

# Batrachotoxin-modified sodium channels from squid optic nerve in planar bilayers: Ion conduction and gating properties

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Squid optic nerve sodium channels were characterized in planar bilayers in the presence of batrachotoxin (BTX). The channel exhibits a conductance of 20 pS in symmetrical 200 mM NaCl and behaves as a sodium electrode. The single-channel conductance saturates with increasing the concentration of sodium and the channel conductance vs. sodium concentration relation is well described by a simple rectangular hyperbola. The apparent dissociation constant of the channel for sodium is 11 mM and the maximal conductance is 23 pS. The selectivity determined from reversal potentials obtained in mixed ionic conditions is  $\text{Na}^+ > \text{Li}^+ > \text{K}^+ > \text{Rb}^+ > \text{Cs}^+$ . Calcium blocks the channel in a voltage-dependent manner. Analysis of single-channel membranes showed that the probability of being open ( $P_0$ ) vs. voltage relation is sigmoidal with a value of 0.5 between -90 and -100 mV. The fitting of  $P_0$  requires at least two closed and one open state. The apparent gating charge required to move through the whole transmembrane