Nerve Impulse Conduction and Electrocardiograms

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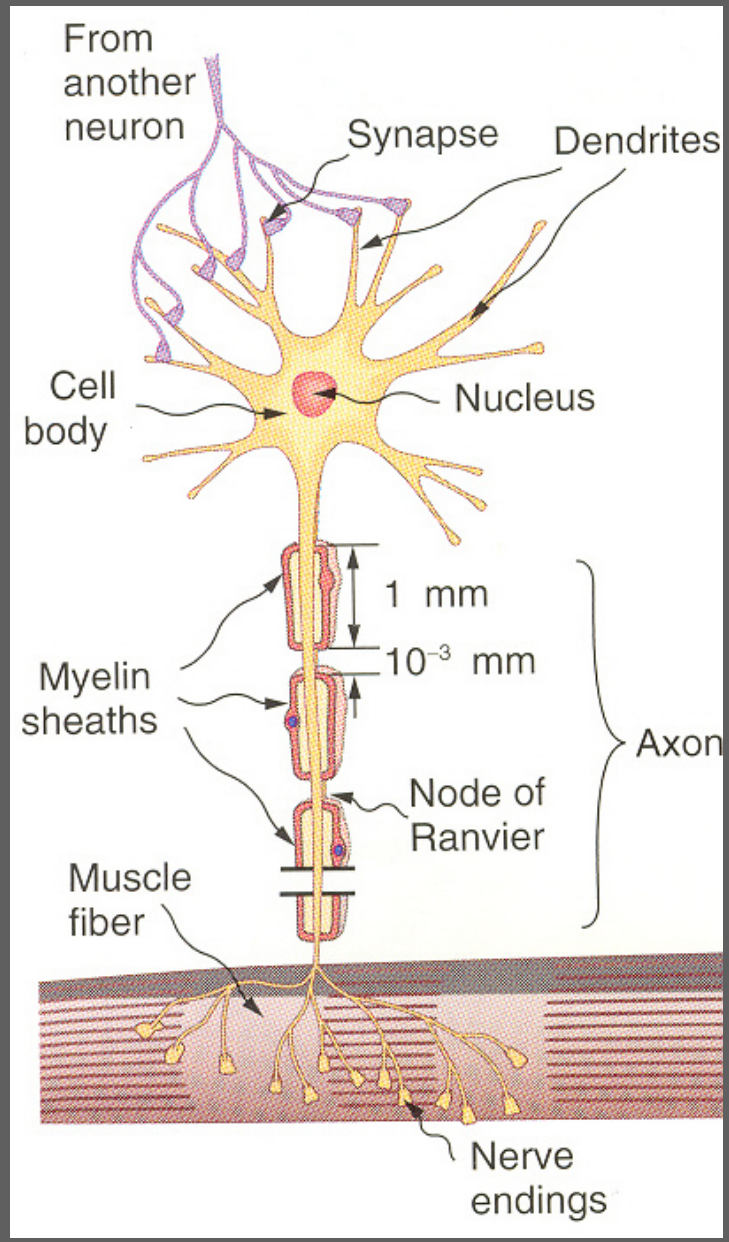
University of Rochester

Reference and source of photos:

