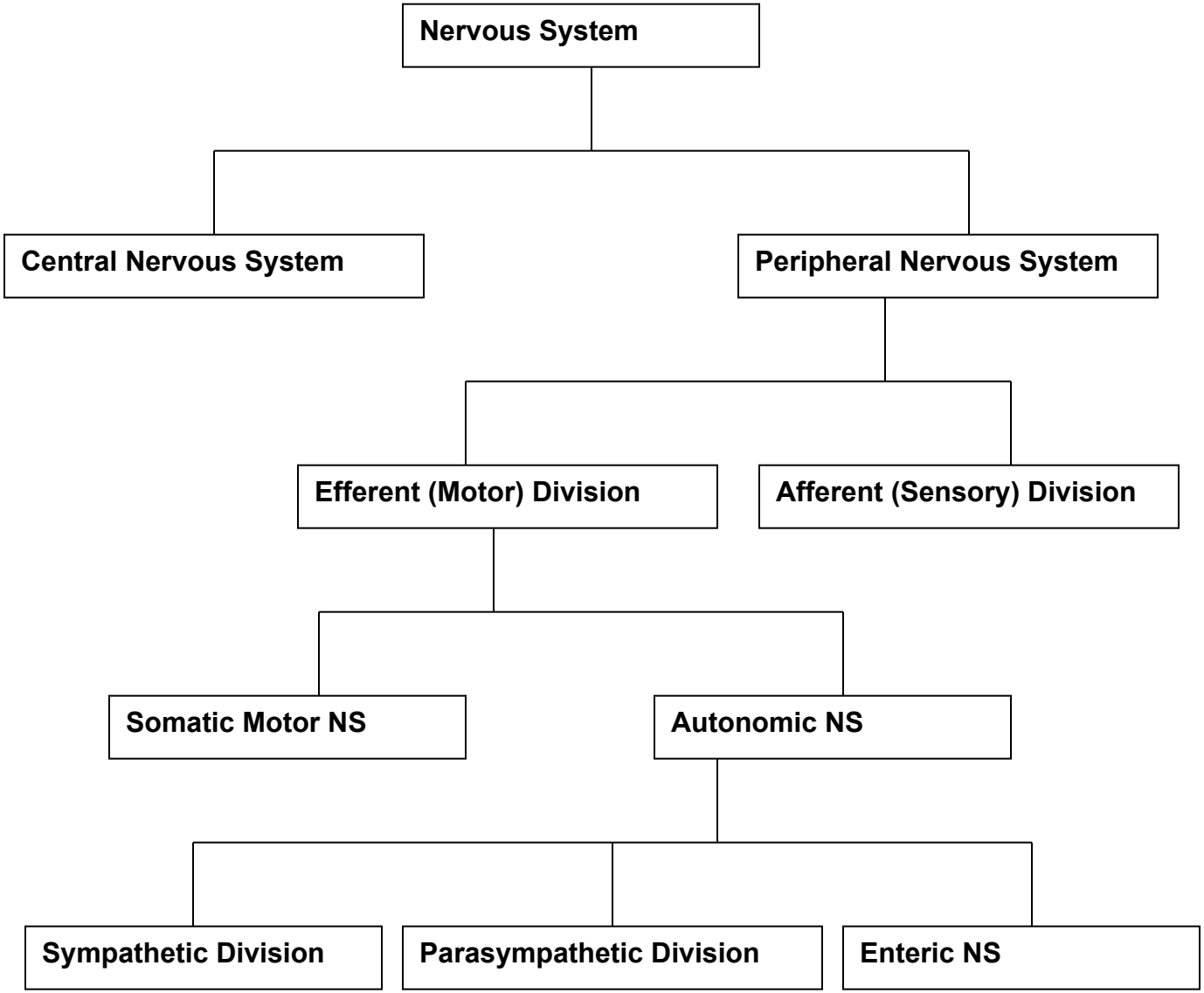


Figure 8-1

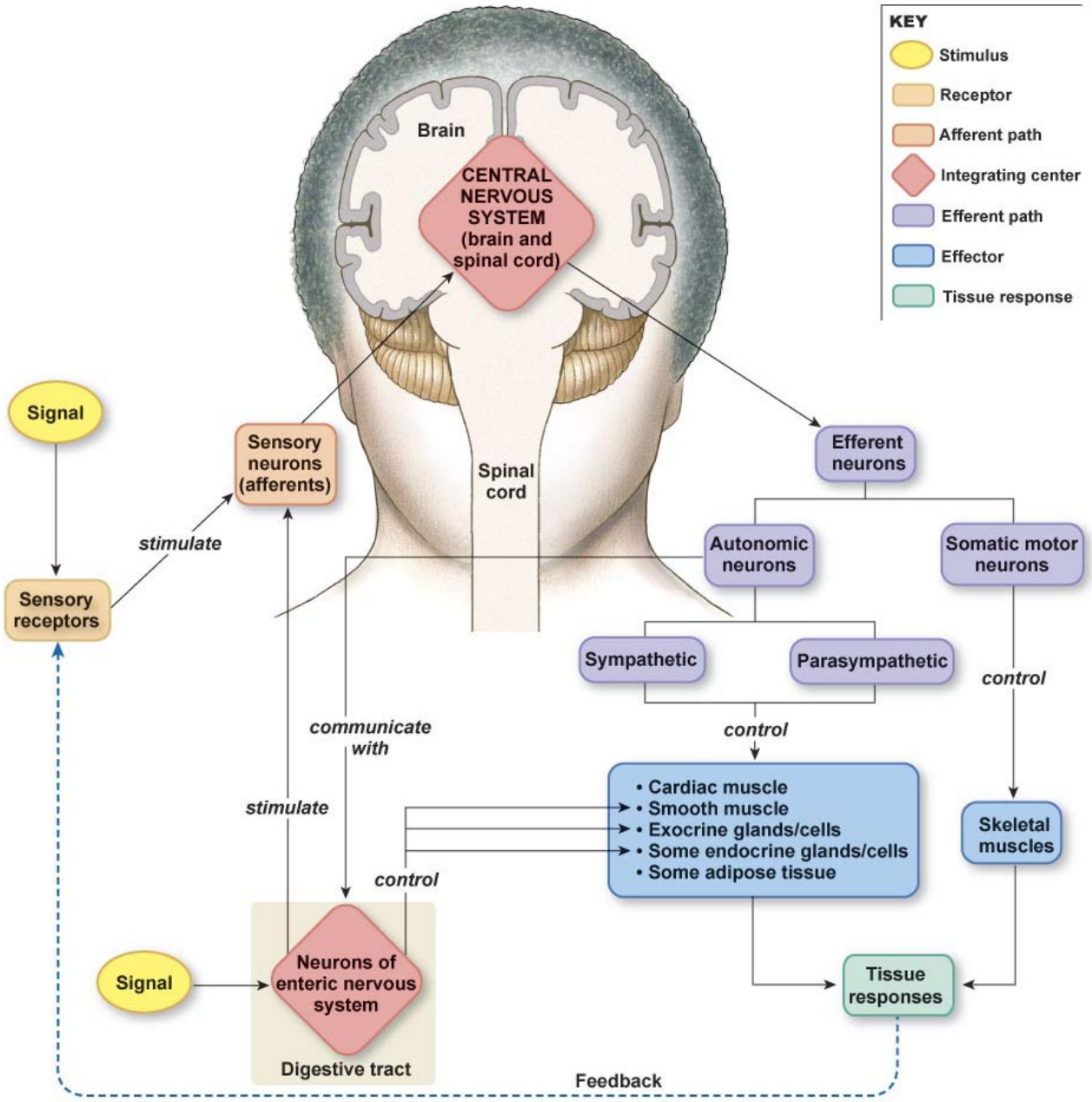


