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Molecular Cloning and Characterization of Neuronal β-subunit of Large-Conductance Ca^{2+}-activated K^+ Channels from Rat Brain

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We cloned the cDNA encoding the neuron-specific β-subunit (β4) of large-conductance calcium-activated potassium channels from rat brain and determined the DNA sequences of the entire coding region (GenBank accession; AY028605). The deduced amino acid sequences of rβ4, 210 amino acids in length, are closely related to the BK_{Ca} β4 subunits of other species but show only limited sequence homology to other β-subunits, β1 - β3. We coexpressed the α(rSlo) and the β-subunit (rβ4) of rat BK_{Ca} in HEK293 cells and *Xenopus* oocytes for electrophysiological characterization. The rβ4 altered the gating kinetics as well as the apparent calcium sensitivity of rSlo. The rβ4 showed a dual effect on rSlo channel activity. The coexpression of rβ4 shifted the conductance-voltage (G-V) relationship of rSlo toward positive voltages at low calcium concentrations. At more than 2 μM, however, rβ4 shifted G-V curve to the left. The β4 subunits of BK_{Ca} may contribute to the modulation of neuronal excitability and neurotransmitter release by interacting with the α-subunit in some neurons of central nervous system. We are currently investigating the molecular mechanism of BK_{Ca} channel modulation by rβ4 using various electrophysiological means.