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DESCENDING EFFECTS OF THE RETICULAR SYSTEM WITH SPECIAL REFERENCE TO THE GAMMA FIBERS

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The author gave a brief review of the properties of the gamma system which provides an indirect route to the ventral horn cells over the muscle spindles. It is hardly necessary to review this part of the paper which those interested in postural control and spasticity will find presented in detail in two chapters of the author's recent SILLIMAN Lectures at Yale University (GRANIT (1955) *Receptors and Sensory Perception. A discussion of Aims, Means and Results of Electrophysiological Research into the Process Reception.* Yale University Press).

The gamma path is effectively controlled from the midbrain tegmentum and this control, in recent work by GRANIT and HOLMGREN (1955): *Acta Physiol. Scand. 35*, 93, was shown to be effected by two pathways, one fast and one slow. The fast pathway is extremely efficient so that each shock to the midbrain tegmentum elicits or drives a gamma burst which starts a spindle burst. These effects have been studied in individual gamma and spindle fibers. The minimum latent period of the gamma spike over the distance midbrain tegmentum to L_7 or S_1 ventral root is of the order of 8 msec. The fast path is fairly vulnerable so that sections in the lumbar region (L_3 to L_6) destroy it (with consequent cessation of driving) when they are carried a little lateral of the gray matter at the level of the spinal canal. The slow path requires repetitive stimulation of the midbrain and then responds in a recruiting fashion as a kind of general "volume control". Its safety margin approaches invulnerability in that any amount of criss-cross sectioning of the spinal cord does not destroy the slow recruiting response. Transection of practically the whole cord is required for removal of the slow gamma control of the spindles. This path is probably used for

general tonus effects whilst the fast path is used for the cooperation gamma/spindle effects with rapid movements.

DISCUSSION

Dr ECCLES: The explanation of the site at which lumbar section interrupted the cending path to the small motoneurones may be that the long descending fibers l already relayed, as described by LLOYD, in the upper lumbar region, and the lesion interrupting the short relay fibers which lie close to the ventral grey matter.

Dr VAN BEUSEKOM: In my study of the long descending and ascending fiber-syst of the cord I found that no long, fast-conducting fibers were present at the places rounding the lumbar grey matter that Dr GRANIT severed. Those long fast-conduc fibers can only be situated in the periphery of the cord. (After further discussion the cooperation of Dr ECCLES): It is probable that Dr GRANIT severed the driving citing) pathway after it passed a relay in the lumbar grey matter to secondary s and thin neurones.

Dr GRANIT: The sections were done at the lumbar level. Loss of driving after myar proved that there was at least one synapse on the route. Since we have to account l for a speed of roughly 40 m/sec as well as for the fact that driving could be destro it is necessary to have a precise large-fiber path but the destruction itself, as sugge by Prof. ECCLES, may have been at the post-synaptic level. Thus the main effect have been carried at fast speed, i.e. in large fibers, between midbrain tegmentum the lumbar segments.