Figure 8-2

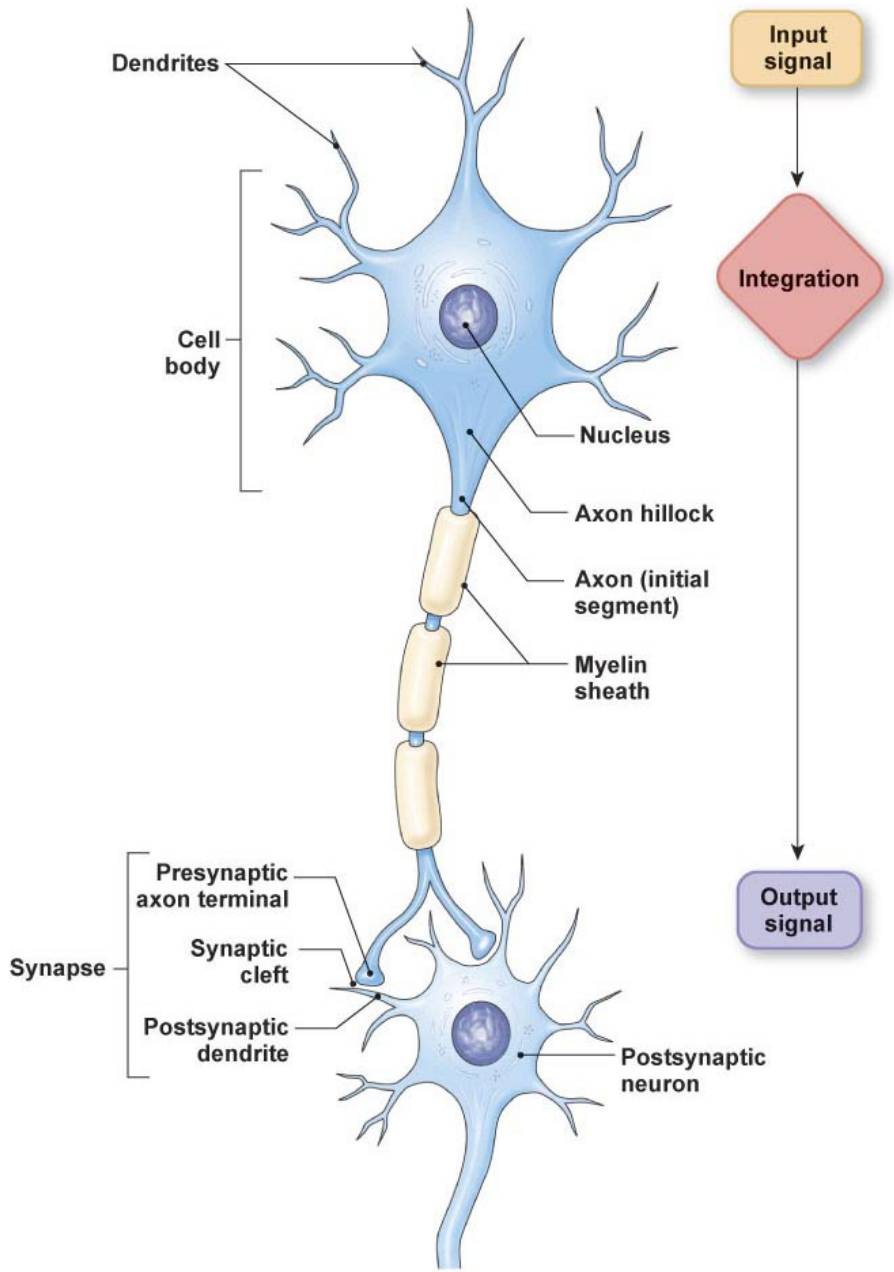


Figure 8-3

