生物物理学 II　Handout No. 4

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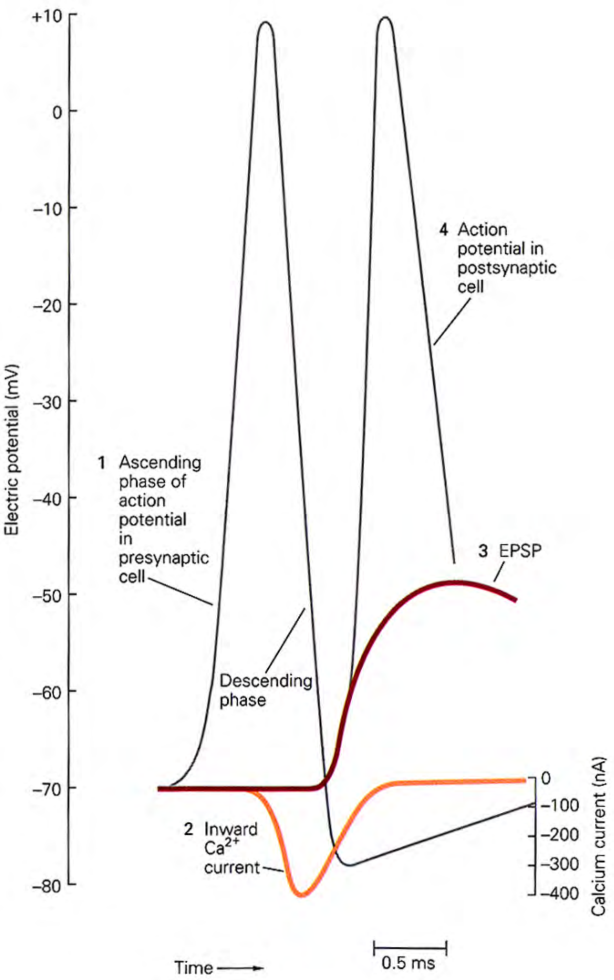

Figure 14.4 The time course of Ca^{2+} influx in the presynaptic cell determines the onset of synaptic transmission. An action potential in the presynaptic cell (1) causes voltage-gated Ca^{2+} channels in the terminal to open and a Ca^{2+} current (2) to flow into the terminal. (Note that the Ca^{2+} current is turned on during the descending phase of the presynaptic action potential owing to delayed opening of the Ca^{2+} channels.) The Ca^{2+} influx triggers release of neurotransmitter. The postsynaptic response to the transmitter begins soon afterward (3) and, if sufficiently large, will trigger an action potential in the postsynaptic cell (4). (EPSP = excitatory postsynaptic potential.) (Adapted from Llinas 1982.)

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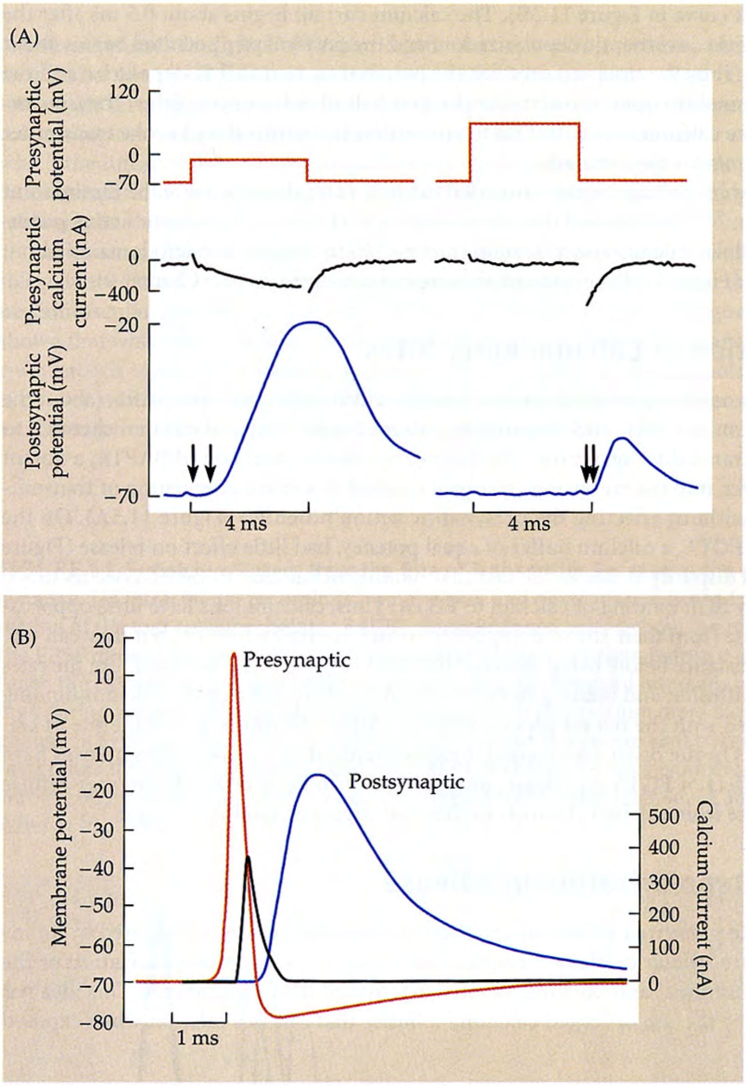

