

C13**Ionic Basis of Spike Afterdepolarization in Rat Hippocampal Dentate Granule Cell**

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When repolarization of neuronal action potential does not decline monotonically but interrupted by additional depolarization, this prolonged depolarization phase is referred to afterdepolarization(ADP). ADP is considered to play a crucial role in the modulation of neuronal excitability, since it contributes to burst firing. We studied the ionic mechanisms underlying ADP in the soma of dentate granule cells, using rat hippocampal slice (300 μ m in thickness) prepared from 2- to 3-week-old SD rats. Slices were superfused with artificial CSF solutions containing 2mM Ca^{2+} , and experiments were performed at 32-34 $^{\circ}$ C. Action potentials were recorded by applying current pulses of 3ms duration at the current clamp mode using the whole cell patch technique.

In 97cells out of 121cell tested, action potential of dentate granule cells showed ADP, which was characterized by a sharp notch followed by a depolarizing hump starting at about -48mV and lasting 3-5ms. Bath application of 10mM Ca^{2+} increased the potential level of ADP by 10-15mV and also increased the duration significantly. A K^{+} channel blocker, 4-aminopyridine (4-AP, 2mM), also enhanced ADP and often induced subsequent burst firing. (The effects of 10mM Ca^{2+} and 4-AP were additive) On the contrary, ADP was significantly suppressed in Ca^{2+} -free solutions and 2mM $NiCl_2$. even in the presence of 4-AP (2mM).

When the high concentration of Ca^{2+} buffer, BAPTA (10mM), was added to pipette solutions, or BAPTA-AM (100 μ M) was added to bath solutions, ADP was also suppressed. Na^{+} channel blocker, TTX (100nM), and Cl^{-} channel blocker, Niflumic acid (100 μ M), did not affect the ADP. Substitution of Na^{+} with Li^{+} or N-methyl D-glucamine did not significantly affect ADP. From above results, it could be suggested that ADP in dentate granule cells primarily depends on external Ca^{2+} , but subsequent change in intracellular Ca^{2+} also contributes, at least in part, to the shaping of ADP