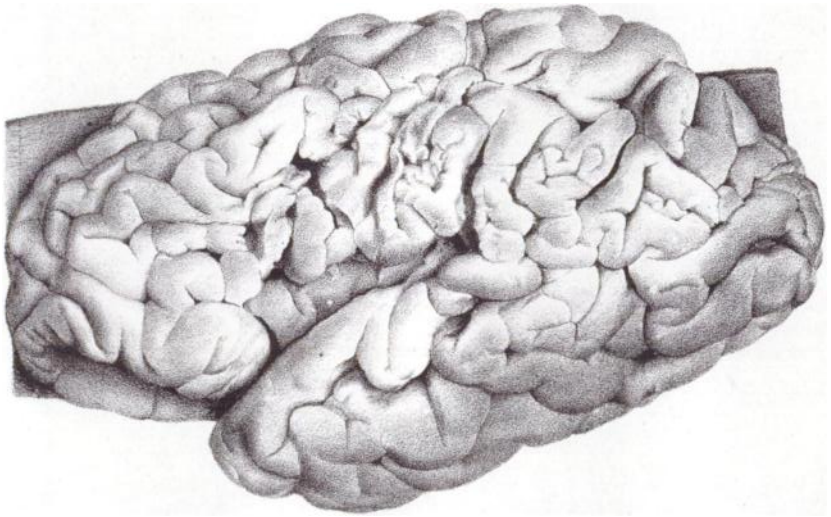
degree in nearly all, a pure case of any one variety being comparatively uncommon.

The attack of mania complicating the case is interesting. I believe the exciting cause of this was the irksome confinement in the asylum. She was a refined and over-sensitive gentlewoman, predisposed to insanity, and it seems reasonable enough to suppose that to be ordered about and controlled by nurses might have this effect. It is to be noted that when relieved of this confinement and control the acute symptoms abated.

Perhaps the maniacal attack was a fortunate complication, and led to the ultimate recovery of the patient from the chronic insanity. In delusional insanity there is probably an anæmic condition of the cerebral cortex generally, with ill-nourished cells in the sensory centres, lessened activity, and disturbed relations with the other centres. A diseased habit of cell nutrition is set up with irregularity of cell development. The acute maniacal attack takes place. Relaxation of the blood vessels and hyperæmia of the cortex occur with increased activity of cell nutrition and development, and when the acute symptoms subside the centres are left in a condition more nearly approaching the normal. The diseased habit has been, in short, changed by the stimulation of the cells affected. The same thing would probably have occurred had the patient been attacked by an idiopathic fever.

Post-Mortem Appearances (some of which were difficult to explain) of certain parts of the Nervous System in a Case of Spastic Hemiplegia. By Edwin Goodall, M.D.Lond., B.S., M.R.C.P., Pathologist and Assist. Med. Officer, West Riding Asylum, Wakefield. (With Plate.)

J. R., æt. 26. Diagnosis of mental state—idiocy. Degraded in habits, and of low degree of intelligence. He could appreciate simple orders, and express assent and dissent: speech possessed up to this amount only. The clinical notes of the physical state are unfortunately scanty. They are as follows:—Right arm generally smaller than its fellow, and wasting is more evident in certain places. The forearm forms an acute angle with the upper arm, the flexor muscles being rigid and prominent; passive extension possible only to the extent of a few inches. Muscles of upper arm evidently wasted, but those of the forearm and hand are notably so. The entire limb is held in close contact with the chest; passive abduction to a limited degree is



West, Newman lith.

To illustrate Dr Goodall's case.

possible. The forearm is held across the chest, with the hand flexed. The fingers, too, are bent upon the palm and thumb, are compressed, and folded on each other, so that the hand forms a cone. Patient could not use the hand for any purpose, though he could offer some slight resistance to attempts to abduct the arm. When the limb was pricked he showed signs of pain.

The right leg was much less affected. It was held stiffly and in somewhat everted position. In walking very little movement took place at the knee, the limb was dragged along with the inner margin of foot scraping the ground. A limited degree of flexion at the knee joint was possible when patient lay in bed; he was found at times with the limb slightly bent. Progression took place in jerky fashion, the left side doing the major part of work. The whole of right lower limb was wasted, as compared with its fellow.