FIGURE 11.3 Presynaptic Calcium and Transmitter Release at the squid giant synapse. (A, B) The presynaptic terminal is voltage-clamped and treated with TTX and TEA to abolish voltage-activated sodium and potassium currents (A). Records show potentials applied to the presynaptic fiber (upper trace), presynaptic calcium current (middle trace), and EPSP in the postsynaptic fiber (lower trace). A voltage pulse from-70 to-18 mV (left panel) results in a slow inward calcium current and, after a delay of about 1 ms (arrows), an EPSP. A larger depolarization, to +60 mV (right panel), suppresses calcium entry. At the end of the pulse, a surge of calcium current is followed within about 0.2 ms (arrows) by an EPSP. (B) If a voltage change identical in shape to a normal action potential is produced by the voltage clamp (labeled Presynaptic), then the EPSP is indistinguishable from that seen normally (labeled Postsynaptic). The black curve gives the magnitude and time course of the calcium current. The synaptic delay between the beginning of presynaptic depolarization and the beginning of postsynaptic response is due in part to the time required to open calcium channels and in part to the time for calcium entry to trigger transmitter release. (After Llinas,1982.)

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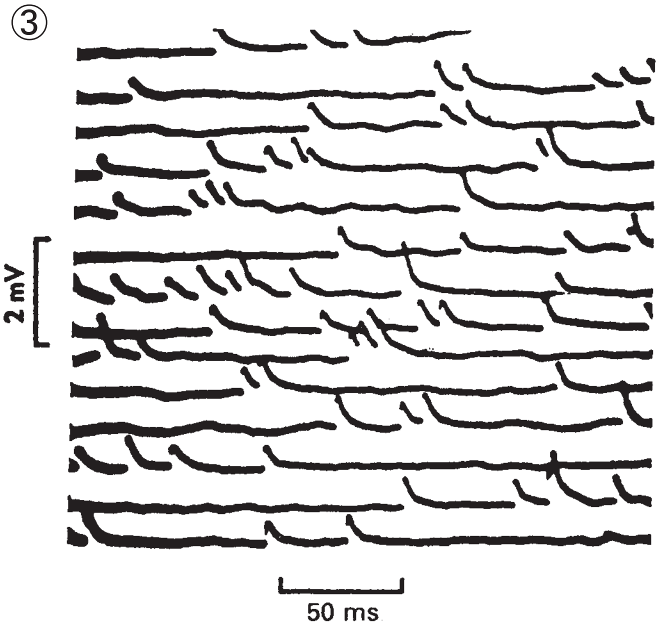

Fig. 7 .18. A series of membrane potential records from a frog neuromuscular junction showing miniature end--plate potentials. (From Fatt and Katz , 1952 .)