Experiment 9.—Female, aged 35, very well developed. Right sciatic : 160 lbs.; detached from the spinal cord in less than a minute. The left sciatic could not be tested at the time.

In all these cases, the experiments were performed from one to three days after death. In applying the weights, an amount rather less than it was considered probable would be needed to rupture the nerve was first attached to the hook; and then, with the help of assistants, small weights were rapidly added until the nerve gave way. Excluding Experiment 4, all the subjects were adults; and in these, the average weight required to rupture the nerve was 140¾ lbs. In Experiment 1, the nerve gave way with an exceptionally small force—viz., 100 lbs.; but, in the other two male subjects (Experiments 5 and 8), the average weight required was 164½ lbs. On an average, a loop of the great sciatic would, I think, bear for a short time nearly the entire weight of the body.

Even more interesting than the amount required to rupture the nerve, was the position at which it gave way. Out of the fourteen cases in the table, six broke at or near the point where the hook was applied. In the other eight cases, the nerve itself did not break; but its connections with the spinal cord and its membranes were detached. All the specimens thus obtained presented essentially the same appearance, and consisted of the nerve-roots of the last lumbar and first and second sacral nerves. These were torn at the point where they joined the spinal cord. Tracing these nerve-roots downwards to the dura mater, a small portion of this membrane was found connected with each pair of spinal nerve-roots, a short time before the latter joined. The dura mater, in fact, was torn near the point where it is prolonged from the main sheath on to each nerve. Then, the anterior primary divisions of the last lumbar, and two upper sacral nerves, could be traced down to the point where they become continuous with the great sciatic. The branch from the fourth lumbar, to join with the fifth to form the lumbosacral cord, was always present. The posterior primary divisions, and other small branches, were broken near their origin.

REMARKS.—The experiments detailed above were not published at the time the paper was read, as I intended, before doing so, to conduct a more extensive and carefully planned series of experiments. Circumstances have hitherto prevented me from working much further at the subject. As, however, the operation of nerve-stretching is now becoming a comparatively common one, both for central and for peripheral nervous affections; and as I believe the results I obtained may prove, not merely useful to the surgeon, by affording him some guide to the amount of force he may safely apply, but also because I think they have a value in connection with the question of nerve-stretching in central lesions, I venture to lay them before the profession.

My experiments clearly show, that the great sciatic nerve is able to withstand a considerable strain; but they also indicate the necessity for caution; more especially in the downward traction of the nerve. I have several times attempted to break this nerve in the dead subject, but have invariably failed, although the nerve was greatly stretched, and I sometimes heard suspicious crackling noises. The suggestion of Dr. John Cavafy, in the JOURNAL (December 17th, 1881), that surgeons should come to some more definite idea of the amount of force employed, should certainly be acted upon. There are several points in connection with the operation of nerve-stretching, which have not apparently been sufficiently considered. If a nerve, such as the great sciatic, having an almost direct origin from the spinal cord, be pulled downwards, an anatomical examination will show at once that almost the entire strain is borne by the dura mater. If the vertebral canal be opened from behind, so as to expose the spinal dura mater, and at the same time the great sciatic be stretched, a slight downward movement of the lower part of the dura mater is at once visible. By careful measurement, however, I find that it is not displaced more than an eighth of an inch. The dura mater possesses very little extensibility; and, further, the nerve-roots piercing it nearly opposite the intervertebral foramina, the stretching of the great sciatic rather tends to displace the dura mater laterally. Even a cursory examination will at once show that this cannot occur to any appreciable extent. If the dura mater be opened in the lumbar region, and the roots examined, it will be evident that the slight displacement produced by the stretching of the dura mater can have no appreciable effect in increasing their tension, and thus enabling them to act directly upon the spinal cord. The dura mater thus serves as a very efficient protector of the delicate spinal nerve-roots; but, should it be torn, an extremely small force would suffice to detach them from the spinal cord. It therefore appears evident that stretching a nerve, such as the great sciatic, produces no direct mechanical action upon the spinal cord. Stretching a nerve less directly connected with the spinal cord, such as the median, is still less likely to affect directly the spinal cord; and, of course, there is no danger, in case of rupture, of its being detached from the cord. In the few experiments I have

made upon this nerve, it always broke at the point where the force was applied.