Sight, hearing, sensibility of skin of face unaffected. Movements of eyes, of tongue, and of face unaffected. Sides of face symmetrical.

Death resulted from phthisis. At the necropsy no morbid changes were discovered in the bones of the skull or in the meninges of the brain. Such opacity as existed in the lepto-meninges—along the course of veins—was present in the same degree on the two sides. No unilateral changes were observed in the pia and arachnoid, such as are sometimes noticeable over a shrunken hemisphere. The pia was removed with customary trouble, no adhesions met with. After its removal the diseased state of the *left* hemisphere was apparent; as a whole, it was smaller than its fellow, and there was marked atrophy of certain convolutions, attention being particularly drawn to the state of the ascending frontal and ascending parietal, some of the features of which are illustrated by the accompanying photograph. In addition to the atrophied condition therein shown, the diseased parts exhibited notable pallor and (on section) density, and resembled gristle in consistence. The highest part of the ascending frontal gyrus preserved the normal size and shape, as did that part of the paracentral lobule (not exhibited in the photograph) which is formed by this gyrus. It may be added that, on examination with the microscope, the groups of "motor" cells—with their individual constituents—were found to be well-developed in this macroscopically-normal portion of the ascending frontal. In the corresponding part of the ascending parietal convolution, disease was evident; the naked eye noted diminution in size, and microscopically the morbid alterations of structure presently to be described were seen.

Taken in connection with the clinical observation—that a considerable amount of movement was possible in the right leg—the state of the cortical centre for this limb is of interest.

Those parts of the central gyri which correspond to the cortical centre for the arm, were found to be notably atrophied (middle third in each); and the ascending parietal displayed, on transverse section, a central channel surrounded by a thin wall of sclerosed tissue—the

original grey matter. The clinical note of the state of the right arm may here be recalled, almost complete powerlessness, with rigidity and atrophy.

In connection with the considerable amount of impairment of articulate speech, the sclerosed and atrophied state of the third frontal gyrus in its posterior part is noteworthy.

The transverse measurements of the sections of the left central gyri at their most diseased parts were, asc. frontal 4·5 mm., asc. parietal 3 mm. On the right side measurements at corresponding sites were, asc. frontal 9·5 mm., asc. parietal 6·5 mm.

Weight of whole brain (without membranes), 758 grms.; right hemisphere, 315 grms.; left hemisphere, 275 grms.; cerebellum, 145 grms; pons and medulla, 22 grms.

The right hemisphere was small, but the convolutions, though below average size, were normal.

No inequality between the right and left halves of the pons; pyramids of medulla also equal.

The brain, spinal cord, and certain nerves from the right limbs (median and ulnar in arm and at wrist, posterior tibial at ankle) were hardened in bichromate of potash.

Peripheral nerves.—A number of transverse sections from these were stained, first in aniline blue-black, and then in logwood, the former stain picking out the axis-cylinders, and the latter the connective-tissue nuclei. Examination of these sections under a low power showed a marked degree of lateral compression of the entire nerve with its individual fasciculi. Instead of rounded bundles, all sorts of oval and angular ones appear. Epi-and peri-neurium are considerably increased in thickness, the perineurial sheath being plicated. Nuclei are plentifully distributed. There is marked inequality of staining of the connective tissue of different bundles; in some, too, axis-cylinders are well stained, whilst in others only c.t. nuclei, with faint yellow spots indicating nerves, are visible. The amount of c.t. is very striking; instead of a collection of round nerve fibres, supported by a delicate framework, the field shows a mass of c.t., in comparison with which the nerve-element is quite insignificant. Although the nerve-fibres are greatly reduced in size, many of them retain axis-cylinders. Sections stained by the Weigert-Pal method and examined with a low power show well the degree in which the nerve-tubules are diseased. In some fasciculi these are indicated by well-marked—though small—oval rings of dark-brown or black tint; the nerve-fibres, though compressed, are yet distinct. In other bundles only a few of such comparatively healthy nerves are seen, a large part of the space within the perineurium showing merely scattered traces of nerve-fibres of the faintest yellow colour, scarcely distinguishable from the light yellow ground substance. In other fasciculi, again, no dark rings occur, and even faint yellow ones are few in number, the eye encountering a field of yellow ground substance. (These specimens

were compared with the corresponding ones, stained with aniline and logwood, in order to check the results obtained by the Weigert-Pal method).

