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**POISSON-NERNST-PLANCK (PNP) THEORY OF IONIC CHANNELS.** Duanpin Chen and Robert Eisenberg Dept of Physiology, Rush Medical College, 1750 W. Harrison, Chicago IL

PNP theory predicts many characteristics of biological channels, although it describes a channel of just one conformation in which ionic points can flow through each other. Rectification, variation of conductance with concentration, and flux interactions arise naturally in the theory, if the pore contains an access resistance or selectivity filter, because the shape of the electric field changes with experimental condition. The spatial variation (1) of ionic charge (2) of potential (3) and of the energy of the charge at that potential reveals how each characteristic of real channels can arise even in such an oversimplified model.

When the permanent charge distribution has four maxima, as in thyristors or “Numa rings”, three IV relations satisfy the steady-state equations. Two are stable. One contains few ions to shield the permanent charge or carry current, perhaps corresponding to a closed channel. The other contains enough ions to shield the permanent charge and carry a large current, perhaps corresponding to an open channel. The unstable state may describe a transient or inactivating channel. We have constructed and are integrating a time dependent version of the PNP theory to see if the evolution or switching of these states can account for the time dependent properties of channels.