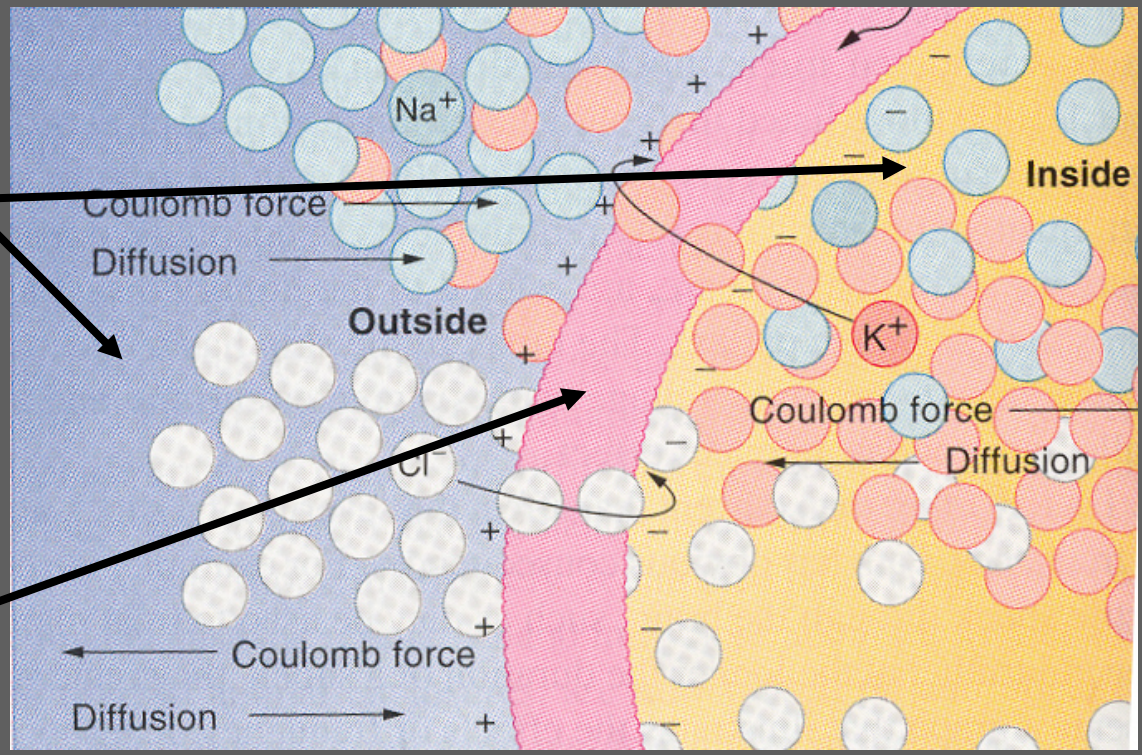
***College Physics* by Paul Peter Urone, 2nd ed., Brooks/Cole, 2001.**

Nerve cells (neurons) receive “electric signals” through dendrites and pass the signal on through the axon



Electrically neutral, but different, fluids

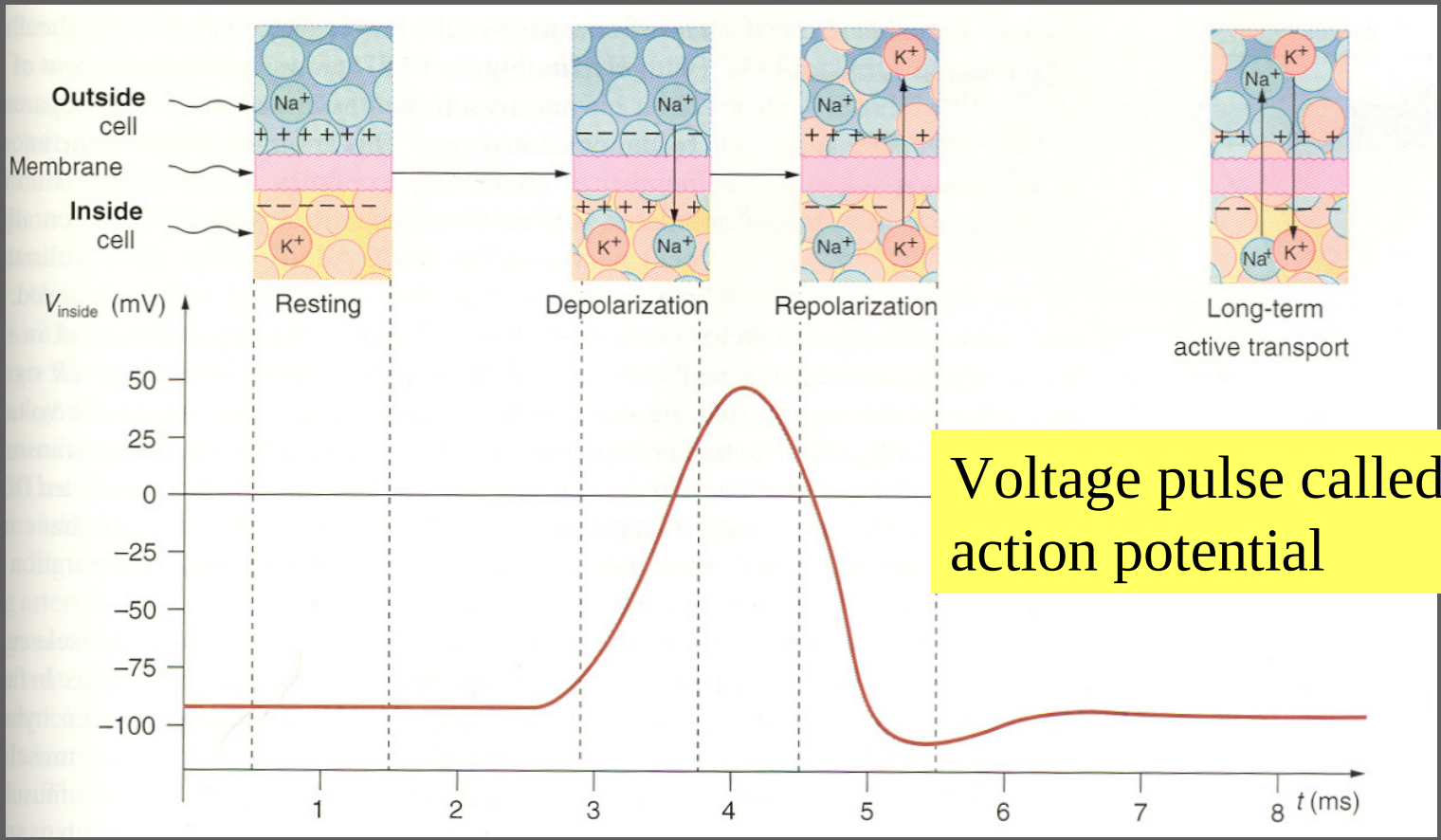
Semipermeable membrane: at rest K+ and Cl- can cross, Na+ cannot



