THE RANGE AND TECHNIQUE OF PREFRONTAL LEUCOTOMY.

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When Dr. Cook, who has the thankless task of organizing the papers and discussion of this meeting, told me I had let him down because I had not secured one of the most distinguished surgeons in the country, Mr. Jefferson, he put it to me that the least I could do was to fill in the gap. I was puzzled as to what to say until Prof. MacDonald gave me a clue, and instead of talking on physiology and anatomy, which, after all, you probably know better than I do, I propose to give you a few general considerations which seem to make for the defence of an operation such as this against Prof. MacDonald's criticism.

The whole of Prof. MacDonald's cricitism depends upon a static view of the central nervous system; it is a view in which I was brought up, and which was popular in physiology and is taught in the medical schools at present. It is an easy view. There are centres which govern movement, centres which govern sensation, centres which govern inhibition, in other words one goes back to the telephone-system idea of the central nervous system, by which messages can be sent from one part of the body to the other, and messages arriving from one part can be co-ordinated with messages from another. Until such time as we realize the almost infinite lability of the central nervous system we shall find ourselves at fault. So long as we continue to make classifications of functions, to localize functions, to try to think what will happen here or there in consequence of a lesion, we shall always be liable to find ourselves outwitted by the recuperative powers of the damaged nervous system. I think possibly I could illustrate what I mean by referring to some quite old work, which is very little known because it is inconvenient to incorporate it in textbooks or to lecture about it. I refer to the work of Sherrington and Graham Brown on the motor cortex of the chimpanzee. They trained the chimpanzee to open a cupboard door, turning the handle with one hand and the key with the other, to get the food out. Having trained him they destroyed the motor cortex on one side and he became hemiplegic. In course of time he not only recovered from the hemiplegia but was able to perform his usual tricks. They then exposed the whole of the cortex on the mutilated side and stimulated it electrically, and found no other area had taken over the function of the motor cortex. Having failed to find such an area on the homonymous hemisphere, they destroyed the motor cortex on the other side. Again the chimpanzee became hemiplegic, and again he recovered. He was able to perform all his tricks without difficulty. On neither hemisphere could electrical stimulation reveal any motor focus.

When I was assisting Sir Victor Horsley at Queen Square, operations were occasionally performed on cases of Jacksonian idiopathic epilepsy. One of the cases I remember was that of a man who had Jacksonian fits beginning in the thumb; the corresponding area in the cortex was excised and subsequently he had complete flaccid paralysis of the hand, from which he gradually recovered. A year or so later his only comment was that he did not think he played tennis quite so well as before the operation.

What is the point of all this? It seems as though the central nervous system can re-orientate itself. If it cannot work in one way it will do so in another. We have not done irreparable damage by cutting the 'phone system. If there is dysfunction in one part another will take on its functions. In our own experience we know that if we cannot remember something in one way we try to remember it by some other method; if we cannot perform an action by one method, we cast about until we find another.

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After a destructive lesion, the central nervous system is not, of course, exactly the same as before, but it is going too far to say *a priori* that any particular lesion will make it impossible for the central nervous system to perform any particular action; it may do it more circuitously, probably not so skilfully, but I think one can say this, that it is up to the opponent of Moniz's operation to show that one has inflicted a lesion of such a nature that the nervous system is unable by any other mechanisms to perform the majority or possibly all of the mental operations which it executed before. I do not say that they are performed so well, but they may be performed, sometimes even a good deal better. If one alters the particular form of imagery used by certain people, their mental operations may be very much improved.

At the Burden Institute Dr. E. L. Hutton and I are engaged in some research on the forms of imagery which are used in mental operations, and one notices that certain types of imagery may constitute a grave disability for certain modes of mental operations. I am one of those who hear the " still small voice " all the time, which may often be a grave disability, particularly if I wish to do mental arithmetic. If I had some form of cerebral lesion affecting my auditory kinaesthetic mechanism and compelling me to adopt visual imagery, I should not be surprised if ultimately my performance at mental arithmetic did not considerably improve.

