LOCALIZATION IN THE BRAIN.

SINCE 1870, when Fritsch and Hitzig showed that the cortex of the brain was excitable, physiologists have been actively experimenting on it. Thus far, investigation has given rise to two theories regarding the function of this gray matter. One theory looks upon it as the seat of the higher intellectual activities: the other, considering it as a sort of mosaic composed of small areas, looks upon each area as possessing some definite function, either sensory or motor. Moreover, such is the nature of these areas, according to this theory of localization, that, if they be stimulated, perfectly definite movements or sensations are excited, while, if they be destroyed, the movements or sensations over which they preside are abolished.

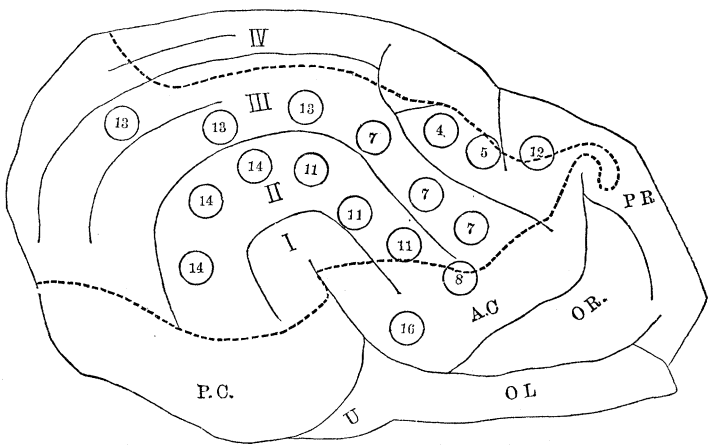
At the International medical congress held in London in the summer of 1881, these views were both ably represented; the former being supported by Professor Goltz of Strasburg, while Dr. Ferrier and Professor Yeo, both of London, represented the latter. Goltz had a dog, and Ferrier a monkey. The animals were exhibited before the physiological section of the congress, and each investigator stated his conclusions as based on the animals presented. Both animals were then killed, and their brains placed for examination in the hands of an eminent committee, consisting of Dr. Gowers, Dr. Klein, Prof. E. A. Schaefer, and Mr. J. N. Langley. The reports of this committee have recently been published in the *Journal of physiology* (vol. iv. Nos. 4 and 5); and, having now before us this complete description of the lesions, it is possible to estimate the value of the peculiarities exhibited by the animals while alive.

The dog presented by Goltz had been subjected, between November, 1880, and May, 1881, to five operations. By these a large portion of the cortex of both hemispheres had been washed away with a stream of water. Casually observed, this dog showed nothing abnormal in its bearing. It ran round the room, wagging its tail and sniffing about, as any dog is apt to do in a strange place. Its expression, however, was stupid, and its gait heavy; but it appeared to possess all its senses, and have control over all its muscles, — two points which are to be emphasized as of fundamental importance in the present discussion. This dog was, however, quite different in many ways from a normal dog. In travelling about, it avoided not only real objects obstructing its path, but those which were not real, — such, for instance, as a spot of sunlight on the floor, or a bit of white cloth spread flat.

Fear was apparently absent. The cracking of a whip and threatening gestures produced no effect; and, when an angry, spitting cat was held up to test the impression which it would make on this dog, it calmly began to lick the cat's face. It would eat dog's flesh, something which a normal dog is said not to do. When pent behind a low fence, it made no systematic effort to get out, although it apparently wanted to do so; the difficulty seeming to be that it did not know how.

Without further continuing the list of variations from the normal, it can be briefly said that this dog, though possessing his senses and not paralyzed, had yet lost something which goes to make up the difference between an intelligent and a stupid animal; or, to quote Goltz, there was a weakness of perception. The conclusions which Goltz drew from the actions of his dog are too obvious to need statement.

The monkey presented by Ferrier had been operated on seven months before. At that time what Ferrier calls the motor zone — a region about the fissure of Rolando — had been destroyed on the left side. This was done with a thermo-cautery. In the animal as exhibited, there was weakness in the right leg, and the position of the right arm was abnormal. No voluntary use of either of the limbs on that side had been noticed since the operation. Otherwise the monkey was quite well. Dr. Ferrier briefly stated that he considered this paralysis as due to the destruction of the motor zone of the cortex, which presided over the muscles on the right side of the body, the destruction of which would, according to the theory of localization, produce this effect. It now remained for the post-mortem to show what were the lesions in both these cases.



Right side of dog's brain, after Langley, slightly altered. I., first convolution; II., second convolution; III., third convolution; IV., fourth convolution; *A C*, anterior composite convolution; *P C*, posterior composite convolution; *O L*, olfactory lobe; *O R*, orbital lobe; *PR*, Prorean convolution; *U*, uncinate convolution. The circles numbered 4, 5, 7, 8, 11, 12, 13, 14, 16, represent areas localized by Ferrier on the brain of the dog, and have been taken from his fig 32, 'The functions of the brain,' p. 149. The broken line encloses the region which the lesion is known certainly to have covered, and within which all the gray matter of the cortex had been removed.