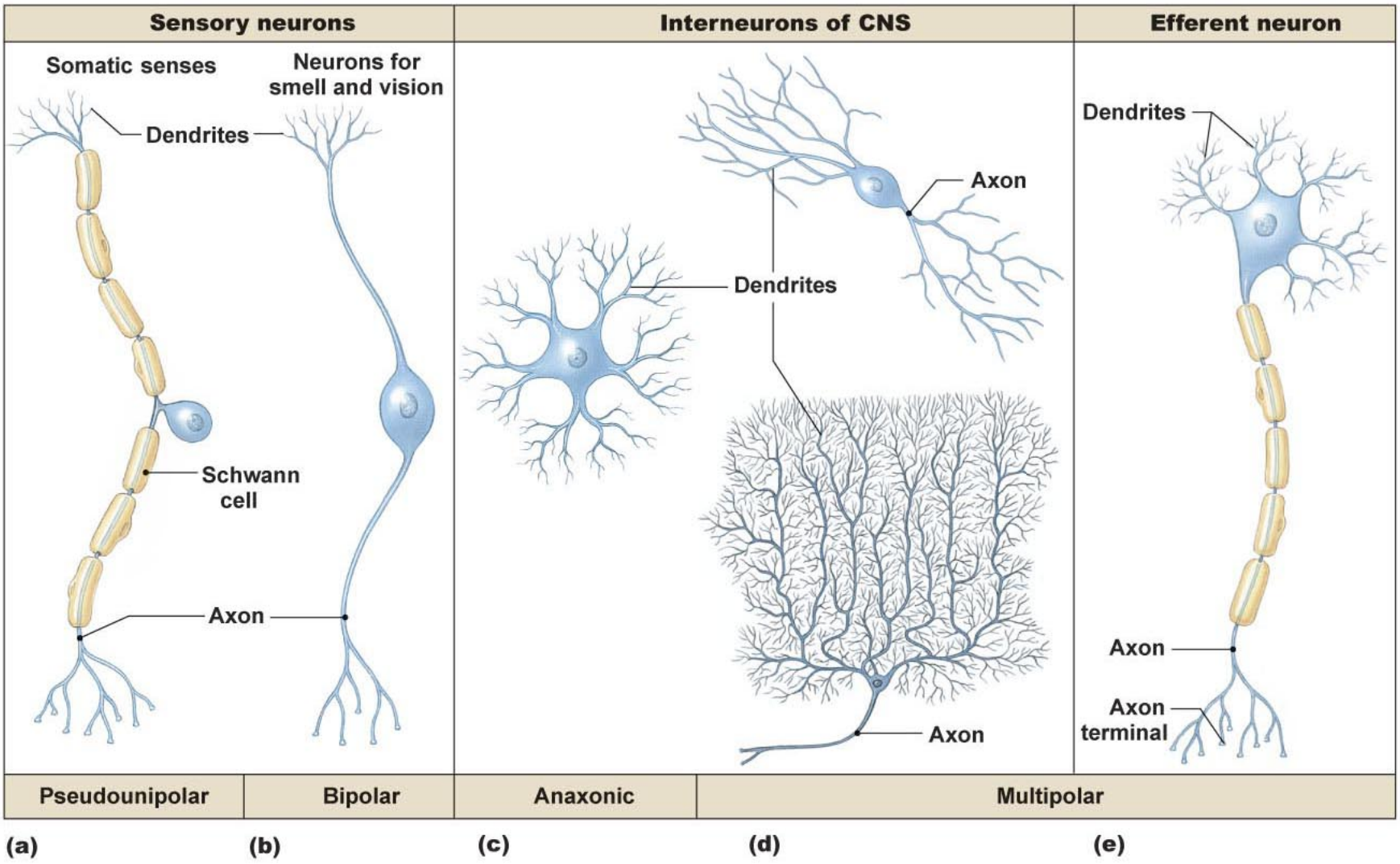


Figure 8-4

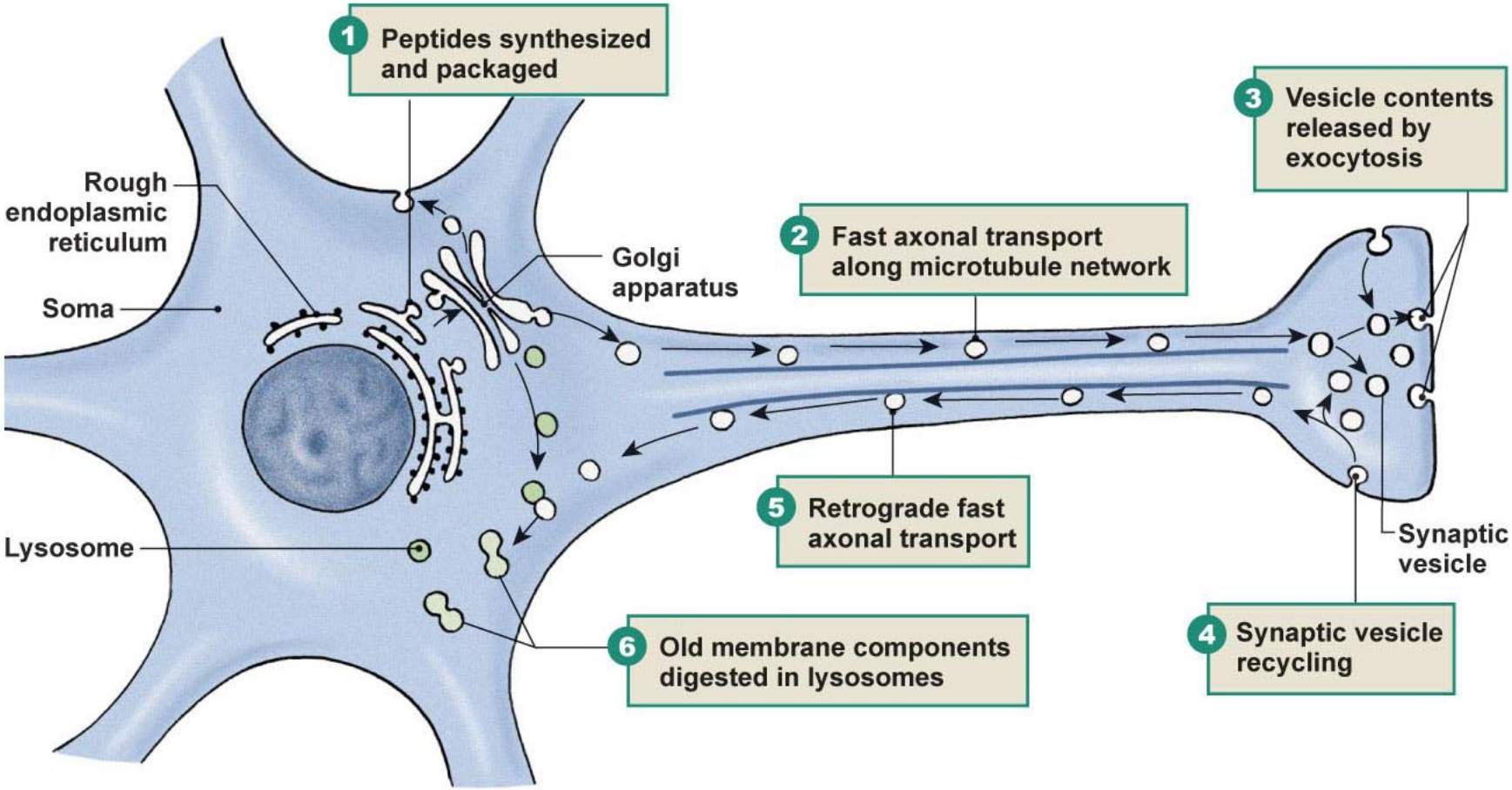
