EFFECT OF HIGH EXTRACELLULAR POTASSIUM CONCENTRATION ON ADAPTATION IN INVERTEBRATE NEURONS

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The effect of extracellular potassium concentration on the membrane electrical activity has been studied on neurons of *Helix pomatia* and *Arion subfuscus*.

The cells were impaled with two microelectrodes, one to inject current (depolarizing steps lasting 9 - 18 s) and the other to record electrical potentials.

Without depolarizing current, changes in frequency and shape of action potentials of spontaneous discharging neurons were observed when exposed to a high $[K^+]_o$.

At low stimulating currents the initial discharge frequency $F(0)$ is linearly related to the current strength $G$ up to $(K^+]_o = 17.1$ mM (the highest tested concentration).

The current upper limit of the linearity range between $F(0)$ and $G$ is higher in normal perfusing solution, $[K^+]_o = 4$ mM, than in solution with increased $K^+$ (reduction up to 50%).

In the linearity range $F(0)/G$ adaptation of the discharge frequency has been described by means of a behavioural model and each neuron, in normal perfusing solution, was characterized by four model parameters: the proportionality constant between $F(0)$ and $G$, $K$; the decay constant of the frequency, $\tau_f$, the inhibitory current from a single nerve impulse, $b$, and the decay time constant of the inhibitory current, $\tau$.

A $[K^+]_o$ increase leads to a membrane depolarization and the current required to reach the firing threshold is lower than in normal conditions; higher $K$, $\tau_f$, $\tau$ and lower $b$ values are calculated. Other effects, like subthreshold oscillations, or opposite results can be obtained and may be explained by the inactivation of some ionic currents, the decreased potassium chemical gradient or the variations in the rate of exchange with external medium at high current strength.