

A cAMP regulated K⁺-selective channel from the sea urchin sperm plasma membrane

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Ion channels are deeply involved in sperm physiology. In sea urchin sperm cyclic nucleotide levels increase during chemotaxis and in the acrosome reaction (AR). Although cyclic nucleotides are second messengers known to directly or indirectly modulate ion channels, it is not clear how they modulate sperm responses to the egg outer layer. Here, we describe a cAMP regulated K⁺-selective channel from sea urchin sperm plasma membranes fused into planar bilayers that may have a role during sea urchin sperm chemotaxis and/or the AR. Its single channel conductance in 100 mM KCl is 103 pS. In bi-ionic experiments, the channel displayed a K⁺/Na⁺ permeability ratio ($P(K^+)/P(Na^+)$) of ~5. Thus, in sea water its reversal potential would be ~ -13 mV and channel opening would depolarize spermatozoa. The channel has low open probability ($P(o) = 0.8 \pm 0.2\%$ at 0 mV applied voltage) and weak voltage dependence. Channel activity is reversibly up-regulated by cAMP in the cis bilayer side, but not by cGMP.