
C1**Functional Effects of β 4-Subunit on Rat BK_{Ca} Channel α -Subunit, rSlo**

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To understand the functional roles of the neuron-specific β -subunit of large-conductance calcium-activated potassium (BK_{Ca}) channel, we isolate the full-length complementary DNA of β 4-subunit from rat brain library and investigated its effects on the function of α -subunit (Slo). The deduced amino acid sequence of rat β 4 (r β 4), 210 amino acids in length, was closely related to those of β 4 subunits in other mammalian species but showed only a limited sequence homology to the other β -subunits, β 1 to β 3. When expressed together with the α -subunit of rat BK_{Ca} channel (rSlo), the r β 4 subunit profoundly altered the electrophysiological characteristics of rSlo channel. The co-expression of r β 4 resulted in the increased cooperative activation of macroscopic rSlo channel for intracellular Ca²⁺. Single-channel recordings showed that the increased Hill coefficient for Ca²⁺ was due to the changes in the open probability of the rSlo/r β 4 channel. The voltage-dependent activation of rSlo channel was also altered upon co-expression of r β 4 and the effects were sensitive to the intracellular Ca²⁺ concentration. The r β 4-subunit decreased both of the activation and the deactivation rate of macroscopic rSlo currents. The dwell-times of both open and closed events were increased when observed at the single-channel level. Thus, the BK_{Ca} channels composed of rSlo and r β 4 subunits exhibited slower kinetics for steady-state gating compared with rSlo channels. Since the β 4 subunit of BK_{Ca} channels is limited in central nervous system and highly expressed in certain sub-regions of brain, the electrophysiological properties of individual neurons should be affected by the expression of this second subunit.