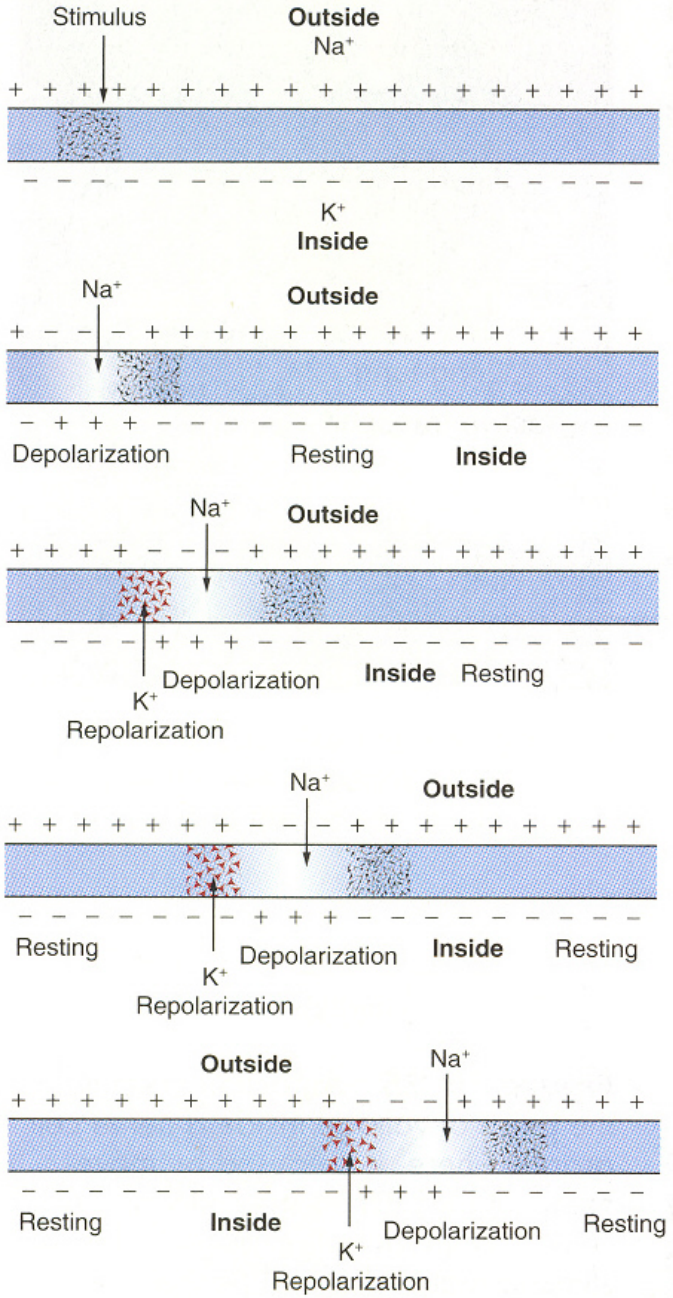
Diffusion of K+ and Cl- creates a charge separation (and a potential difference) across the membrane, until it is shut off by the Coulomb force

70-90 mV difference, 8 nm wall means E is huge!