Mr. Langley, to whom the right brain of the dog

was given, has made a very thorough report. Indeed, he reviewed the whole subject of the fissures and convolutions of the dog's brain before giving his observations in this particular case. His main conclusions are perhaps best indicated by a figure showing the extent of the lesion. This is traced on a schematic outline representation of the right hemisphere seen from the side.

In some places doubt as to the exact extent of the lesion rose from the obliteration of some of the fissures, and a possible dragging of the brain during cicatrization. The region enclosed within the dotted line in the accompanying figure leaves out all the doubtful points, and includes the part only which is certainly known to be covered by the lesion.

In order plainly to indicate the significance of this injury, some areas localized for the dog's brain by Ferrier have been inserted in the figure in positions which are approximately correct. The number of these areas involved, as can be seen at a glance, is very large.

The left brain of the dog was examined by Dr. Klein. Without going into the details of his report, it may be stated that the extent of the lesion was rather less than that on the right side. The destruction of the gray matter did not extend quite so far forwards, nor so far towards the base, but it was still extensive enough to include some two-thirds of the areas which were embraced by the lesion on the opposite side.

If, then, the theory of localization were correct, we should have expected to find this dog largely paralyzed on both sides of his body, and blind in both eyes. That this was not the case, the actions of the animal plainly showed. There was some degeneration found in the deeper parts of the brain, but it was apparently of little importance.

The brain of the monkey was examined by Professor Schaefer. The lesion was found quite strictly confined to the motor zone. It thus covered an oval region, occupying about the middle third of the brain, and bisected transversely by the fissure of Rolando, the ends of which extend beyond the oval on both sides. Beneath this, in the medullary centre, was a secondary lesion having about the same extent. The basal ganglia were not involved. But the very important fact was developed, that the pyramidal tract connected with the left side of the brain had undergone Wallerian degeneration through its whole extent, while there was also found an unexplained tract of degeneration in the left lateral column of the cervical cord. These deep lesions being discovered, it became at once impossible to decide whether the effects observed in the monkey were due to a removal of a certain portion of the cortex or not; so that it cannot be considered that in this case the monkey presented by Ferrier furnishes any evidence in favor of localization. From the dog, on the other hand, which was exhibited by Goltz, the conclusion is warranted, that large portions of the cortex can be removed without producing any of those effects which would be expected if the theory of localization were true; and at the same time there is some reason to believe that the removal of portions of the cortex diminishes general intelligence.

We have discussed but two experiments, and they in themselves are not sufficient ground for any generalization; yet the position in the scientific world, of all concerned, is such as to render these particular observations of more than usual importance in the history of this interesting question, and hence worth some passing attention.

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THE WINTER OF 1879-80 IN EUROPE.

THE meteorological conditions which characterized this phenomenally cold winter have been carefully studied by M. Teisserenc de Bort. There are but few as severe winters in a century, while the month of December was the coldest on record at Paris. This exceptional cold was due to, 1°, the position of the maximum pressure; 2°, the clearness of the sky; 3°, the presence of snow upon the ground; 4°, the calm which prevailed. These conditions were united for twenty-seven consecutive days. Proceeding from the characteristics of this particular season, the author discusses the subject of the persistence of areas of high and low pressure in certain localities, and the resulting weather phenomena. These 'centres of atmospheric action' destroy the parallelism of isobars and isotherms with the equator, and control the prevailing winds. Thus, an area of high pressure generally prevails in Siberia in winter, and a similar area at about 35° north latitude in the Atlantic, near Madeira. The displacement of these maxima produces modifications in the weather of the whole of Europe, causing these abnormal seasons. Three types of cold weather may be recognized: 1°, that characterized by the displacement of the Asiatic maximum towards Europe, in which the weather is dry and quite cold; 2°, that characterized by the removal of the Madeira maximum towards France and Europe, with low areas in Tobolsk and near the Azores, in which cold and calm weather prevail; 3°, that characterized by the displacement of the Madeira maximum northward, with relatively low pressures over central Europe and the Mediterranean, and giving rise to cold with dampness and snowfall.

Similarly, two types of mild weather may be noted: 1°, that characterized by low pressures in northern Europe, with the displacement of the Madeira high area towards Spain and the Mediterranean; 2°, that characterized by a general spreading of high pressure eastward to its maximum in Russia. These types are hardly distinct enough to be classed separately: both are accompanied by south-west or west winds, bringing warm and moist air from the ocean. While the fact of the controlling influence of barometric areas is fully recognized, it is not so easy to account for the displacements which are observed. The author supposes that these are due to changes in the thermic condition of different regions of the globe, but does not attempt to further investigate this subject. If it were possible to foretell the barometric conditions of