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Persistent Discharge from Sympathetic Ganglion Cells Following Preganglionic Stimulation.*

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If volleys of impulses enter a sympathetic ganglion at frequencies not exceeding 15 or 20 per second, each impulse arriving at a given synapse causes the discharge of not more than one impulse from the corresponding ganglion cell.¹ Thus no repetitive discharge has been observed, and there is evidence that this is also true in certain cases of synaptic transmission in the central nervous system. To account for this it has been assumed that there is a rapid decay of the excitatory state developed by the presynaptic impulses. The neurohumoral hypothesis takes cognizance of this fact by assuming that the acetylcholine is rapidly hydrolyzed.

We have recently discovered conditions in which the statements made in the preceding paragraph do not correctly describe the course of the excitation at the synapses. For we have observed a long-lasting discharge of impulses from ganglion cells, following a brief period of preganglionic stimulation at a frequency of 40 or more per second.

All of the nerves leading to and from the stellate ganglion of the cat were sectioned. The preganglionic trunk was then stimulated while recording the impulses in the postganglionic inferior cardiac nerve.

At the lower frequencies each preganglionic volley initiates a single volley of impulses in the postganglionic nerve. If the frequency of stimulation be 40 or more per second the synchronized discharge of impulses does not continue throughout the course of a period of stimulation but soon becomes random due to the asynchronous activity of the several ganglion cells.² When the stimulation of the preganglionic nerve is stopped the discharge from the ganglion does not cease but the random discharge from many cells continues for some time thereafter.

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¹ Bronk, D. W., and Pumphrey, R. J., *Proc. Soc. Exp. Biol. and Med.*, 1935, **82**, 1661.

² Bronk, D. W., Tower, S. S., Solandt, D. Y., and Larrabee, M. G., *Am. J. Physiol.*, 1938, **122**, 1.

During the high frequency stimulation the number of ganglion cells discharging gradually gets less. At the end of the period of stimulation there is not a sudden, further decrease in activity, but only gradually and over a period of 0.2 to 0.5 seconds do the cells go out of action. Then for the short space of 0.2 to 1.0 second there is no discharge, following which a certain amount of activity again develops and continues for 15 or more seconds. The intervening period of inactivity is apparently related to the phase of decreased irritability revealed by the positive after potential following the period of intense activity.

It is not possible to say what proportion of the ganglion cells participate in this after-discharge or at what frequency, until we have many records of the activity of small groups of cells. For only thus can individual impulses be observed and quantitative measurements made. At the present time we can estimate that in the initial phase the number of cells in action may well be 25% of those responding at the beginning of the period of stimulation. Several seconds after the end of the stimulus the activity falls to 5 or 10%.

How many units continue in action is probably of less significance than the fact that certain of them do continue to discharge for 15 or more seconds after the end of the trains of impulses which developed the excitatory state at the synapse. We are, therefore, forced to conclude that the altered state of the nerve cells or the altered state of their environment is capable of persisting for many seconds at a level which causes the rhythmic discharge of impulses from the cells.

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Relation of Potassium to Family Periodic Paralysis.

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The older literature on family periodic paralysis contains observations which might suggest a relationship of disturbed K metabolism to the attacks. K citrate was thought by Mitchell¹ to have a

* Godey and Seeger Fellow.

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¹ Mitchell, J. K., Flexner, S., and Edsall, D. L., *Brain*, 1902, **25**, 109.