

it would be highly desirable that a similar measure should be applied to Asylums, the medical element being strongly represented in the Central Controlling Body. This measure would, we venture to think, be preferable to swamping the Asylum's office altogether in the Local Government Board, as at present talked of. Asylums are hospitals, and a central body governing them ought to be essentially medical; the Local Government Board is essentially lay.

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*The Functions of the Brain.* By DAVID FERRIER, M.D., F.R.S. Smith, Elder & Co., London, 1876.

This work may fairly be considered as representing the latest additions to our knowledge of cerebral physiology. The opening chapter is devoted to a brief sketch of the structure of the brain and spinal cord. Then follows a description of reflex action as observed in the lower animals and in man. A very ancient drawing of an ascidian, which here does duty, as it has done in other works for the past forty years, leads one to enquire whether it is not possible to make a more faithful illustration of this interesting creature. The function of the *Medulla oblongata* are fairly described, but in all these descriptions there is not much that strikes one as being fresh or worthy of special attention. Dr. Ferrier having led the way up from the lowest nervous function to the highest, proves not only by his own, but by the experiments of others, that the cerebrum is the sole seat of volition. For whilst an animal may exist, if fed, and even perform combined movements without any cerebrum, that is, with only the basal ganglia, it is incapable of originating active manifestations of any kind. Consciousness also has its seat, not in the mesencephale, but in the higher nerve centres. The nerve faculty of adaptation to circumstances, which an animal without any cerebrum may be capable of, is no proof of consciousness, and, therefore, though the lower nerve centres may have this faculty of adaptation, they do not necessarily possess consciousness, or even sensation. Under the impression that many erroneous ideas arise from confusion in respect to these terms, Dr. Ferrier suggests the term *æsthesis*, to signify a new physical impression on the centres of special sense, and the term *noesis* to signify a conscious impression, but he does not use these terms much himself.

*Equilibration*, the loss of which is so prominent a fea-

ture in many nervous diseases is a function of the mesencephalic and cerebellar centres. It may be overthrown by lesions of the afferent or efferent apparatus alone, or of the encephalic centres alone, or by conjoint lesions. The afferent apparatus consists of (1) Organs for the reception and transmission of tactile impressions: (2) The organ for the reception and transmission of visual impressions: (3) The semicircular canals and their afferent nerves. The inco-ordination of Locomotor Ataxy does not depend on the muscular sense in particular, nor on the loss of cutaneous sensibility in general. Hence it would appear that the efficient excitant of the co-ordinating centres of equilibration and locomotion is a special form of cutaneous impression generated by contact.

Visual impressions exert an important influence on equilibration, and may, in a measure, compensate for the loss of tactile impressions.

Recent researches on the functions of the semicircular canals of the inner ear have made it clear that these have a very important relation to the power of equilibrations. In Meniere's disease they are diseased, and cause sudden attacks of vertigo and sickness, which are generally preceded by, or are associated with, ringing or pain in the ears.

*Functions of the Optic Lobes or Corpora Quadrigemina.*—The destruction of these centres causes blindness; irritation produces dilatation of the pupils on the opposite side, and various other effects which tend to the belief that these ganglia are concerned, not only in visual sensation, but, also, that they are the centres specially connected with the reflex expression of feeling or emotion.

*Functions of the Cerebellum.*—This organ seems to be a complex arrangement of individually differentiated centres, which, in associated action, regulate the various muscular adjustments necessary to maintain equilibrium of the body: each tendency to the displacement of the equilibrium round a horizontal, vertical or intermediate axis acting as a stimulus to the special centre which calls into play the antagonistic or compensatory action. There seems to be a connection between the semicircular canals and the cerebellum, from the remarkable similarity between the effects of lesion of the former and injury or removal of certain parts of the latter.

The irritation or removal of the cerebellum has no effect on the sexual organs or instinct.

*Functions of the Cerebrum.*—Though the credit of having

first demonstrated the localisation of the cerebral functions belongs to Hitzig and Fritsch, yet their experiments have been elaborated and improved on by Dr. Ferrier. He has been successful, not only in eliciting more definite results, but also in obtaining results from parts which they consider to be inexcitable. This success he attributes to the use of the induced, in preference to the continuous electric current for excitation; and also to increasing the current up to a much higher state of intensity. He labours to prove, in answer to objections brought against his experiments, that the effects of the excitations are not due to conduction to the basal ganglia; and the errors which might arise from diffusion to neighbouring centres have been carefully allowed for and eliminated by repeated experiments. The results from excitation are, in nearly all cases, checked by destruction of the parts, and are supplemented by careful post mortem examinations as to the extent of the lesions, etc.

The fact that even after removal of the grey matter the same effect may be produced by stimulation in the denuded spaces, is no argument that the motor effects are dependent on the corpora striata, etc. For the cortical centres act downwards on the muscles necessarily through the basal ganglia and motor tracts, and the application of the electrodes to the medullary fibres is essentially equivalent to the stimulus caused by the functional activity of the centre itself.

It is difficult to summarise the results of Dr. Ferrier's experiments without reference to the illustrations with which his work abounds. The areas of electrical irritation are given in circles which not only point out the seat, but also limit the extent of the regions for certain definite movements.

The areas to which the electrodes were applied, and the effects of stimulation on them, are as follows:—

1. *On the postero-parietal lobule.* Advance of opposite hind leg as in walking.
2. *On the upper part of the ascending parietal, and adjoining part of the ascending frontal convolutions.* Complex movements of thigh, leg and foot, as the animal would employ in grasping, or in scratching itself.
3. *Close to the ascending frontal portion of above centre, and close to a slight sulcus or depression at the upper part of the ascending frontal.* Movements of the tail (pleasure) associated with some of the movements as in 2.

