

13. Care should be exercised with regard to the seating at meals of any patient at all in the habit of coughing or cleaning his throat forcibly. Such patients should sit by themselves at separate tables.

14. Finally in order to reduce infection to a minimum the installation of a central vacuum cleaning system is desirable.

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- (8) *Arch. Int. Med.*, 1922, vol. xxix, p. 33.
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NOTE.—By polishing is meant the use of rubbers; by waxing, the application by hand of liquid polish consisting of wax and its solvent. This application has little if any antiseptic action during the brief period in which it remains fluid on the floor. I have recovered *B. Flexner*, living, after four hours continued immersion in the mixture in general use.

The Inter-reaction of the Endocrine, Sympathetic and Central Nervous Systems in Organismal Toxæmia, with Special Reference to Emotional Disturbance.⁽¹⁾ By DAVID ORR, M.D. Edin., Deputy Medical Superintendent, Lancashire County Asylum, Prestwich.

WHEN approached by the President of the Medico-Psychological Association to give a short address at the Annual Meeting I chose the above title. On reflection, however, I find it is somewhat over-ambitious and cannot be dealt with in the time at our disposal. It would be better, perhaps, if I endeavoured to place before you some

⁽¹⁾ An address at the Annual Meeting in Edinburgh, July, 1922.

broad principles relative to the close association between neuropathology and psychiatry, and indicate the data in support of the view that anatomically, physiologically, and pathologically the entire nervous system must be regarded, along with its endocrinic appendages, as a unit, each of whose component parts reacts upon the others.

It is true that I am by training more of a pathologist than a psychologist, but I have had the opportunity of combining pathological with clinical work in the wards, always keeping in view the fact that morbid anatomy is the sure foundation of clinical medicine in all its spheres; and the inevitable conclusion to which one has been driven is that we psychiatrists have in the past taken too narrow an outlook on our subject. Some of us, for example, concentrate on pathology or bacteriology, others on psychology, and there exists that curiously artificial imaginary line drawn across the medulla oblongata which separates the neurologist from the alienist. It always reminds one of another imaginary line—the equator. There are signs, however, that scientific Father Neptunes are making efforts to induce both schools to cross the line and become neophytes of the new faith.

There are two points which I wish to emphasise. The first is that the sympathetic nervous system is a very important factor in determining the localisation of lesions in both the spinal cord and brain; the second, that the cerebro-spinal nervous system and the endocrino-sympathetic nervous system are interdependent.

Let us look at the first point. As you are well aware, there are certain lesions of the brain and spinal cord which are called system lesions and are confined to definite anatomical tracts. Some are due to degeneration of the controlling nerve-cells or to injury of the fibres between the nerve centres and the terminals. Others, however, are non-systemic, and differ from the above in that, although they affect definite areas, they do not give rise to "tract" lesions at the onset of the disease. These latter lesions are found in the cord round the periphery, and on either side of the postero-median system. Nor are all the fibres here affected. Amongst the degenerated fibres are many healthy ones, thus constituting a marked difference between this type of lesion and a "mass" degeneration.

In considering the ætiology of those non-systemic lesions one first thinks of the possible action of some toxin or other deleterious substance, and in all probability some poison is at work. But this explanation proves inadequate, for when one comes to examine a spinal cord in all its levels it is found that the lesions have a most peculiar anatomical distribution. In early cases the lesions affect the segments of the cord between dorsal I and lumbar II. Further, the intensity of the lesion decreases from above downwards. It is obvious, therefore, that there is another factor in the ætiology besides

toxicity, and a suggestion of that factor is obtained from our knowledge of the distribution of the sympathetic preganglionic fibres from the cord to the sympathetic lateral chain. These fibres connect the central nervous system with the endocrino-sympathetic system, which amongst its many functions controls the reaction of the vascular system to stimuli, and those fibres are given off from the level of the first dorsal segment to the second lumbar. This factor therefore suggests that if those lesions are distributed in an area of the spinal cord which corresponds to that from which the sympathetic preganglionic fibres take origin, then it is possible that this, the lower and more archaic portion of the nervous system, exercises some rôle in the determination of the regional localisation of pathological changes in the spinal cord.

In order to test this theory certain experiments were conducted, and in the first place the abdominal cavity was chosen as the site of infection in rabbits. Celloidin capsules containing a broth culture of the *Staphylococcus pyogenes aureus* were introduced, and an examination of the spinal cord at a later period revealed primary degeneration of the myelin sheaths round the cord margin and on either side of the postero-median septum. Further, there were dilatation, congestion and hyaline degeneration of the vessel walls with thrombosis of a similar hyaline type. The primary myelin degeneration was confined to the cord segments between the lower cervical and upper lumbar levels. There was thus a perfect analogy between the results of this series of experiments and the pathological changes found in the non-systemic lesions referred to above.