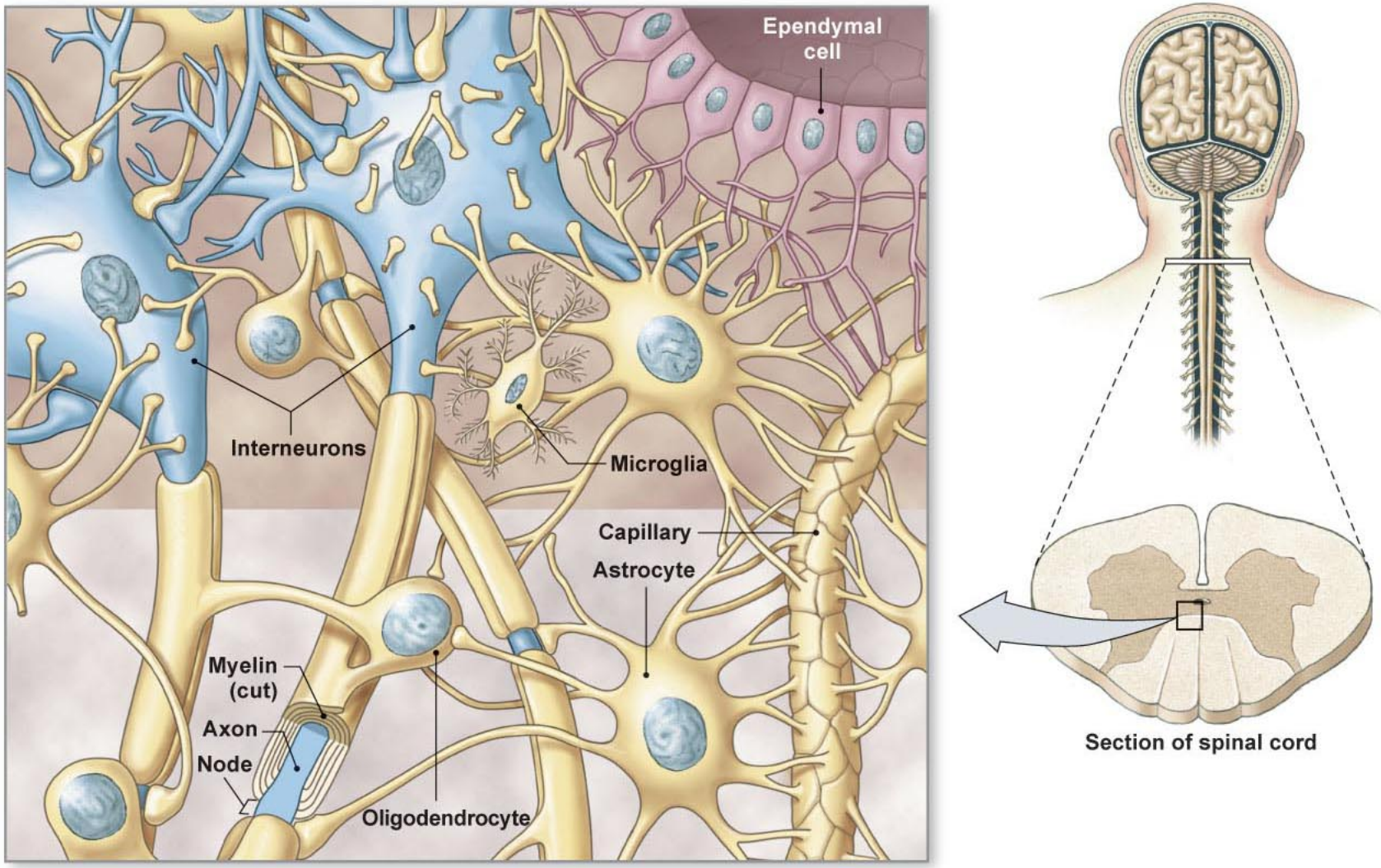
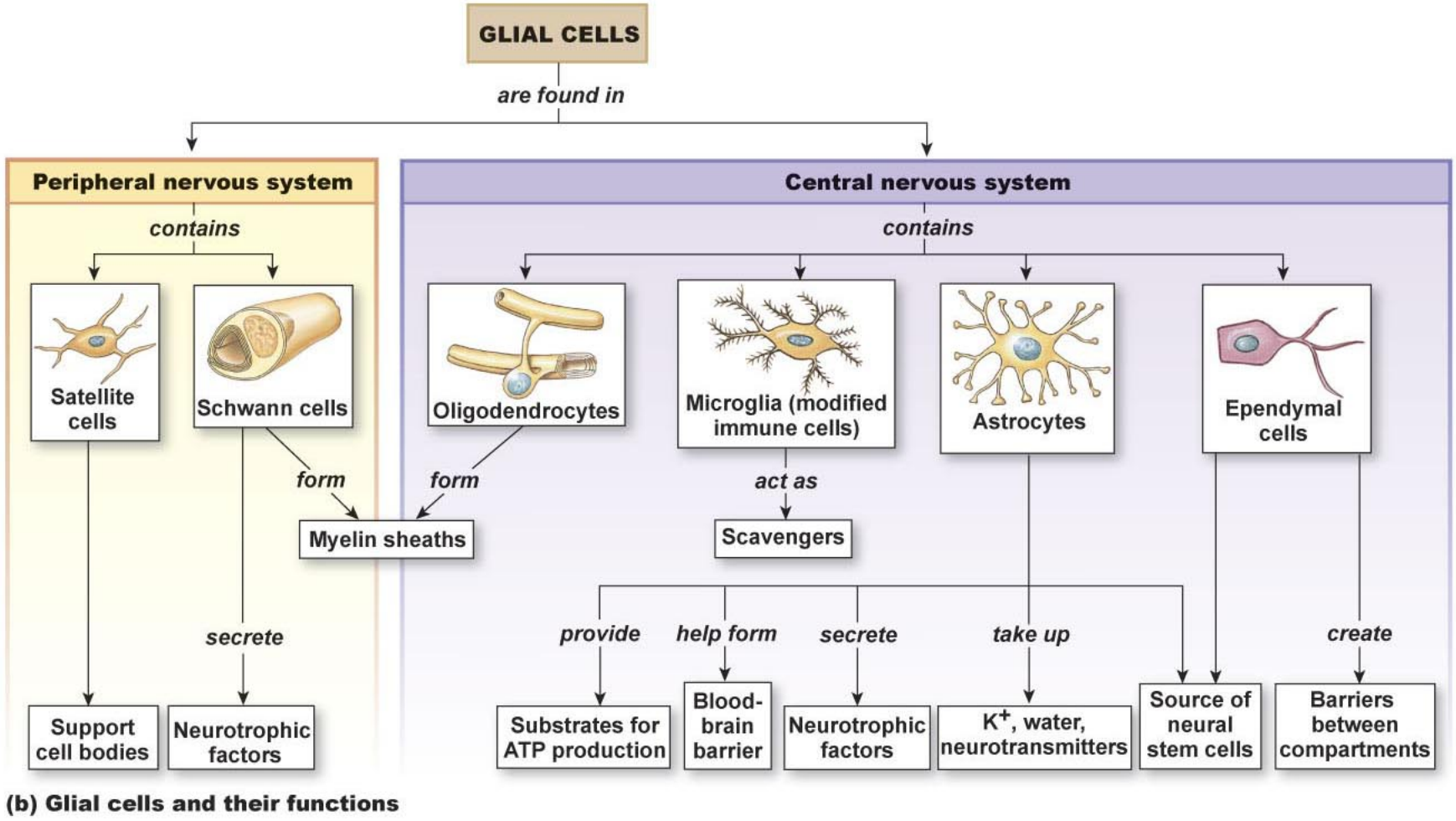


