Single channel currents activated by glycine and GABA in spinal cord neurons

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It is well known from noise analysis that certain inhibitory amino acid transmitters open ion channels which are permeable to chloride. We have used the patch clamp technique (1) on spinal cord neurons obtained from embryonic mouse (2) in order to facilitate direct observation and characterization of discrete single channel currents activated by glycine and GABA.

Experiments were performed with cells bathed in Ringer solution at room temperature (22-24°C). A patch pipette containing (in mM) 150 KCl, 1 $CaCl_2$, 1 $MgCl_2$, 5 HEPES was tightly sealed against the neuronal surface.

At the cells resting potential discrete K inward currents were recorded which decreased in amplitude upon depolarizing the membrane patch. They disappeared completely at depolarizations of about 50 - 65 mV to 0 mV membrane potential.

At this stage discrete outward currents were recorded if the pipette contained 10 - 25 µM glycine or GABA. At more hyperpolarized membrane potentials both outward and inward currents were present. In control experiments without glycine or GABA in the pipette, no outward currents were observed. Glycine and GABA channels have unitary amplitudes with mean open times of 9 and 15 ms, respectively. They display a linear current-voltage relationship in the potential range with an estimated reversal potential of about -60 mV giving conductances of 28 pS for glycine and 21 pS for GABA-activated channels.

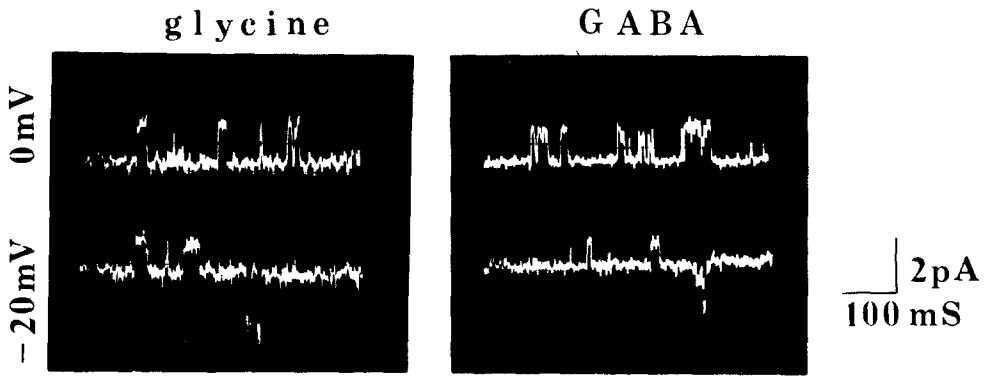

Fig. 1: Current steps (outward current is upward) activated by glycine and GABA at two membrane potentials. At 0 mV all events are outward whereas at -20 mV additional K inward currents are evident.

1) Hamill, O.P., Marty, A., Neher, E., Sakmann, B. and Sigworth, F.J., (1981), Pflügers Arch., in press.

2) Ransom, B.R., Neale, E., Henkart, M., Bullock, P.N. and Nelson, P.G., (1977), J. Neurophysiol., 40, 1132.