生物物理学 I　Handout No. 6

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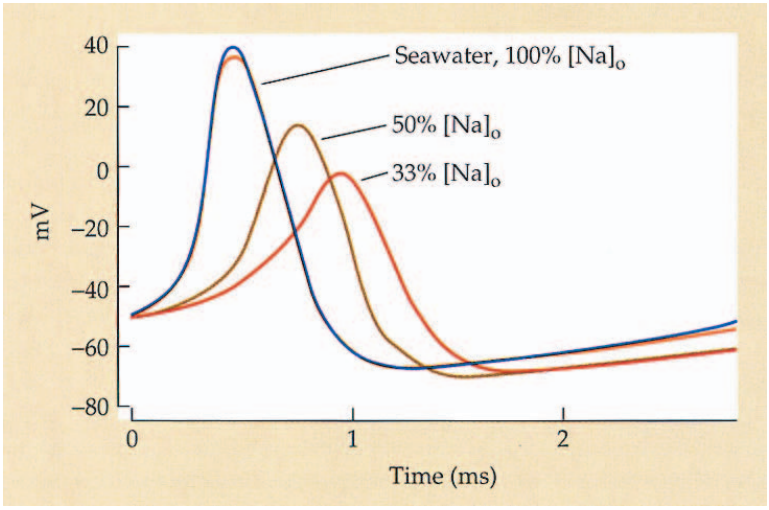

FIGURE 6.1 Role of Sodium in Action Potential Generation. Action potentials recorded from a squid axon bathed in seawater (blue), in solutions containing 50% (green) and 33% normal sodium (red), and then returned to seawater (orange). (After Hodgkin and Katz, 1949.)

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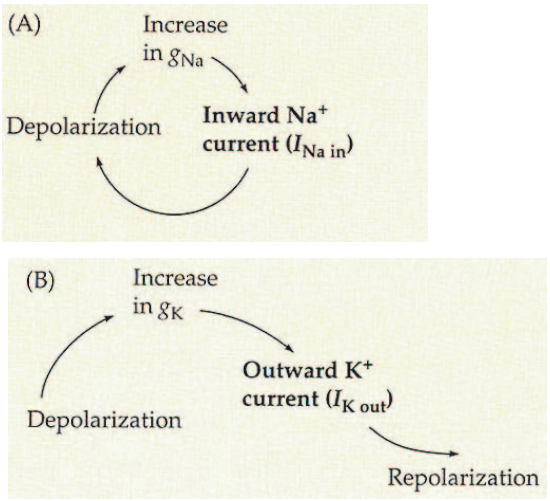

FIGURE 6.2 Effects of Increasing Conductances (g_{Na} and g_K) on membrane potential. (A) Sodium entry reinforces depolarization. (B) Potassium efflux leads to repolarization.

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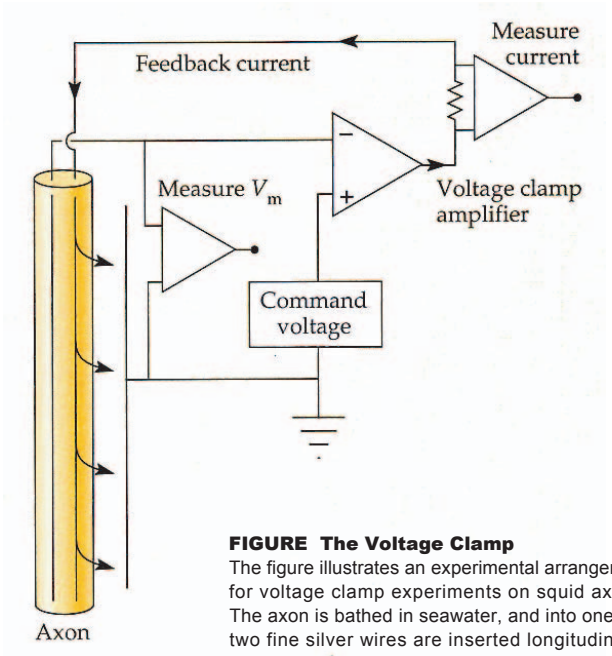

