

## Two Pathways from Brain Stem to Gamma Ventral Horn Cells.

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It is known that the gamma impulses to the muscle spindles in many reflexes coincide with or even precede the motoneurone or alpha impulses (for a review, see GRANIT 1955). This means that such reflexes are accompanied by muscle spindle contractions with consequent excitation of their sense organs. Thus, although the spindle is in parallel with the muscle fibres, it is not unloaded (or passive) during the reflex but discharges impulses, serves as a measuring instrument, and through the myotatic reflex pathway influences the alpha ventral horn cells.

Now, when the gamma cells, and thus indirectly the spindles, are excited from the brain stem, one would expect this mechanism of precise alpha-gamma co-excitation to break down owing to the long conduction distance, unless there existed a pathway which in speed and efficiency compared favourably with the ones running the alpha motoneurons.

The experiments in which stimulation of the brain stem has been carried out (GRANIT and KAADA 1952, ELDRED, GRANIT and MERTON 1953) show this gamma-spindle mechanism of excitation to be highly efficient. Even the spindle impulses, which do not emerge until the original gamma-effect has traversed the muscular loop, may turn up in advance of alpha excitation and muscle contraction. The observation (GRANIT and KAADA, their Fig. 9) that

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