The distribution of the cord changes in the cord levels from which the pre-ganglionic sympathetic fibres are derived excites the strong presumption that disturbance of sympathetic control of blood-vessels is a determining factor in the localisation of the results of toxi-infection reaching the central nervous system through the blood-stream. It is suggested that a stasis of the blood-current with increased permeability of the vessel-wall occurs, thus affording the most favourable conditions under which mild toxicity of the blood can induce morbid nutritional changes in the surrounding tissues. It is noteworthy that the periphery of the cord and the postero-median septum derive their blood-supply from the pial vessels. These alone are under sympathetic control.

The above method of experiment with some modifications was then applied to the study of the brain, and here one was able to attack the problem of sympathetic influence more directly owing to the comparatively easy access to interference of the sympathetic chain in the neck. When the cervical sympathetic was divided and no other factor introduced the following changes were found in the rabbit's brain: Vascular dilatation, perivascular œdema, and morbid

changes in the nerve-cells—restricted to the divided side. The areas affected were those supplied by pial vessels, *viz.*, the cortex cerebri, the cornu ammonis, the fascia dentata, the caudate and amygdaloid nuclei, and the pyriform lobe.

After division of the cervical sympathetic and subsequently inducing a general intoxication, the above areas were again affected on both sides, but the unilateral sympathetic division intensified the toxic morbid lesion on the same side. It will be apparent that the areas involved in these later experiments are the archaic regions of the brain plus the cerebral cortex which is developed from the archepallium. All are supplied by pial vessels now acknowledged to be under sympathetic control. Other changes which we found and which are at present under investigation, were periarteritis in the head of the caudate nucleus, and an active secretion of lipoid material from the choroid plexuses and the lining ependyma of the ventricles.

From the anatomical and pathological aspects of the above-described lesions it seems reasonable to conclude that disturbance of the sympathetic mechanism plays a definite part in the localisation of lesions in the central nervous system, and in this connection another question arises—What part does the resulting nutritional disturbance in the archaic portions of the brain play in the genesis of morbid emotional states and their sequelæ? This brings us to our second point.

As you are aware, stimuli from the sensory nerves which subserve (a) our life of relationship with the outside world—from the limbs and special senses—and (b) stimuli from those which are connected with our life of nutrition—which make us aware of the sensations of well- or ill-being—all meet more or less intimately in the basal ganglia. These ganglia form a huge primary end-station and send fibres to the cerebral cortex, which in turn sends strands of nerves to them. In this manner reciprocal action is assured between all parts of the nervous system by definite anatomical paths, and from the researches of Ramon y Cajal we know that there exists a special mechanism by means of which stimuli may reverberate throughout the widest possible territory in order to induce the most perfect neurological co-ordination possible, so as to preserve that harmony between all parts of the nervous system so essential to the biological well-being of the organism. Cajal's two laws, the law of dynamic polarisation and the law of avalanche, both based on prolonged and accurate anatomical study, show us how by collateral connections between individual cells and cell-nuclei the smooth working of the nervous system is achieved.

Every nerve-cell receives its impulses from, say, for example, an incoming sensory axis-cylinder by means of its dendrites. The

stimulus passes through the cell-body and leaves it by the axis-cylinder—the law of dynamic polarisation. But each axis-cylinder is provided by many collaterals which impinge upon the dendrites of many cells, and hence the stimulus thus passing through many cell groups affects a very wide area, arousing impressions which are registered as it travels—the law of avalanche. In like manner an emotional condition arising peripherally may travel a long way. It will impinge upon the basal ganglia and in all probability upon the cortex simultaneously. The physical expression of emotion will be reflexly brought into action, anxiety will develop, the ductless glands will react to the stimulus, and the sympathetic and autonomic nervous mechanism will be thrown out of concord, with the physical results so familiar to us all, such as persistent tachycardia and tremor. It is those phenomena following emotion which show us so clearly the interdependence of the whole nervous system, and demonstrate the futility of concentrating on one part alone. The tendency to-day is to take a broader and more biological view of nervous disorders. Such would seem to be the surest foundation of future research.

Some Aspects of Sociology and their Psychiatric Application.⁽¹⁾

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I.

CULTURE AND ENDOWMENT.

WE attribute great psychopathic significance to the stresses incident to the adjustment of the individual to his culture. Everyone is supposed to bear the marks of this conflict. In fact, this disharmony is blamed for all human unhappiness and inefficiency not due to famine and disease. If this opinion is justified how is it that culture, the product of the mind, is not better adapted to the needs and natural capacities of its creator?

The reason is partly that culture, as an adaptation to reality and the exigencies of social existence, must in some sense be a discipline and a constraint. But even allowing for this and admitting the mechanisms described in *Totem and Tabu*, it remains that culture is not the natural and direct expression of the impulses of the people.

Cultural evolution is largely independent of germinal evolution. This is obvious in the case of language, and can be demonstrated of

⁽¹⁾ First of a series of articles specially written for the *Journal of Mental Science*,