In sections stained with aniline and logwood examined under a high power, the most striking features are the shrunken and diseased nerve-fibres and the altered endoneurium. The fibres least diseased show curious shapes (lozenge, spindle, pear, and simple oval), and are much reduced in size, but their axis-cylinders are distinct, and these, surrounded by the yellow-tinted medulla, form prominent objects. The most diseased fibres, however, are mere relics of nerve-tissue; they are no longer compact bodies, but present themselves as parti-coloured collections of granules, lying between their healthier fellows. The yellow tint of the former fibre is mixed with blue, from imbibition of the stain by diseased tissue. In many fibres of fair size no indication of axis-cylinder is appreciable. Those adjoining the perineurium show extreme degrees of lateral compression. These various structures are scattered in a homogeneous (slate-coloured) ground substance, the appearance of which is very suggestive of the uniform matrix of hyaline cartilage * Strongly-marked bands of fibrous tissue pass in from the periphery of the bundle in places, obscuring and doubtless compressing the nerve-fibres.

As regards the blood-vessels, measurement showed that the thickness of their walls was much above the average in healthy specimens; and the nuclei of the muscular coat were very considerably increased in number.

In the Weigert-Pal specimens—examined under the same power—the rings which appear oval under a low power are seen to be irregular in shape (as just described). Some extremely small rings (nerve-fibres) are seen, and the relics of nerve-tissue above mentioned appear strewn about the field as brownish-yellow granules. Certain fasciculi present a striking appearance, showing, in one part of their area, sharply defined, black rings, and elsewhere faint yellow ones, which, at the borders and extremities of the oval (compressed) bundle, give way to granules scarcely distinguishable from the ground substance. Apart from the corroboration afforded by the other stains, it would seem quite impossible that such appearances, repeated in numerous specimens, should be due to anything but advanced disease of the medullary sheath.

Longitudinal sections of the nerves showed (*a*) increase of epi-and peri-neurium, (*b*) irregular staining, some fasciculi staining well, others badly, and parts of the same fasciculus exhibited these variations, (*c*) nerve-fibres diminished in size, (*d*) plentiful and irregular distribution of nuclei. In places it is impossible to make out the

* In a paper in "Archiv. f. Psych. u. Nervenkrankheiten," xxi. Band, 2 Heft, Dr. A. Adamkiewicz figures nerves the roots of which had been compressed by the organized exudation of pachymeningitis hypertrophica. In these similar alterations of endo-neurium and nerve-fibre had occurred.

individual nerve-fibres, their borders being blurred and ill-defined, and the structures themselves having a faded appearance. With the Weigert-Pal method the shrunken and poorly-stained fibres can be followed a considerable distance; those immediately beneath the perineurium are especially diseased, being shrivelled and of a faint yellow tint.

It may be added that these morbid appearances are pronounced in the nerves from the upper limb particularly, in the posterior tibial the changes are less advanced.

Transverse measurements of fibres of a healthy nerve in two diameters, at right angles to each other (in a large number of instances), 11, 13 and 15 μ.

Similar measurements of diseased nerve-fibres, 7-12 μ length, 3 μ breadth, and the length is in many below the figures given.

Spinal cord.—On naked-eye examination of hardened pieces from various regions, no changes in the crossed pyramidal tract were detected. Sections were taken from cervical, dorsal, and lumbar districts—several from each—examined and compared with healthy sections. No asymmetry was observed in any, measurements with a millimeter rule giving equal results on the two sides. Naked-eye examination of the sections failed to reveal inequalities of staining (increased staining with aniline, or want of staining with Weigert-Pal) in the lateral columns. Microscopical examination failed to show any increase of connective tissue, loss or atrophy of nerve-fibres, disease of nerve-cells, vascular alterations, or, in fact, any lesion whatsoever. The crossed pyramidal tract in the cervical enlargement was particularly examined, with the negative result stated; it could not even be determined that a greater number of small nerve-fibres was present on one side than on the other (the results were confirmed by an independent observer). The granular ("fatty") bodies occurring in early stages of sclerosis could not be seen here.

