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Excitation and inhibition of cerebellar Purkinje cells.

Single Purkinje cells of the cat's cerebellar cortex (anterior lobe) were closely approached with fine KCl-filled micro-capillaries. Evidence of identity was given by their brief-latency spike response to schocks to the fastigial nucleus or overlying *arbor vitae*. The shortest latencies (0.35 to 0.6 msec) must be due to invasion by antidromic impulses in the efferent axones. Slightly longer latencies (0.6 to 0.8 msec) could also be due to monosynaptic (climbing fibre) excitation of the Purkinje cell. In optimal conditions the diphasic extracellularly-recorded spikes reach giant size : up to 50 mV from positive to negative peak. These spikes begin with a positive-going prepotential, separated by an inflexion from the positive-going phase of the spike. They are identical with the spikes fired by the cell in natural trains in the absence of artificial stimulation. Firing frequencies are relatively low, 10 to 50 c/s, the trains being separated by spells of silence. Following repetitive stimulation of the n. fastigii, or sometimes without such stimulation, a persisting excitatory state may develop, in which higher firing frequencies are seen. Each time the frequency rises high enough, the take-off of the spikes from the prepotentials is delayed, and it may then fail altogether, prepotentials of reduced size following one another at about 500 c/s. As the frequency falls, the prepotentials grow to normal size and are again able to generate impulses.

Intracellular records have been few, but inhibition by hyperpolarization has been seen. In every Purkinje cell record, brief inhibitions, each lasting about 50 msec, are a conspicuous feature. In intracellular records they are seen to be due to persisting depolarization (inactivation) of the cell membrane. Such regular and specific behaviour must have a structural correlate. The unique synaptic relationship between basket cells and Purkinje cells suggests the basket cells as its most likely basis.

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