The manner in which a beneficial effect is produced by the operation of nerve-stretching is very obscure. In some cases of sciatica, it may be due to the breaking up of adhesions, etc., pressing injuriously upon the nerve. In cases of central lesions, it probably acts upon the same general plan as other counter-irritants.

There is abundant clinical evidence to show, as one would expect, that the operation of nerve-stretching produces a powerful local action—not unfrequently being followed by temporary paralysis. Then, again, it produces a marked effect upon distant nerve-centres, such as the respiratory and cardiac, as is shown in Langenbuch's cases. As a counter-irritant, it stimulates, not merely the nerve, but also its connecting trunk and branches.

In the operation, many surgeons attach special importance to the downward traction of the nerve—apparently believing that, by this means, they produce some direct mechanical action upon the spinal cord. This appears to me, as I have before stated, to be an erroneous idea: the nerve-fibres, as far up as the dura mater, being put upon the stretch, but not the spinal nerve-roots beyond.

Dr. John Cavafy, in the BRITISH MEDICAL JOURNAL (December 17th, 1881, page 974), objects to the "nerve-stretcher" of M. Gillette, partly on the ground "that the extension must affect the peripheral and central portions of the nerve itself." If my view be correct, this is rather an advantage than otherwise, as a longer tract of nerve-fibres is thus stimulated. Furthermore, by stretching a loop of the nerve, the force is divided between the peripheral and central ends—so that there is less liability to rupture. Traction upon the peripheral end of the nerve can be employed with more safety than upon the central end, the former being the stronger; and the nervous stimulation would probably be as great, if not greater.

CASES BEARING ON CEREBRAL LOCALISATION.

By JAMES SHAW, M.D.,

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CASE 1. *Idiocy with Congenital Aphasia, Dextral Hemiplegia, and Contracture and Atrophy of Right Limbs. Destructive Lesion and Atrophy of Left Cerebral Hemisphere.*—H. C., admitted April 21st, 1879, aged 10, was described, in the statement appended to the "order for admission", as an epileptic whose insanity was congenital. The "medical certificate" stated that he was quite incoherent and unintelligible; dirty and destructive in his habits; idiotic in appearance and manner; easily excited, when he tore his skin with his nails.

On April 24th, he was observed to be a deformed lad. He squinted slightly inwardly with the right eye. The right side was chiefly affected, both arm and leg being as stiff as if the joints were ankylosed. He had an idiotic expression of countenance, and did not seem to have any intellect; and was very wet and dirty in his habits. He had had several fits since admission. His appetite was good, and he was fairly nourished. July 22nd. He had a prolonged attack of syncope after an epileptic seizure a few days ago. The fits increased in frequency and severity. The condition on February 22nd, 1880, was as follows. His chest was deformed, narrow, and projecting; his head very large, twenty-three inches in circumference, and of the hydrocephalic conformation. He knew those about him, took notice of them, and evinced a considerable amount of jealousy, joy, grief, anger, etc. On February 23rd, 1881, his right arm was paralysed and contracted; the elbow bent and stiff; the hand bent back on the arm; the wrist stiff; the fingers were flexed on the palm of the hand. The right leg was paralysed and contracted, and strongly flexed at the knee-joint. The ankle was stiff, and the sole of the foot turned in. The right arm was atrophied; the right leg also, but not so much. He moved the left arm, hand, and fingers freely. He moved the left leg, and could stand when supported on the right side. He displayed some pleasure by his facial expression when spoken to, and screamed when annoyed, but had never been known to utter any articulate sound. On March 1st, he was paler and thinner and did not take food well. On March 10th and 11th, he had a series of severe and prolonged epileptic seizures, in which the convulsions were bilateral, and the eyes turned upwards and to the left. He died March 12th, 1881.

