生物物理学 II　Handout No. 2

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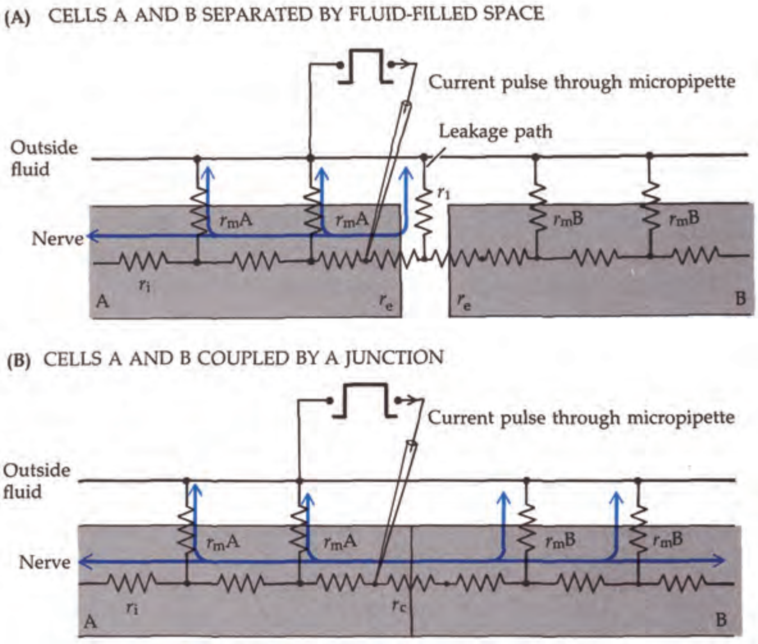

6 Pathways for current flow between cells. (A} Electrical model of two cell processes separated by a fluid-filled gap. Current flow out of the end of process A through the end resistance r_e escapes from gap (resistance r_1) without entering process B. (B) Cells brought into close apposition. In this model, current can flow from process A into process B. For significant coupling to occur, however, the coupling resistance r_c must be low compared with the other membrane resistances r_m.

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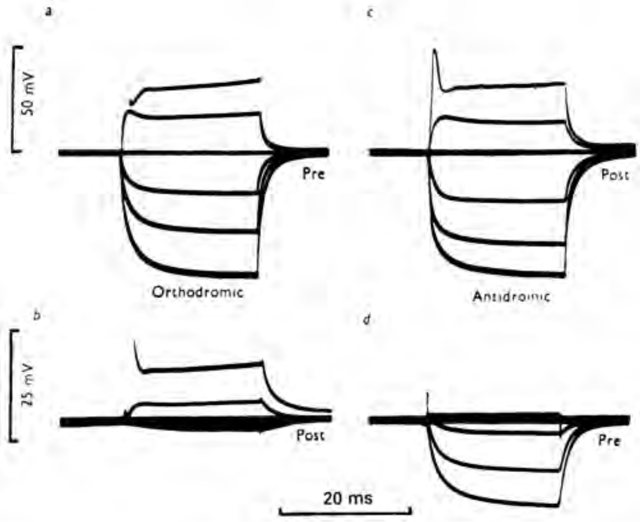

Figure 12.6. The rectifying properties of the crayfish giant motor synapse. Current is passed through the membrane of one of the fibres, and the membrane potential in both fibres is recorded. a and b show responses in the pre- and post-fibres to current through the pre-fibre membrane; notice that only depolarizing currents cross the synapse from pre- to post-fibre. c and d show responses in the pre- and post-fibres to current through the post-fibre membrane; notice that only hyperpolarizing currents cross the synapse from post- to pre- fibre. (From Furshpan & Potter, 1959.)

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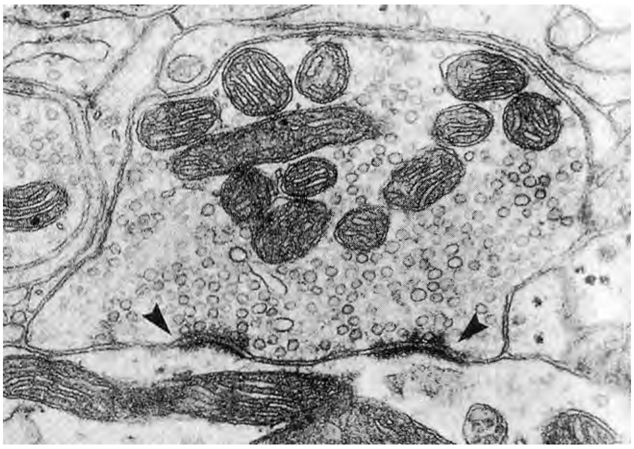