A stimulus causes the cell membrane to become permeable to Na+ momentarily. Some Na+ rushes in and causes depolarization, which in turn, shuts off the permeability to Na+. Then repolarization occurs.

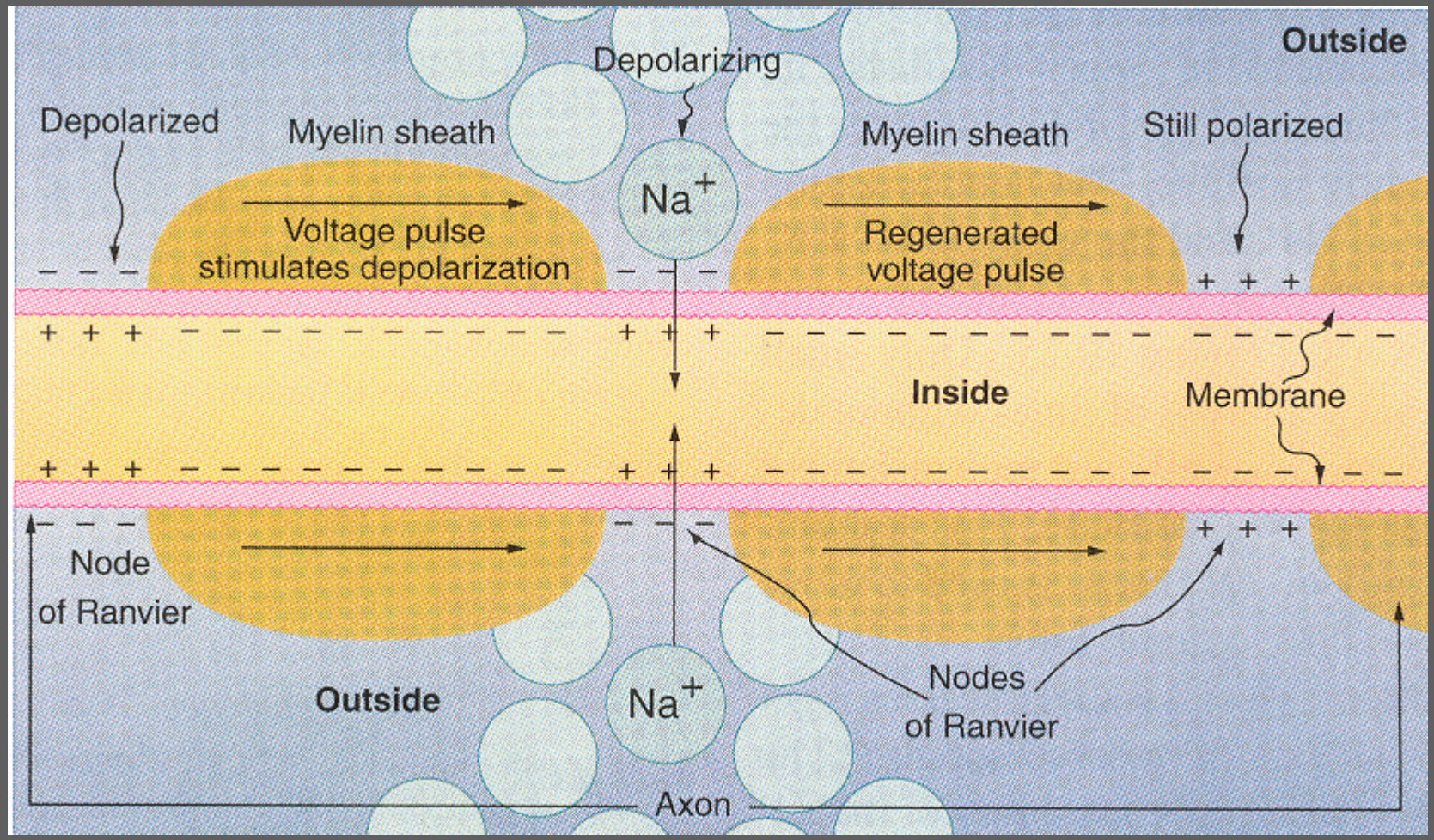


Voltage pulse called the action potential



The changing voltage and electric fields provide the stimulus to adjacent cell walls

The pulse travels about 1 m/s along the cell wall



Myelenated axons transmit the nerve impulse faster, acting like a conductor between gaps where the voltage impulse is regenerated.

A depolarization wave can move across muscle cells, and does in the heart. You can detect the changes in potential caused by this depolarization wave by using conductors placed on the body. This is called an electrocardiogram