The Gramicidin A Channel as a 2-Site Pore: Evaluation of the Kinetic Parameters from Measurements of the Flux-Ratio Exponent

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As has been shown by Hladky et al. for different cation species, conductance measurements of the gramicidin A channel in lipid bilayers can be interpreted in terms of a 2-site single-file pore model (1). Measurements of the flux-ratio exponent n (2,3) give additional support to this conclusion. Near chemical equilibrium, the permeation of a single cation species between symmetrical solutions can be described by a set of 5 rate constants: Aa, Da (rate constants for first and second particle jumping into the pore, where a is the activity in solution), β, ε (first and second particle jumping out of pore) and k (particle changing site within the pore). Our calculations show that the flux-ratio exponent is a function of only two parameters,

$$n = f(Da/k, \beta/k)$$

so that D/k and β/k can be immediately determined from flux-ratio vs. activity curves. Using a simple transformation of the conductance vs. activity curve, the remaining three kinetic parameters are easily found. The results of this method for Cs^+ diffusion are compared with earlier estimates of the kinetic constants.

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