Necropsy.—An abnormally large quantity of serous fluid was found in the cranial cavity. The right lateral ventricle was greatly dilated. A gelatinous-looking mass was found attached to the left cerebral hemisphere laterally and inferiorly; this proved to be an enormous cyst containing serous fluid. The convolutions of the region over which the cyst was situated were completely destroyed, and the portion of the centrum ovale underneath was represented by a thin lamina, in

some places translucent. The missing convolutions were: the posterior half of the second frontal, the greater part of the third frontal (the orbital portions of the convolutions being intact), the inferior halves of the two ascending convolutions, the supramarginal and angular gyri, the whole of the first and second temporal, the convolutions of the island of Reil, and most of the external surface of the occipital lobe. The left central ganglia were atrophied. There was secondary degeneration of the left cerebral peduncle, and of the left half of the pons Varolii and medulla oblongata. The middle portion of the peduncle was very much flattened in comparison with the same part of the right peduncle. The pons Varolii was asymmetrical, and very much smaller on the left side. The left pyramid, viewed superficially from before, was hardly a third of the right in breadth. The medulla oblongata was asymmetrical, on section through the middle of the olivary bodies. The prominence formed normally by the pyramid being absent on the left side; the restiform body was apparently slightly more massive on the left than on the right side. The right cerebral hemisphere was very large proportionately to the dilated lateral ventricle, but apparently normal as to membranes, convolutions, and cortex. The weight of the different portions of the encephalon, free from membranes, is as follows:

Left hemisphere of cerebrum	...	...	2,830 grains.
Right "	...	...	8,074 "
Left half of cerebellum	...	...	996 "
Right "	...	...	750 "
Pons and medulla	...	...	248 "

Total weight of brain ... 12,898 "

REMARKS.—In this case, the lesions were too extensive to throw any light on the localisation of the centres for individual members, or on the exact limits of the motor area; yet it is perhaps worth recording, as tending at least to support the theory of the cross action of the cerebral hemispheres through the pons and medulla, and of the localisation of motor centres for the limbs of each side in the opposite half of the brain, especially as Dr. Brown-Séquard insists on the rejection of these generally received views. The third left frontal, or Broca's convolution, was almost completely destroyed, and the faculty of speech was absent. The aphasia was not the *aphasie d'hébetude* of M. Jaccoud, as the patient, for some months before his death, displayed a considerable amount of intelligence, with powers of perception, attention, and memory superior to those of many idiots capable of articulating.

The only abnormality observed in the muscular movements of the neck, face, eyes, mouth, or tongue, was the slight internal strabismus of the right eye; there may have been slight differences in the two sides which passed unnoticed. It is also possible that the muscles of one side in this region being influenced more by those of the opposite side than a left limb by a right, or a right by a left, the motor centres in the right hemisphere more readily acquire the functions of those destroyed in the left half of the brain. He could see, hear, feel, and taste fairly well, but the comparative acuteness of the special senses on the two sides was not investigated, nor was the cutaneous sensibility tested.

With regard to the cerebellum, the right and left hemispheres were to each other almost exactly as three to four (750 grains and 996 grains). Were the functions of the cerebellum purely motor, and limited to the muscles of the same side of the body, the difference should be much greater, as there was an entire absence of movement in the right arm and right leg, and therefore no co-ordination required in those members. For the same reason, this case does not seem to support the view of Dr. Charlton Bastian, that it is a "supreme organ for the reinforcement and regulative distribution of outgoing currents." On the other hand, the patient could maintain himself in the sitting posture in a chair, except when he was seized with an epileptic fit. The case, therefore, seems to support Dr. Ferrier's theory, that the cerebellum is an organ of equilibration.

CASE II. *Dementia with Sinistral Hemiplegia and Contracture: Lesion of Right Ascending Convolution at their Upper Extremities, and of Base of Superior Frontal Convolution.*—E. O., a housewife, aged 50, was admitted on September 4th, 1879, in very feeble physical health, affected with heart-disease, and suffering from dementia. No previous history could be obtained; and the statement appended to the order for admission afforded no information as to duration, cause, etc.

