

RECENT TRENDS IN NEUROLOGICAL SCIENCES

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Ladies and Gentlemen :

Neurologist is really at the cross-roads. Neurology is making progress almost at the space travel pace. It is nearly 30 years. I remember the year 1929 when I first joined the Hospital for Epileptics and Paralytics in Queen's Square, London and attended demonstrations given by Drs. Collier & Kinier Wilson. At that time Drs. Russell Brain—now Sir Russel-Purdin Martin and Kritchley were yet junior neurologists. In those days the chief emphasis was laid on clinical neurology. But much water has flown down the rivers during these last 30 years, and neurology as it is today has gained much from experimental neurology.

There were times when neurology attempted to understand the derangement in the structure & function of big masses of brain matter. Then came the period when microscope began to be used and we thought of neurones, neuroglial tissue, the blood vessels and the connective tissue in the brain, i.e. the so-called neuronic unit. It passed on then to electron microscopy and we came to the submicroscopic structures like mitochondria, Golgi apparatus, nissel granules, nucleus, nucleolus and so on. Now we have passed beyond that. We have come to what is beginning to be called the molecular pathology. The essential change is in the molecule, as that of the ribo-nucleic acid and other molecules which keep up the nutritional requirements of the cell. Well, we have gone even further now. The other day an esteemed friend, a professor of physics, met me and said that medical sciences will remain empirical till the medical man knows or understands the energy problem, and he talked to me about electrons, neutrons and protons. It seems that the primary derangement is in the electron and the proton which produces disease. May be, that in another ten years we have what will be called the proton or the electron pathology. This is where we are gradually getting to. With what good or with what evil I will not here try to enter into, but the fact remains that unless we keep pace with science we are likely to be left behind and we will be called uncivilized and we will be called unprogressive. It is very necessary therefore, that in order to keep our heads above our shoulders, we make a strenuous effort to keep pace with the investigations that are going on at the moment in neurological sciences. With these few remarks I will pass on now to some highlights in neuro-physiology and neuro-pharmacology which have helped the neurologist to solve some of his problems.

The first region that I might make mention of is the spinal cord. There are three structural features in the spinal cord which have recently been discovered and which have a practical application. *Firstly*, we deal with the inter-neurons or the internuncials, a group of cells which are situated between the posterior and anterior horns and are the cells which seem to control the facilitation and the inhibition of the anterior horn neurons. They really constitute the gear box in the spinal cord because they seem to determine the strength of execution. *Secondly* there are the cells of the anterior horn. These cells have been differentiated into three types. There are the gamma cells which are given prominence and are considered to control the basic tone of the muscle fibre. Then are the alpha phasic and the alpha tonic cells which control the phasic and the tonic contractions of the muscle. *The third* group of cells lie in the posterior horn. This is the latest addition. These cells seem to be essentially connected with the pain phenomenon. They not only have input from the posterior root ganglion cells but are also influenced by the motor fibres coming down the pyramidal and the extra-pyramidal systems. This allows the input at the lowest level of the spinal cord to be correlated to what is coming from the cerebral cortex. This correlation has given a very important function to the spinal cord in regulating the execution such that the final movement is a goal achieving act and appears to be a rational behaviour. Here perhaps I might also mention that inhibition and facilitation have been given a lot of biochemical basis recently. The significance of gamma-aminobutyric acid has come into great prominence. It conduces to hyper-polarization or de-polarization which influences the impulse generation.

This knowledge has given to the neurologist a rational therapy to control the massive spasms in the lower extremities in cases suffering from paraplegia. You know that for a person who is practising neurology this complication is one of the very difficult problems to face in a paraplegic. This has recently been treated by injecting procaine into the sciatic nerve. It seems to be fairly effective to control these spasms and it acts by changing the input in the posterior horn cells to favourably effect the exaggerated facilitation. Similarly in physiotherapy the knowledge of the functions of cells in the anterior horn i. e. the alpha cells have proved very useful.

Going above the spinal cord I come to the brain stem and immediately refer to the reticular tissue of the brain stem. This reticular tissue has gained a lot of popularity as you all know, and some very important functions are being attributed to it. Consciousness, arousal, and facilitatory and inhibitory mechanisms for various postural tones are some of the functions located in the reticular tissue of the brain stem. Eletroencephalographically when arousal response is elicited, there are two types of activities easily seen. There is the phasic form which is a sudden sharp spike, then there is the tonic response in

which there is a big spike followed by a trail. It has been surmised and also demonstrated that the phasic form comes from the excitability of the thalamic zone while the tonic form comes from lower regions of the brain stem. The two phases of arousal response are significant of the fact that the brain stem functions to keep up a perpetual type of wakefulness, while the thalamic zone gives an intensity when a particular attentiveness is needed. The whole of this region biochemically has become very important in that all the neuro-humors are demonstrated in this region. Nor-adrenaline, adrenaline, acetylcholine, serotonin and even histamine have been found in this tissue. The function of the reticular tissue seems to depend upon these neuro-humors. This region is affected to a considerable extent by the cerebellar cortex. This has been demonstrated by us experimentally. When cerebellum is stimulated, the reticular tissue shows well marked response.

Beyond this reticular tissue I come to the limbic system itself. Limbic system has at least three important functions. Firstly, the feeling of emotion, secondly, the expression of emotion, and thirdly, the behaviour manifestation. We know that the cortical part of this limbic system consists of hippocampus, the insula, cingulate gyrus, the temporal tip and the orbital surface of the frontal cortex. The nuclei associated with these cortical regions are the hypothalamus, the amygdala, basal ganglia, and even upper part of the brain stem. All these cortical and subcortical regions are intimately connected and the medial forebrain bundle conveys impulses to and fro from these parts. Functionally too there is suggestion of some localization in this area. The more lateral region i. e. periamygdaloid zone is concerned more with self preservation, the more medial portion i. e. the septal region and the cingulate gyrus are meant predominantly for species propagation. This functional segregation helps clinically to localize the lesions.

In my final two or three minutes I may say a little more about the cerebellum. Whilst the convexity of the brain is meant chiefly for discriminatory function, the limbic lobe for self preservation and propagation of species, the hypothalamus for the metabolic processes to provide energy for all the functions and the upper part of the brain stem for consciousness, cerebellum seems to influence all of them. It seems to give tenacity and endurance to all regional function and performance.

In the final analysis, it seems to hold true that the central nervous system not only is mosaic in its lay out but it is mosaic also in its performance.

Thank you.
