

A polysynaptic planar neural network as a model of the myenteric nervous plexus

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Abstract

© Springer-Verlag Berlin Heidelberg 1998. We modeled the esophageal myenteric nervous plexus as three morphological types of ganglia, arranged into neural chains and interconnected to form a network. Cholinergic synapses provide excitatory connections among ganglia and adrenergic synapses provide inhibitory activity within a ganglion. Mathematical formulation is based on Hodgkin-Huxley formalism for the dynamics of the nerve-pulse propagation along the axons and on Michaelis-Menten kinetics for the processes of electrochemical coupling at synapses. We studied the response of the neural network to external stimulation under "normal physiological" conditions and after simulated treatment with chloride salts of divalent ions, botulinum toxin, increased extracellular concentration of calcium ions and agents which alter the permeability of sodium and potassium channels. The special properties of the network tend to preserve nerve-signal conduction despite such noxious interventions.

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