Figure 10-6 The synaptic cleft separates the presynaptic and postsynaptic cell membranes at chemical synapses. This electron micrograph shows the fine structure of a presynaptic terminal in the cerebellum. The large dark structures are mitochondria. The many round bodies are vesicles that contain neurotransmitter. The fuzzy dark thickenings along the presynaptic side of the cleft (arrows) are specialized areas, called active zones, that are thought to be docking and release sites for vesicles. (Courtesy of J. E. Heuser and T S. Reese.)

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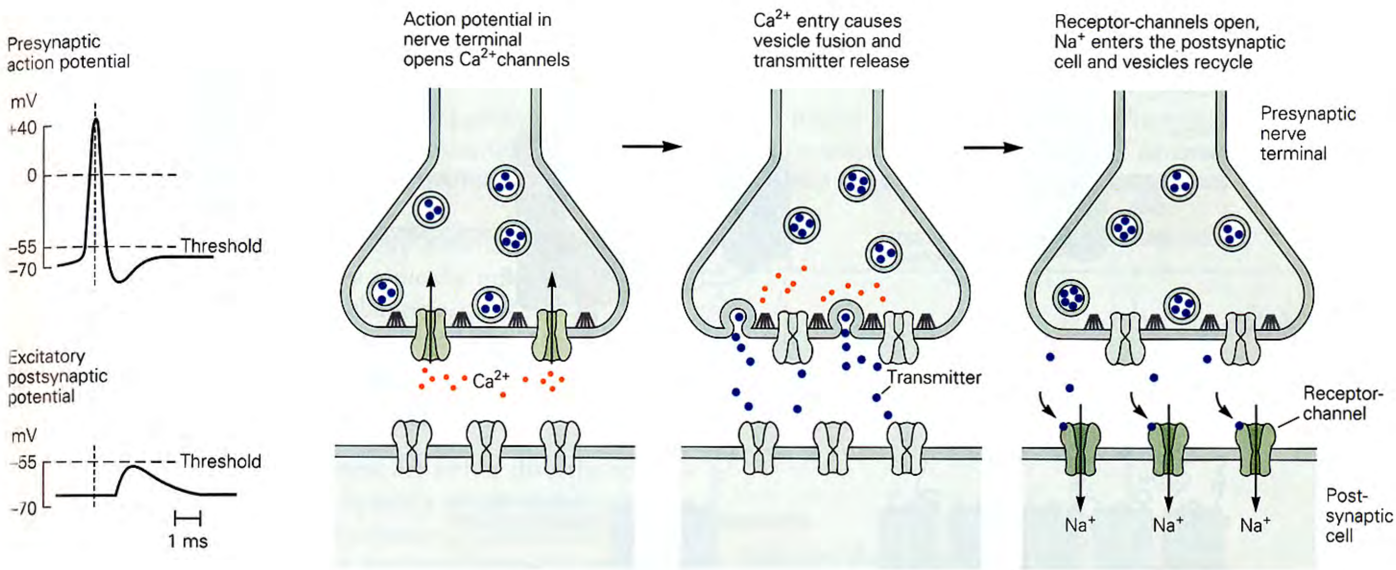

Figure 10-7 Synaptic transmission at chemical synapses involves several steps. An action potential arriving at the terminal of a presynaptic axon causes voltage-gated Ca^{2+} channels at the active zone to open. The influx of Ca^{2+} produces a high concentration of Ca^{2+} near the active zone, which in turn causes vesicles containing neurotransmitter to fuse with the presynaptic cell membrane and release their contents into the synaptic cleft (a process termed exocytosis). The released neurotransmitter molecules then diffuse across the synaptic cleft and bind to specific receptors on the post-synaptic membrane. These receptors cause ion channels to open (or close), thereby changing the membrane conductance and membrane potential of the postsynaptic cell. The complex process of chemical synaptic transmission is responsible for the delay between action potentials in the pre-and post-synaptic cells compared with the virtually instantaneous transmission of signals at electrical synapses (see Figure 10-2B). The gray filaments represent the docking and release sites of the active zone.