The medical certificate stated her to be incoherent, irrational, and stupid, constantly muttering unintelligible nonsense, and shouting day and night "that her body was dead, that she was dying", etc. On September 10th, 1879 (six days after admission), the pupils were equal, the pulse feeble. A systolic cardiac bruit was heard loudest at the apex and to the left. She suffered from constipation. There was

hemiplegia of the left side, affecting the face and both members; the latter being at the same time contracted. The power of attention was very feeble. She was incapable of answering or conversing, and muttered incoherently. She was restless and noisy at night. She was confined to bed. On September 24th, she was weaker, and had an uncontrollable tendency to contract bed-sores. On October 1st, though feeble, she was at times very noisy, shouting out the names of her friends; and she was worse on alternate nights. On November 8th, she was weaker and thinner. Although she had a water-bed and the most careful nursing, she could not be kept free from bed-sores. She died on November 11th, 1879.

NECROPSY.—The brain was well developed, with the convolutions apparently normal as to size and configuration. The only lesions in the right hemisphere were: 1. A patch of softening, brown in colour, with loss of substance caused by a clot now absorbed at the junction of the ascending frontal with the ascending parietal, about three-quarters of an inch long from before backwards, about a quarter of an inch broad in the perpendicular direction, and an eighth of an inch deep, with the adjoining portion of the ascending parietal tinged yellow; 2. A superficial brown patch, a quarter of an inch long antero-posteriorly, and an eighth broad, on the superior ramus of the first or superior frontal convolution (the third frontal of Meynert), near its origin; 3. Two small brown spots, little longer than the head of a pin, on the inferior ramus of the same convolution, near its origin; 4. A small brown spot, not larger than those above mentioned (3), near the commencement of the middle third of the inferior ramus. The diseased portions of cortex were in the region supplied by the median branch of the anterior cerebral artery. In the left hemisphere was a small lacuna, free from abnormal colour, and measuring about one-twelfth by one-sixteenth of an inch, near the commencement of the middle third of the inferior ramus of the superior frontal convolution. This may have been caused in removing the membranes. There was no other visible abnormality in either hemisphere.

REMARKS.—Here, the lesion was purely cortical, and situated for the most part between the præ-frontal and pediculo-parietal sections of M. Pitres, in the superior part of the region included between them. The existence or non-existence of secondary degeneration was not ascertained; but the permanent contracture which M. Charcot ascribes to it was present. Speaking of secondary degenerations, or descending sclerosis, he says (*Leçons sur les Localisations dans les Maladies du Cerveau et de la Moëlle Épinrière*): "Il faut, à mon avis, leur rapporter, pour la majeure partie, la contracture permanente, dite tardive."

He further says that lesions of slight extent in the region of the giant pyramidal cells, viz., the paracentral lobule and the upper part of the ascending convolutions, give rise to well marked secondary degenerations. Had there been brachio-crural monoplegia with contracture, and without facial paralysis, the case would have been typical according to the generally received notions about cerebral localisation, whether from the point of view of the histologist, the clinician, or the experimentalist on the higher mammalia. But the facial paralysis is unaccounted for by any visible cerebral lesion, unless, indeed, it is sometimes a symptom of lesion of the superior portions of the median convolutions, and not of their inferior extremities. It may, however, have been the result of the patient's general physical weakness, which was very marked.

The great tendency to contract bed-sores is characteristic of lesions of the right hemisphere. It is noteworthy that the very serious affection of the intellectual faculties, the power of attention being very feeble, was coincident with lesions limited to the ascending and first frontal convolutions, and extending in the latter beyond the motor area anteriorly, thus assisting to bear out the opinion of Dr. Ferrier and Dr. Crichton Browne, that the functions of the anterior and middle parts of the frontal lobes are purely psychic, and that in these lobes are localised the centres of inhibition, the physiological substrata of the faculty of attention.

HISTORY OF A CASE OF MYXEDEMA.*

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THE patient I am about to introduce to your notice is a woman sixty years old. She is the mother of eight children, and has had two abortions. There is no history of syphilis. Her father and mother lived to the ages of eighty-four and seventy years respectively. She always enjoyed excellent health and spirits until ten years ago, when she received a violent shock, caused by her second daughter being seized with puerperal convulsions while in labour; and from that she dated

* Read before the Northumberland and Durham Pathological Society.