Figure 8-5a, overview



(a) Glial cells of the central nervous system

Figure 8-5b, overview



(b) Glial cells and their functions

Figure 8-6

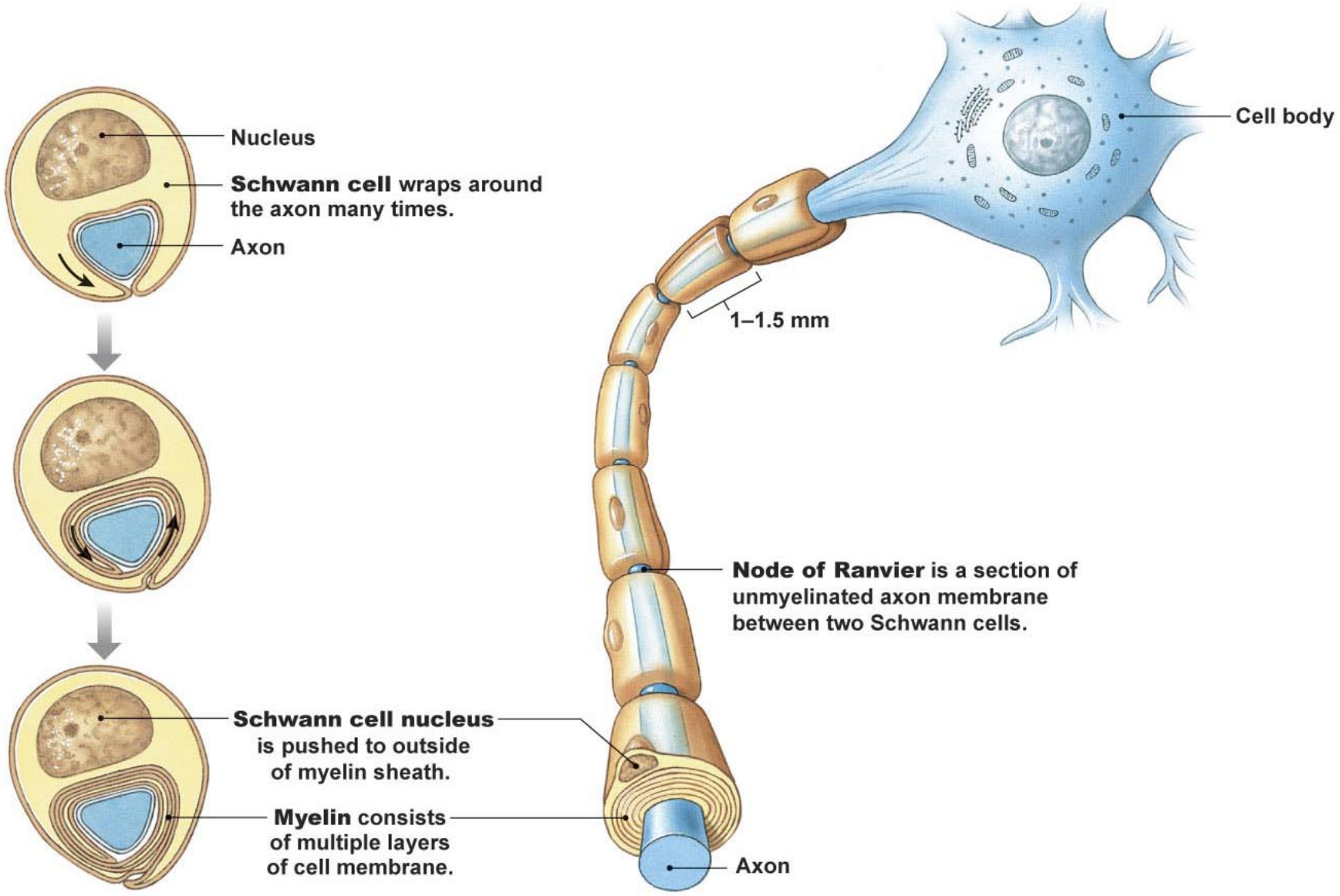


Table 8-2

TABLE 8-2 Ion Concentrations and Equilibrium Potentials

ION	EXTRACELLULAR FLUID (mM)	INTRACELLULAR FLUID (mM)	E_{ion} AT 37° C
K^+	5 mM (normal range: 3.5–5)	150 mM	−90 mV
Na^+	145 mM (normal range: 135–145)	15 mM	+60 mV
Cl^-	108 mM (normal range: 100–108)	10 mM (range: 5–15)	−63 mV
Ca^{2+}	1 mM	0.0001 mM	see Concept Check question 6

Table 8-3

TABLE 8-3 Comparison of Graded Potential and Action Potential in Neurons

	GRADED POTENTIAL	ACTION POTENTIAL
Type of signal	Input signal	Regenerating conduction signal
Occurs where?	Usually dendrites and cell body	Trigger zone through axon
Types of gated ion channels involved	Mechanically, chemically, or voltage-gated channels	Voltage-gated channels
Ions involved	Usually Na^+, Cl^-, Ca^{2+}	Na^+ and K^+
Type of signal	Depolarizing (e.g., Na^+) or hyperpolarizing (e.g., Cl^-)	Depolarizing
Strength of signal	Depends on initial stimulus; can be summed	All-or-none phenomenon; cannot be summed
What initiates the signal?	Entry of ions through channels	Above-threshold graded potential at the trigger zone
Unique characteristics	No minimum level required to initiate	Threshold stimulus required to initiate
	Two signals coming close together in time will sum	Refractory period: two signals too close together in time cannot sum
	Initial stimulus strength is indicated by frequency of a series of action potentials	