What are we constantly doing in psycho-therapy? You may tell the patient who is oversexed to sublimate, and concentrate on other forms of thought. You are doing in fact psychologically what Moniz and his followers are trying to do by surgical methods. One is transforming one particular method of thought into another which is more useful, or which at any rate leads to less disturbance of mental activity, and that is what one is trying to do all the time in psycho-therapy.

This operation was first performed in this country at the Burden Institute, after encouraging reports from witnesses who had seen the results in U.S.A. and elsewhere had been considered, and it was felt that they were too striking to be set aside. Other people can tell you whether the results have justified the operation. All I want to say is that if one thinks that, *a priori*, one must be depriving a person of the potentiality of exercising any particular mental function by an operation of this description, the proof rests with the opponents of the operation. There are indeed one or two cases in which it is improbable that anything of the sort has happened, if one relies on the evidence of family, employers and friends.

I admit that immediately after the operation there seems to be an upset of the nervous system, the nervous shock, Von Monakow's diaschisis, then the symptoms of deprivation follow, but three or even six months afterwards recovery may be virtually completed. If irreparable damage has not occurred before the treatment, the patient may have learnt to use other mechanisms for his mental operations, and very often learnt to use them just as well as he did before.

With regard to the physiological side, one must confess that animal experiments do not contribute much to one's knowledge of this problem.

One has heard much talk of a lack of prevision in these patients. I do not think there is a lack of prevision with reference to non-personal changes in the environment; I think if they were chess players they would be able to see moves ahead as before. The lack of prevision is connected with the forethought which is concerned with the appreciation of the situation of the self in relation to the environment. It is there that they become careless, because they no longer seem to appreciate their social obligations, or pay much attention to their relations with others, but after months, possibly a year, there is a gradual re-education of function, always provided that one has started with a nervous system which has not hopelessly broken down.

A similar process probably takes place in the malaria treatment of G.P.I. patients. For many years I saw every G.P.I. treated by malaria in L.C.C. hospitals, and found that for months—sometimes a year—after they had been discharged from Horton as having been effectually dealt with by fever, they still continued to improve. I do not think anyone with a knowledge of G.P.I. would believe that there was a gradual resolution of the inflammatory process. The patient was exploring fresh, if more roundabout, neural mechanisms, and he was adopting more circuitous, but sometimes equally efficient, ways of conducting his mental processes.

Lastly a word about the operation itself. I have the feeling that we are going

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to be able ultimately to dispense with Mr. Willway's services. I think, instead of this brutal and bloody operation, we shall be able to obtain our results by the use of physical methods. There are many difficulties involved in this policy. The conduction of an electric current inside a sphere has yet to be studied in relation to the head.

One has, however, certain results even with the electro-convulsive therapy which show some resemblance to the operation of leucotomy. I regard the electro-convulsive therapy as a temporary leucotomy, but I will not go so far as to say that the people who do not improve with convulsive therapy will not improve with leucotomy. The trouble is that the E.C.T. effect is only temporary. When checking our results with the electro-encephalogram one finds that one gets signs of the same type of cortical changes that one does immediately after an operation for leucotomy. Of course it is not quite the same thing. In one case there is a severance of nerve tracts, and in the other we are injuring and destroying the nerve cells. Obviously we never sever all the tracts, and probably we are throwing out of gear for varying lengths of time the cells not only in the prefrontal area but in a great part of the frontal lobe. Electrical treatment involves a much bigger area than is imagined. It is not possible at present to localize it to the prefrontal area, and following it one gets a greater degree of excitement and a greater degree of amnesia than with leucotomy.

One last point: I saw Mr. Willway operate in the first case under local anaesthesia; the man was talking the whole time, and when the severance of the tracts took place the talking continued without the least hiatus or any indication that anything had happened. This is an interesting proof that a very complicated mental operation can be continued without the immediate agency of the prefrontal area.

The time is coming when we must abandon in this connection—as in neurology as a whole—the mechanistic faith in which we were brought up. We have to see things as a whole, to adopt a comprehensive view of the nervous system; we have to realize that it is something more complicated, more wonderful than the physiologists have ever thought of, and if Prof. MacDonald will agree with this I think he will see some indications for this operation.

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