

Impairment of a parabolic bursting rhythm by the ectopic expression of a small conductance Ca^{2+} -activated K^+ channel in Aplysia neuron R15

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The electrical properties of neurons are produced by the coordinated activity of ion channels (Hille, 1992). K^+ channels play a key role in shaping action potentials and in determining neural firing patterns. Small conductance Ca^{2+} -activated K^+ (SK_{Ca}) channels are involved in modulating the slow component of afterhyperpolarization (AHP) (Köhler et al., 1996). Here we examine whether rat type 2 SK_{Ca} (rSK2) channels can affect the shape of the action potential and the neural firing pattern, by overexpressing rat SK2 channels in Aplysia neuron R15. Our results show that rSK2 overexpression decreased the intraburst frequency and changed the regular bursting activity of neurons to an irregular bursting or beating pattern in R15. Furthermore, the overexpression of rSK2 channels increased AHP and reduced the duration of the action potential. Thus, our results suggest that ectopic SK_{Ca} channels play an important role in regulating the firing pattern and the shape of the action potential.