A series of vertical transverse sections, stained with aniline blue-black and Weigert-Pal, failed to show any evidence of disease, the naked eye could detect no inequalities in staining or in shape of corresponding parts, and the microscopical appearances on one side of the cord were, so far as could be judged, similar to those on the other. There was no proof of increase of c.t. or atrophy of nerve-fibre in the lateral tracts, no noteworthy disparity in numbers of cells in the grey matter of the two sides; the cells appeared normal (comparison with similar longitudinal sections from a healthy cord was made).

Medulla.—With regard to the pyramids, a difference in size and amount of fibres on the two sides is first appreciable in sections cut from the portion of bulb which lies above the upper pyramidal decussation (decussatio lemnisci). Both in specimens stained with aniline and those double-stained (Weigert-Pal—alum-carmine), the nerve-fibres appear to be more scanty in the left pyramid. Under a high power more minute fibres are seen on the left than on the right side,

and connective tissue nuclei—as brought out by alum-carmine—are in stronger evidence on the former side. But these differences are by no means pronounced, and it is clear that the changes in the left pyramid are slight.

Pons.—The pyramidal bundles were carefully examined, and found to be more scanty on left than on right side. With a low power fewer nerve-fibres appear on the former side than on the latter, and the high power shows that connective tissue is more plentiful between the fibres on the left, and that these fibres are smaller than those of the opposite side. The differences were apparent only on scrutiny, and were exceedingly slight, viewed in the light of the clinical facts. The pons itself was below the average size (though equally proportioned); the individual fibres were smaller than those of an adult pons, hence the differences were the less striking.

The nuclei of the cranial nerves were found to be healthy (in medulla and pons); fillet and post. longitudinal bundle also normal on each side.

Crus.—There is an unequivocal difference between the crura. On examining the middle third (pyramidal tract) it is found that in this part on the left side—in comparison with the right—the number of nerve-fibres is diminished, and particularly that the remaining fibres are small. The connective tissue between the fibres is increased in amount on the left side, and here a large number of "amyloid" bodies is apparent. No "granular" bodies were seen.

Internal capsule.—On examining those parts of the capsule which transmit the upward continuation of the pyramidal fibres, differences are observed between the regions of left and right side, analogous to those obtaining in the case of the crura. Whereas transverse sections of the right capsule (aniline) exhibit closely-packed nerve-fibres in the pyramidal tract, those of the left show, in the corresponding part, an excess of intermediate supporting material, which everywhere separates the fibres from each other; to this the deep blue tint which strikes the eye is due. In certain portions of the affected area no nerve-fibres at all are visible. "Amyloid" bodies are not so much in evidence as in the corresponding crus; no fat granules are to be seen, such as have been described in cases of degeneration of the motor tract. The Weigert-Pal stain gave unreliable results, especially when sections treated with it were submitted to the high powers of the microscope. Even in the right capsule nerve-fibres were unequally stained, such variations being observed as are noticeable in the fibres of healthy peripheral nerves stained in a similar way. No minute comparison between left and right sides could be instituted by aid of this stain; only so much was ascertained under the low power, that, on the left side, processes, of faint yellow colour (*i.e.*, connective tissue) jutted out from the outer limit of the capsule and projected into the pyramidal tract, an observation which corroborated, so far as it went, the more exact results of inquiry by means of aniline blue-black.

Convolutions of motor area, left side.—A great number of sections were taken from frozen brain, and stained with aniline blue-black.

The *outermost* layer of the cortex presents an excess of deeply-stained connective-tissue elements. Instead of a delicate, pale zone with few cells, this layer has a blue appearance, and the cells are densely packed together: the unusual depth of colouration is largely due to the abnormal degree in which the homogeneous matrix is stained. The predominant c.t. cell belongs to the smaller of the two kinds described ;* the larger, flask-shaped element is by no means prominent. Skirting the entire convolution is a belt of condensed tissue of deep blue colour, in which no structure is to be made out beyond indications of fibrillation here and there. The vessels in this layer show no peculiarity.