Figure 5-33

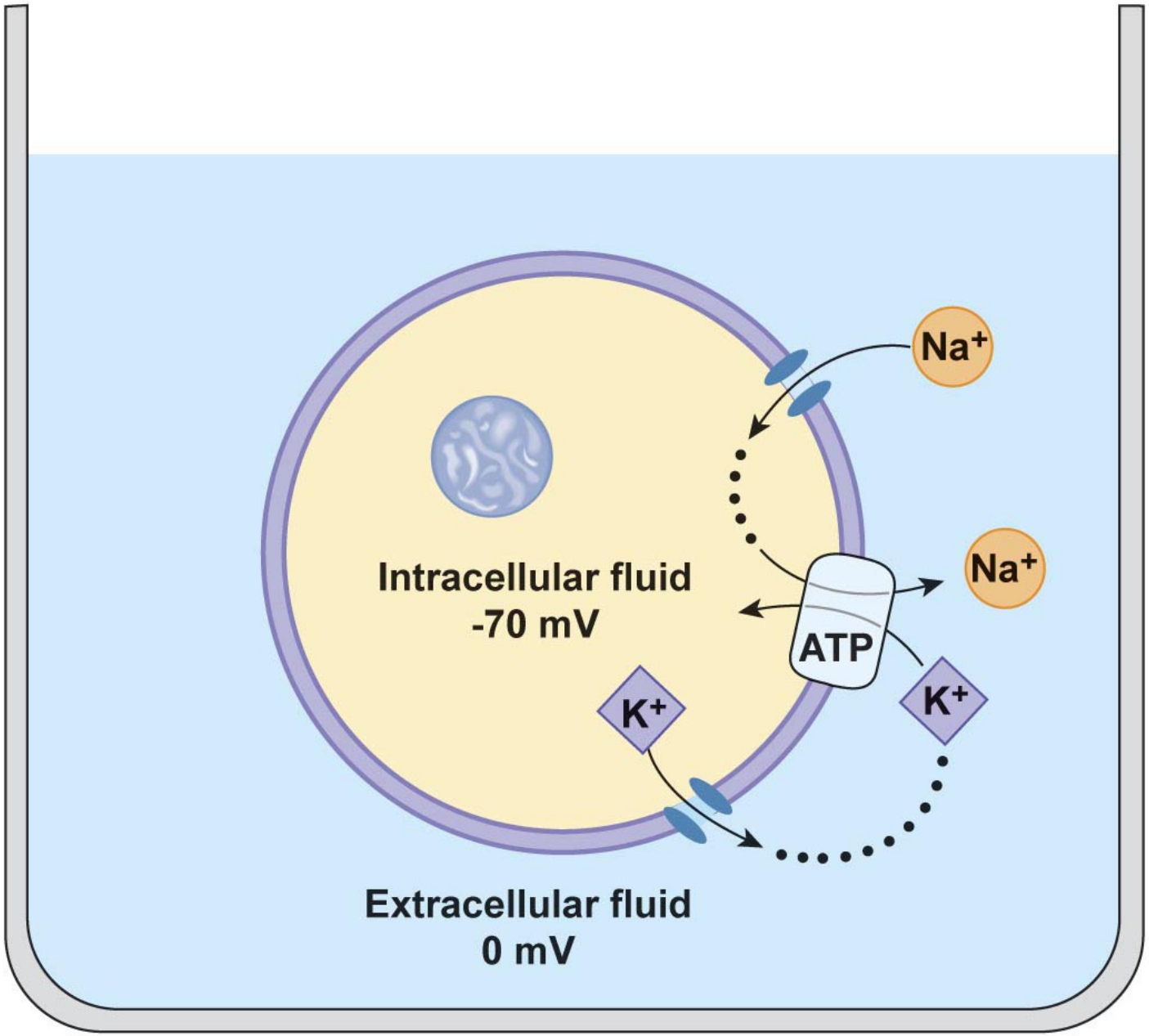


Figure 5-34

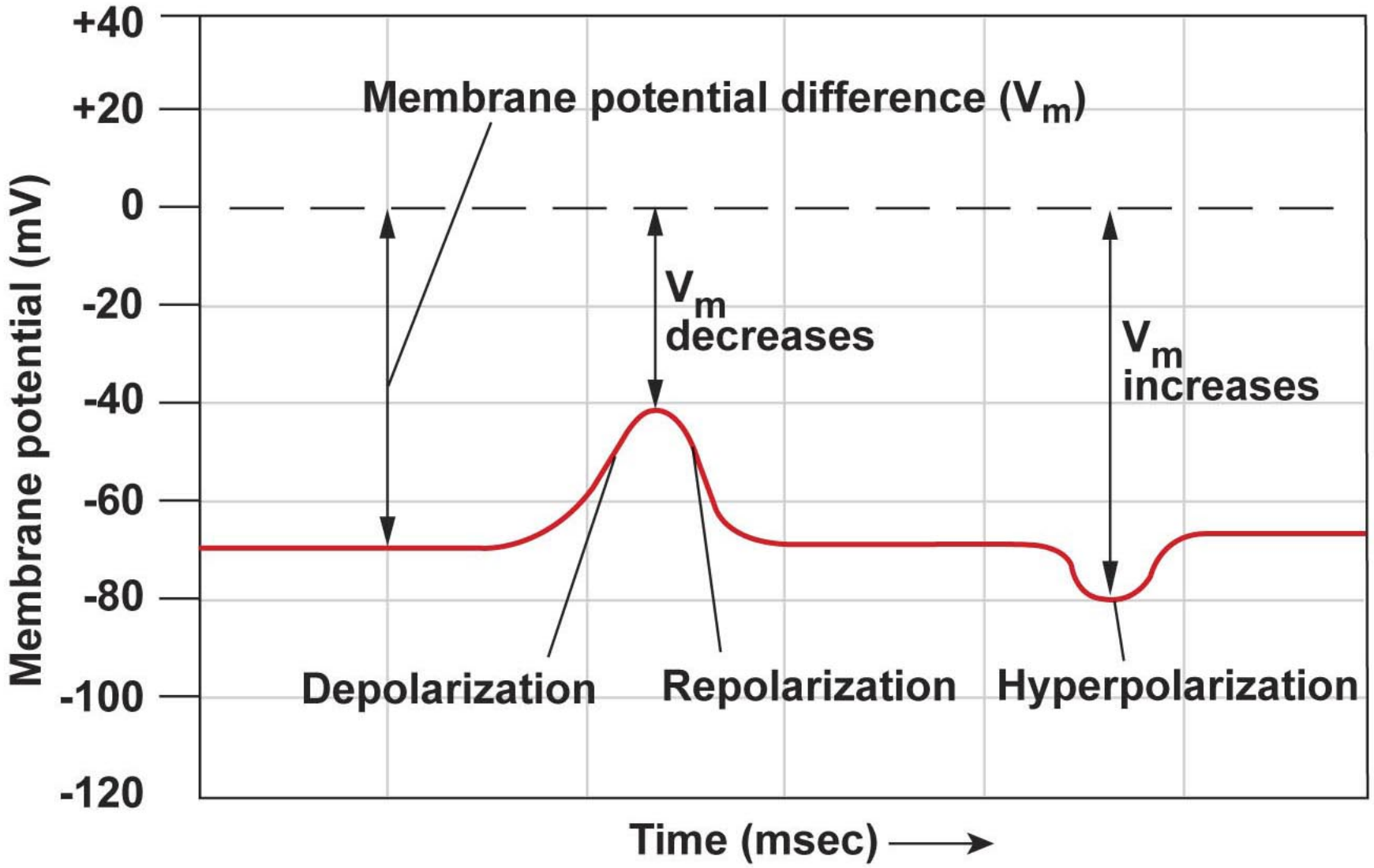


Figure 8-7

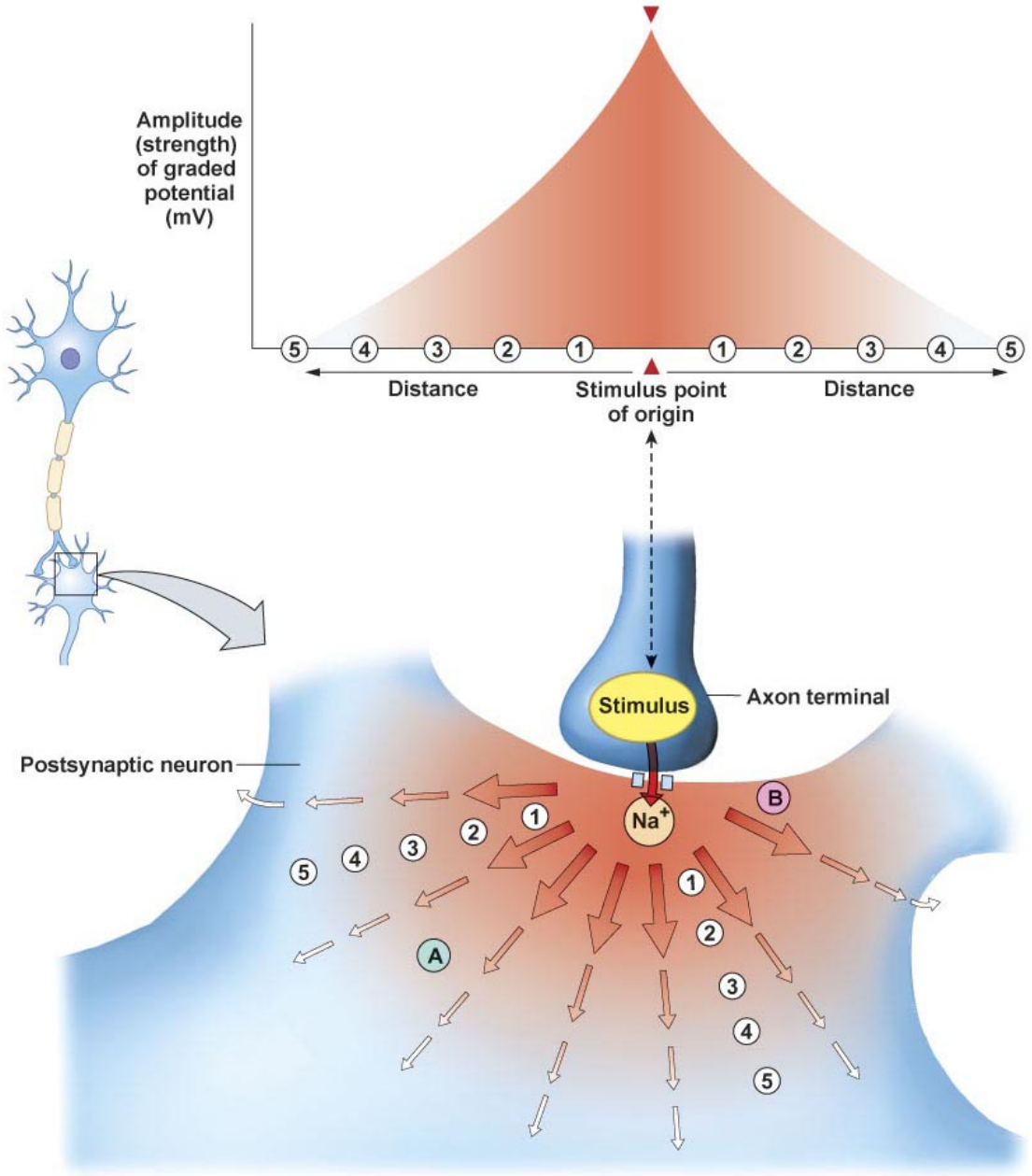


Figure 8-8

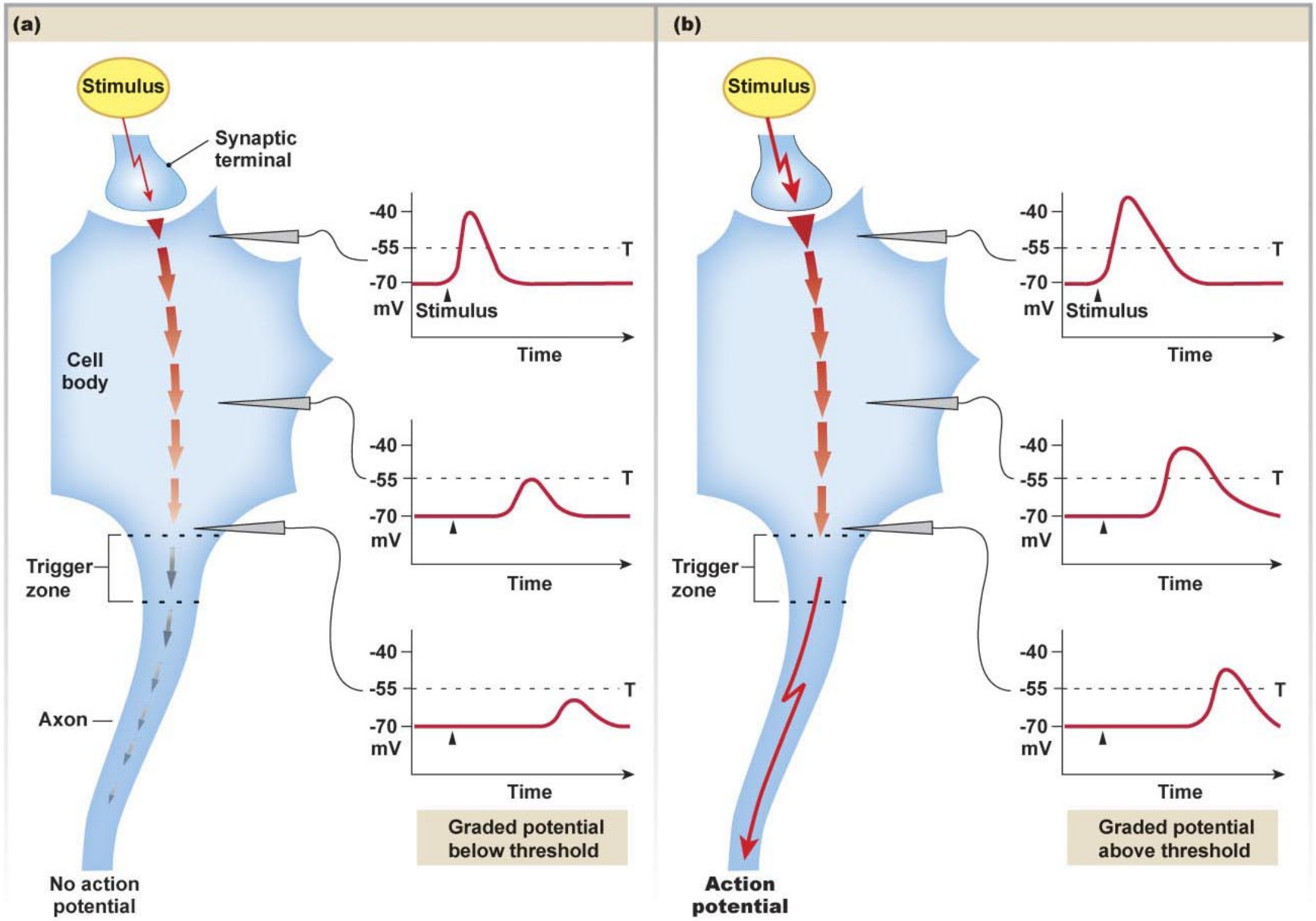


Figure 8-9, overview

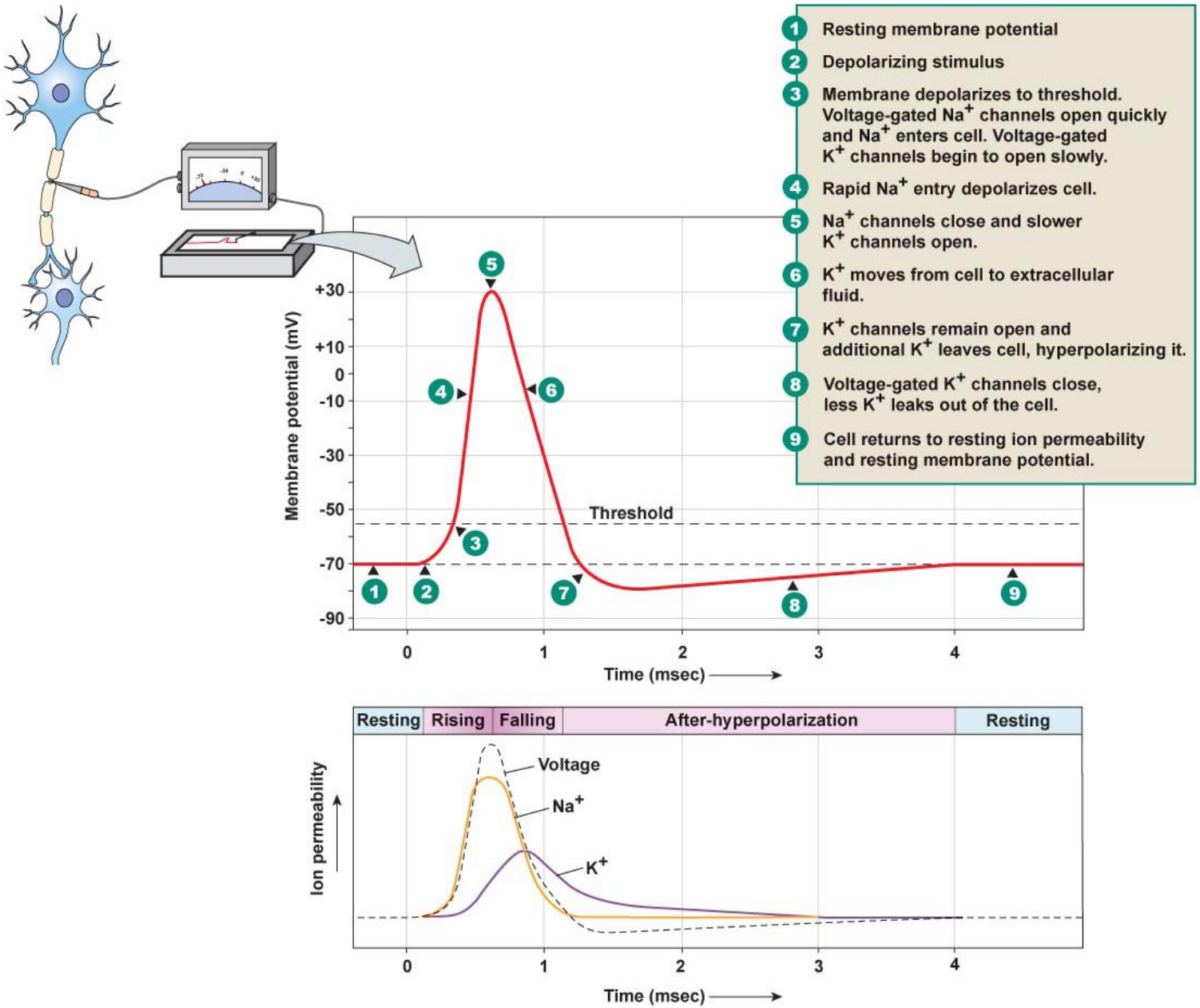
