

Dynamics of Membrane Currents in Generator/Receptor Potentials of Sensory Cells

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In a generalized model of a membrane element with the generator process in receptor potentials the special balance of influx - efflux ratios of the different ion species is taken into account. Furthermore a direct contribution of electrogenic transport to the net membrane current is considered in relation to the impact of compartments (extra/intracellular spaces) in the dynamics of stimulus-response kinetics.

The dynamic membrane model gives the overall stimulus response characteristics of rate sensitive receptors if the following assumptions are fulfilled:

- (1) Permeability for sodium and/or calcium/potassium is a function of stimulus intensity.
- (2) The sodium influx (calcium) required to depolarize a generator potential causes an appreciable accumulation of the ion species within the intracellular compartment which is dependent on the influx/efflux balance.
- (3) Activity changes within the compartments influence diffus. potentials according to the GOLDMAN-principle.
- (4) Concentration -changes with (3) give rise to electrogenic ion transport.
- (5) The processes (3) & (4) rule and control the phenomena of adaptation, rate sensitivity, resetting, flimmer fusion etc. The time constants of these are a function of intra- and extracellular compartment sizes, active and passive transport coefficients.