4. *Situated behind (3), and below (2), and occupying adjoining margins of the ascending frontal and ascending parietal convolutions.* Retraction with adduction of opposite arm. Like swimming movements. In cats like striking a ball with paw.
5. *On the ascending frontal convolution, at its junction with superior frontal.* Extension forwards of the opposite hand and arm, as in reaching. Prehensile movements. In cats movements as in raising the paw to step forwards.
6. *In the ascending frontal convolution, at the bend of the antero-parietal sulcus.* Supination and flexion of the fore arm, as in raising hand to mouth.
7. *On the ascending frontal convolution below (6).* Action of the zygomatics.
8. *On the same convolution below (7).* Elevation of ala of nose and upper lip.
- 9-10. *Areas situated at the inferior extremity of the ascending frontal lobe.* Opening of the mouth with protrusion and retraction of the tongue. In dogs, barking or growling. In cats, mewing, spitting, and lashing of tail as if in a rage.
11. *Extending from (10) to the lower extremity of ascending frontal convolution.* Retraction of opposite angle of mouth.
12. *On the posterior half of the superior and middle frontal convolutions.* The eyes open widely, the pupils dilate, and the head and eyes turn towards the opposite side. In jackals the conjoint action of both sides would cause the appearance of an animal pointing at game.
13. *On the anterior and posterior limbs of the angular gyrus.*—The eyes move towards the opposite side, pupils contract, eyelids close.
14. *On the superior temporo-sphenoidal convolution.*—Pricking of the opposite ear, head and eyes turn towards the opposite side, pupils dilate widely.
15. *Subiculum cornu ammonis.*—Torsion of the lip and nostril on same side.

No satisfactory effects resulted from stimulation of other parts of the brain.

The above results were obtained from the brains of monkeys, to a great extent the same spots produced corresponding effects in the brains of some other animals, but electrification failed to excite any analogous movements in pigeons, frogs, or fish.

*Electrical Stimulation of the Basal Ganglia.*—The results were very uniform in various animals. Irritation of the *corpora striata* causes general muscular contraction on opposite sides of the body. Destructive lesions produce hemiplegia on opposite side, sensation remaining unimpaired. These ganglia are the centres of automatic or sub-voluntary integration of the various voluntary-motor centres differentiated in the hemispheres.

*Optic Thalami.*—Excitation causes no motor manifestations. Destruction occasions blindness, and paralysis of cutaneous sensibility on the opposite side. These ganglia play the same subordinate rôle to the sensory centres as the *corpora striata* play to the motor centres of the hemispheres.

From the results of his experiments on the cerebrum Dr. Ferrier has deduced the following physiological facts:—

*SENSORY CENTRES.*—*The Angular Gyrus*—seems to be the seat of visual sensation. Excitation occasions movements of the eyeballs; destruction of one causes blindness on the opposite side; of both, total blindness.

*The Superior Temporo-Sphenoidal Convolution* is the centre of auditory sensation. Irritation being followed by sudden retraction or pricking of the opposite ear, wide opening of the eyes, dilatation of the pupils, and turning of the head and eyes to the opposite side. Destruction causes deafness.

*The Hippocampal Region* (the Hip. Maj. and uncinatè convol.)—Destruction abolishes tactile sensation on opposite side of body. Experimentation very difficult. Stimulation of course could give no reliable effects on dumb animals.

*The Subiculum Cornu Ammonis, and its neighbourhood.*—This region appears to contain the centres both of smell and taste. Irritation caused a peculiar torsion of lip, and partial closure of the nostril on the same side. Destruction caused loss of taste and smell. The cutaneous sensibility of the tongue was also abolished.

*Occipital lobes.*—Excitation has always been negative, and destruction also. There seems, however, from negative evidence to be a causal relation between the removal of the occipital lobes and the annihilation of the appetite for food.

*Occipito-temporal Convulsions.* Dr. Ferrier suggests, though he has been unable to experiment on them, that these

are the seat of the sensations forming the basis of the sexual appetite.

**MOTOR CENTRES.**—*The convolution bounding the fissure of Rolando.* Destruction causes hemiplegia on opposite side, dissociated from sensory paralysis in any form. The corpora striata may be capable of spontaneous action and co-ordinated locomotion, under the influence of present or past impressions, or of emotional states. Only such movements, however, will be excited as have been automatically organised in the corpora striata. Such forms of activity as are not habitual, and have not become automatic, would be rendered impossible. The seat of origination for motor activity is the cerebrum.

Electrisation of the anterior or motor part of the hemispheres is one of a special character. The head and eyes are directed to the opposite side, and at the same time the pupils dilate widely. The attitude is one of excited attention or surprise. This centre may, therefore, be considered as concerned in those movements expressive of attention and intelligent observation.

*The Antero-frontal regions of the brain,* including the island of Reil, gave only negative results both on irritation and destruction. After the latter, there seemed, however, to be apathy, dullness and sleepiness: in fact a loss of the faculty of attention and intelligence.

Thus far the book gives us valuable data for further investigations; it contains much that we have had to pass over unnoticed, which is no less important. The experiments are without doubt important, for though they do not furnish the complete data for a positive mental science, they serve to aid in overthrowing the data of a false psychology, and to form the foundation of a more perfect philosophy.

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*System of Positive Polity.* By AUGUSTE COMTE. Third Volume, containing Social Dynamics, or the General Theory of Human Progress. London: Longmans, Green, and Co., 1876.

The general reader will probably find this volume more interesting than the two volumes which appeared before it, but he will do well to read those volumes before he reads it, if he wishes to have a thorough understanding of what he is about. The spirit of it is indicated in these remarks—“ In