In the *second* and *third* layers the small, round c.t. cell is again prominent to the comparative exclusion of the angular nerve-cell. The delicate upward prolongations of the pyramidal cells—so numerous in healthy specimens—are here exceedingly rare. The nerve-cells are few in number and stunted, with scanty and shortened processes, and such cells as are present show abnormality of staining; the nucleus is not sharply defined, as in health, but appears almost insensibly to blend with the surrounding protoplasm. The neuroglia matrix is throughout these layers—as, indeed, throughout the cortex—much too deeply stained, and clumps of tissue are here and there visible which are still more deeply coloured. Since the sections were of average thickness, and the staining process lasted the customary time, the uncommon depth of staining must have been due to disease, a conclusion amply borne out by the appearance of individual elements of the specimens.

Fourth layer.—The average size of a considerable number of motor cells on the left side (mostly contained in sections from the ascending frontal gyrus) was 48 μ × 24 μ. On the right side the average size of an equal number was 59 μ × 32 μ. The average on left (diseased) side is greater than the lowest limit assigned to the motor cells in health (30 μ × 12 μ, Bevan Lewis), though the average length of the diseased cells is much less than that of healthy ones—60 μ. But the diminution in number and the deformity of these cells are here more striking than the diminution in size. In some sections from 3-6 cells only are available for measurement, and even when comparatively numerous they are stunted and misshapen, and their primary processes are shortened or altogether absent, the cells then appearing as more or less rounded bodies. Scarcely any of them exhibit lateral processes.

Fifth layer.—But little remains of the cell-formation peculiar to this layer; an occasional spindle or tri-radiate cell meets the eye, but these rare specimens are almost lost in the wealth of round c.t. elements. In many sections a separate spindle-cell layer can no longer with propriety be spoken of.

* Bevan Lewis.

On examining the central cone of medulla and the region immediately beneath the cortex, one sees a homogeneous ground-substance of deep blue colour, and great numbers of small round cells, instead of the scattered round and flask-shaped cells, the vessels and fibrillæ, and the faintly-coloured matrix of the healthy specimen. The paucity of vessels in the diseased parts (grey and white matter alike) should be mentioned.

To summarize the appearances in the cortex, examined by the fresh method, there is atrophy of nerve-cells and overgrowth of c.t. cells; in some specimens—especially from asc. parietal gyrus—the morbid state is so advanced that were it not for the presence of a few pyramidal cells, which, though deformed, yet give evidence of being nerve-cells, there would remain no proof of the real nature of the tissue.

Central convolutions, right side.—In fresh sections obtained from these parts the proper structure of the cortex was fairly evident, though imperfections could easily be detected; in the brain of an idiot it could scarcely be otherwise. The cortical layers could clearly be distinguished, although their individual elements were, in comparison with perfect specimens, scanty and small. This observation did not, however, apply to the case of the motor-cell layer, the elements of which—as is evident from the average stated—were well-developed. The cell-groups, in fact, were numerous, and the cells of fair size, with well-formed processes. In the outermost layer of the cortex spider-elements were unduly large and prominent.

These results, obtained by the fresh method, were compared with and supplemented by others got from examination of sections from the hardened brain, which were stained with aniline and Weigert-Pal respectively. The former sections show that diminution in size and number of the axis-cylinder processes in the central cone of medulla is very marked on the left as compared with the right side. More vessels are seen in sections from the left side than were apparent in similar sections in the fresh state. Corrugating action of hardening reagents may explain the difference, as a result of which the cells of connective-tissue are diminished in size and number; hence more capillaries come into view. On the right side, where no excess of c.t. cells existed, and where, therefore, the shrinking action of reagents has not had such scope, the difference between fresh and hardened specimens, in respect of wealth of vessels, is less marked. In general, much less information is obtainable from the hardened than from the fresh sections. With the Weigert-Pal stain marked differences are again visible between the convolutions of right and left sides. Disease of the left is strikingly shown by the state of the medullated fibres in the central white matter: they are shrunken and scanty, being separated also by tracts of unstained connective-tissue. The sheaves of fibres which radiate outwards into the cortex are, on this side, few and small, and the intra-cortical meshwork is in great measure destroyed.

