duration. The abuse of

opium, the betel nut, or hasheesh, occasion a certain number of mental troubles, but with the exception of the "running amuck" or "amucking," they are mild in form, and usually recovered from within a short time after the noxious agent has been withdrawn. None of these narcotics are nearly so deleterious as the alcoholic drinks of the West, and not one is so directly pernicious to the intellectual part of man, or causes more rapid and extensive degeneration of the neural tissues.

The *sleeping disease* is not widespread even in Africa, being confined for the most part to the west coast, though it has been occasionally met with in Abyssinia. This malady has not yet been sufficiently studied to allow of any definite statement as to its pathogenesis. The majority of cases that have been examined during life have shown the presence of *filaria perstans* in the blood, and of *ankylostoma duodenale* in the intestine. The few autopsies that have been performed have shown this form of filaria in the blood channels as well as in the tissues. Besides the parasite there have been inconstant findings of enlarged pituitary and pineal glands, as well as a swollen condition of other glands more distinctly belonging to the lymphatic system.

The disease attacks all ages. In some seasons in the Congo region villages are decimated, and even if the inhabitants flee from their homes they may carry the germs with them to develop at some later date. The duration of the malady in severe cases is from two to three months, in the milder ones it may last several years.

The disease begins insidiously in those attacked. The patients lose their energy and become somnolent, a mental disposition that increases to a lethargy. As in some forms of syphilitic brain disease, the patient may be roused for a moment from his stupor by direct stimuli, when he will reply coherently to questions, but quickly relapses into sleep. Even while eating, the victims will pause, stare into vacancy, and fall asleep with the food, half masticated, in their mouths.

In the early stages there is no malnutrition, and the temperature may be slightly elevated or subnormal. The reflexes present no change. The cervical glands are quite often enlarged.

Later on nutrition suffers profoundly, the sufferers become bedridden, localized choreic tics or convulsive movements develop, which may later assume a general character. Tetanic contraction of the muscles of the neck has been noted. Death takes place from malnutrition, or in hyperpyrexia.

The *amok* of the Malays, if it can be regarded as a disease entity, seems to be entirely confined to individuals of that race, and is perhaps the most interesting of all the mental disorders of the Orient. It never affects women. The fury is attributed by various writers to opium, hasheesh, insolation, jealousy, but not to alcohol, as this drug is shunned by the race. Epilepsy is excluded, from its infrequency among the Malays. The affected individual, without any prodromal symptoms, suddenly rushes in a state of blind rage through the streets of the village in which he is living, shouting "Amok, amok," and, brandishing his kris (the native sword), seeks to slay all persons he may encounter, without any distinction of age or sex. At the end of the period of excitement, if he is not slain meanwhile, or does not commit suicide, he falls into a state of stupor, lasting a variable time, out of which he awakens without any recollection of the events that have taken place during the paroxysm of blind fury. The duration of the entire seizure varies from a few hours to several days.

Hysteria is a fairly common neurosis among the Siamese and Tagals, but is less frequently encountered in other races. Epilepsy is rare. Paranoia and periodic insanities are among the more common forms of psychoses.

The numbers of the *insane* among the natives in Eastern Asia and the Asiatic islands, Africa, and Australia, are considerably fewer than among the Caucasians. It is, however, difficult for a foreigner to estimate accurately their actual number, since the maniacs, which form the most numerous contingent, if dangerous, are slain, the melancholiacs are allowed to follow their natural drift toward suicide and starvation, and the dements die from lack of sufficient care.

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