FIGURE The Voltage Clamp
The figure illustrates an experimental arrangement for voltage clamp experiments on squid axons. The axon is bathed in seawater, and into one end two fine silver wires are inserted longitudinally. One of the wires provides a measure of the potential inside the fiber with respect to that of the seawater (which is grounded) or, in other words, a measure of the membrane potential (V_m). It is also connected to one input of the voltage clamp amplifier. The other input is connected to a variable voltage source, which can be set by the person doing the experiment; the value to which it is set is thus known as the **command potential**. The voltage clamp amplifier delivers current from its output whenever there is a voltage difference between the inputs. The output current flows across the cell membrane between the second fine silver wire and the seawater (arrows); it is measured by the voltage drop across a small series resister.

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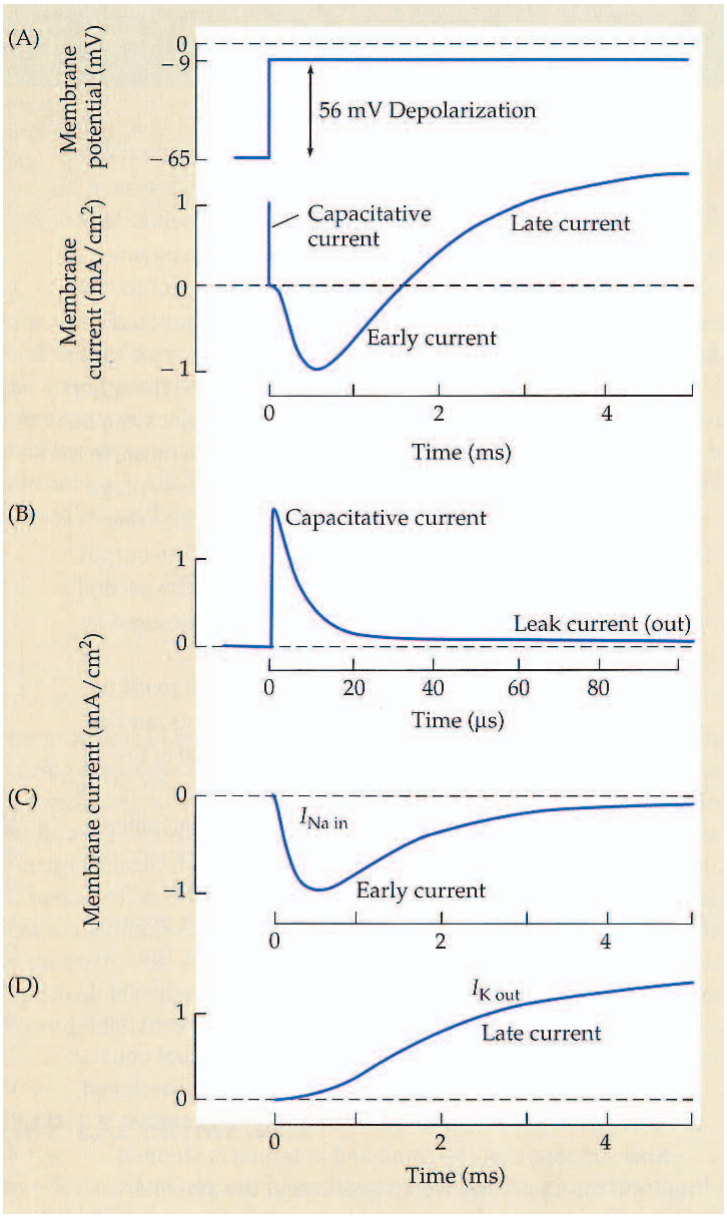

FIGURE 6.3 Membrane Currents produced by depolarization. (A) Currents measured by a voltage clamp during a 56 mV depolarization of a squid axon membrane. The currents (lower trace) consist of a brief positive capacitative current, an early transient phase of inward current, and a late, maintained outward current, These are shown separately in B, C, and D. The capacitative current (B) lasts for only a few microseconds (note the change in timescale). The small outward leak current is due to the movement of potassium and chloride. The early inward current (C) is due to sodium entry, the late outward current (D) to potassium movement out of the fiber.