Returning for a moment to the fresh sections, each, from the ascending parietal gyrus of the left side, exhibited a small hole at the base of the grey matter (the section of the channel which was described as traversing the length of the gyrus). Microscopically, this aperture was found to be bounded by dense connective-tissue, and on the outskirts of the band so formed numerous spider-cells were found. The function of the part must necessarily have been seriously damaged by this loss of tissue.

These morbid appearances of the motor area of the left hemisphere and the peripheral nerves of the right side have been described in some detail because, in view of them, the (apparently) normal state of the spinal cord is of much interest.

In connection with the observations made in this case it will be seasonable to refer to a paper in "Brain," Vol. ix.,* in which the relationship between the cortex of the brain and the lateral pyramidal tracts is dwelt upon. It appears from this article that the common assumption—that "the motor area of the cortex coincides with the 'cord-area,' *i.e.*, with the area of cortex destruction of which causes degeneration in the cord"—is not altogether justifiable. Sherrington has, in fact, found that a lesion lying behind the "motor area" of the best authorities causes degeneration in the lateral pyramidal tract, and he and Langley came to the tentative conclusion that the cord-area stretched further posteriorly than the described motor area. Now, in the case under notice, disease existed at the two ends of the nervous system, in the cortex and peripheral nerves, but the connecting tract in the cord was apparently unaffected. The loss of power in the limbs was due to disease of the motor area of cortex: the wasting of limbs to disuse. How is the apparently intact state of the cord to be explained? May we not assume that it was due to the influence of the cord area of the cortex, which remained unaffected, or in large measure so?

A case permitting of comparison with the present one is quoted in an article in "Brain," Vol. ix.† It affords an instance of disease at centre and periphery co-existent with integrity of the intermediate connecting tract. Whilst the muscles showed extensive degeneration, and the anterior cornua of the cord were diminished in size and contained

* Recent observations on degeneration and on nerve-tracts in the spinal cord. A critical account by J. N. Langley, F.R.S.

† J. A. Ormerod. "Amyotrophic Lateral Sclerosis."

atrophied nerve-cells, the nerve-trunks "showed no well-marked pathological change."

But in the present unsettled state of our knowledge of the course of the motor-fibres in the cord speculation of a different order may be permissible. The fibres of each pyramid of the medulla may proceed to their destination not only by way of the direct pyramidal tract of the same and the lateral pyramidal tract of the opposite side, but also through the direct tract of the opposite and the lateral tract of the same side; and they may favour a particular tract or tracts; possibly may be distributed amongst the four tracts, proceeding to their termination by way of cross-connections. One might, therefore, in seeking an explanation of the present case, entertain the supposition that the nerve-fibres connected with the affected limbs, being scattered in the manner suggested, failed, though individually shrunken, to attract that attention which would have been drawn to them had they been collected together in a single tract of the cord.

OCCASIONAL NOTES OF THE QUARTER.

Koch's Lymph as a cause of Mental Disorder.

In a special number of the "Berliner Klin. Wochenschrift" is the report of a contribution to the discussion on Koch's treatment by Prof. Jolly, the well-known alienist, who has succeeded Prof. Westphal at the Charité. Prof. Jolly's contribution is on the development of certain psychoses as an after-effect of the injections by Koch's method. We feel inclined to exclaim "Et tu Jolly!" for of all recent impeachments of the "cure" surely this was the least to be expected. Prof. Jolly must, however, be read, for we shall then find that what he says is, in all respects, most reasonable, and that his statement may be said to amount to an impeachment of some degree of seriousness. He first points out the well-established fact that pyrexia does not affect the mind, during its presence only, in the form of the delirium of fever, but that any and every kind of fever is liable to be followed by certain psychoses. He then states that it was most reasonable to expect that the fever artificially excited by Koch's method would not prove an exception to this rule, and proceeds to detail three cases in which as a sequel to the injections a definite insanity arose.