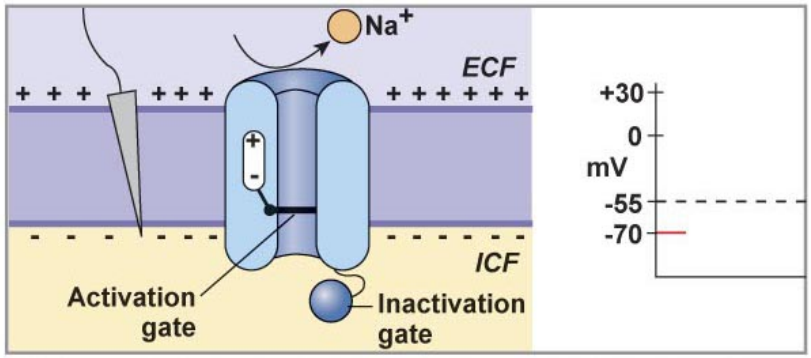
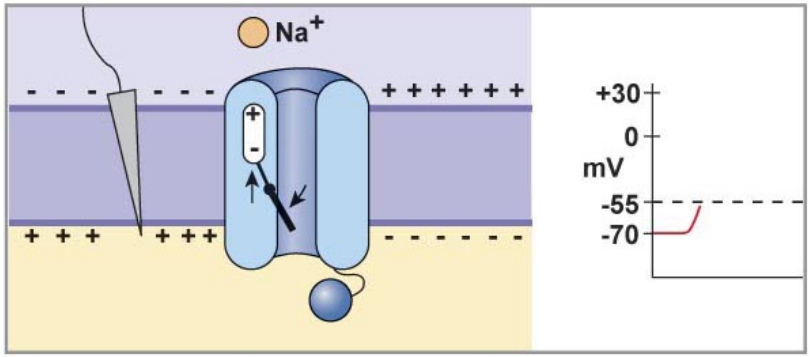


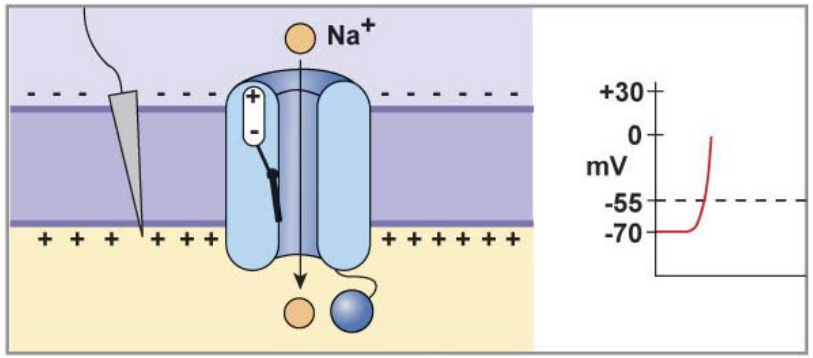
Figure 8-10



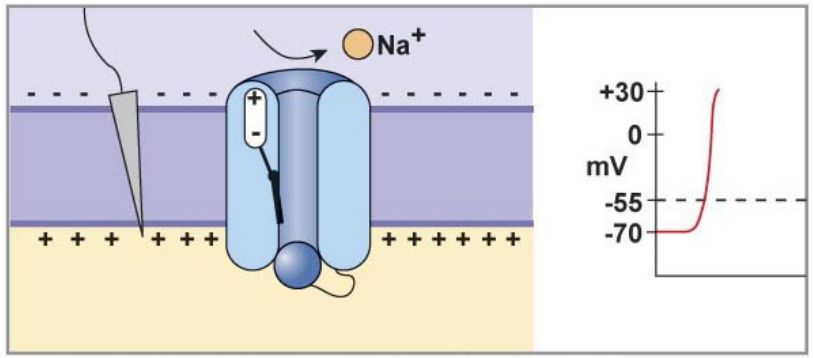
(a) At the resting membrane potential, the activation gate closes the channel.



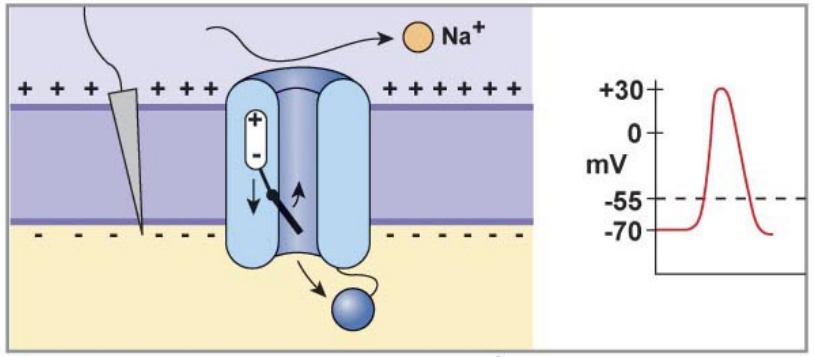
(b) Depolarizing stimulus arrives at the channel. Activation gate opens.



(c) With activation gate open, Na^+ enters the cell.



(d) Inactivation gate closes and Na^+ entry stops.



(e) During repolarization caused by K^+ leaving the cell, the two gates reset to their original positions.

Figure 8-11

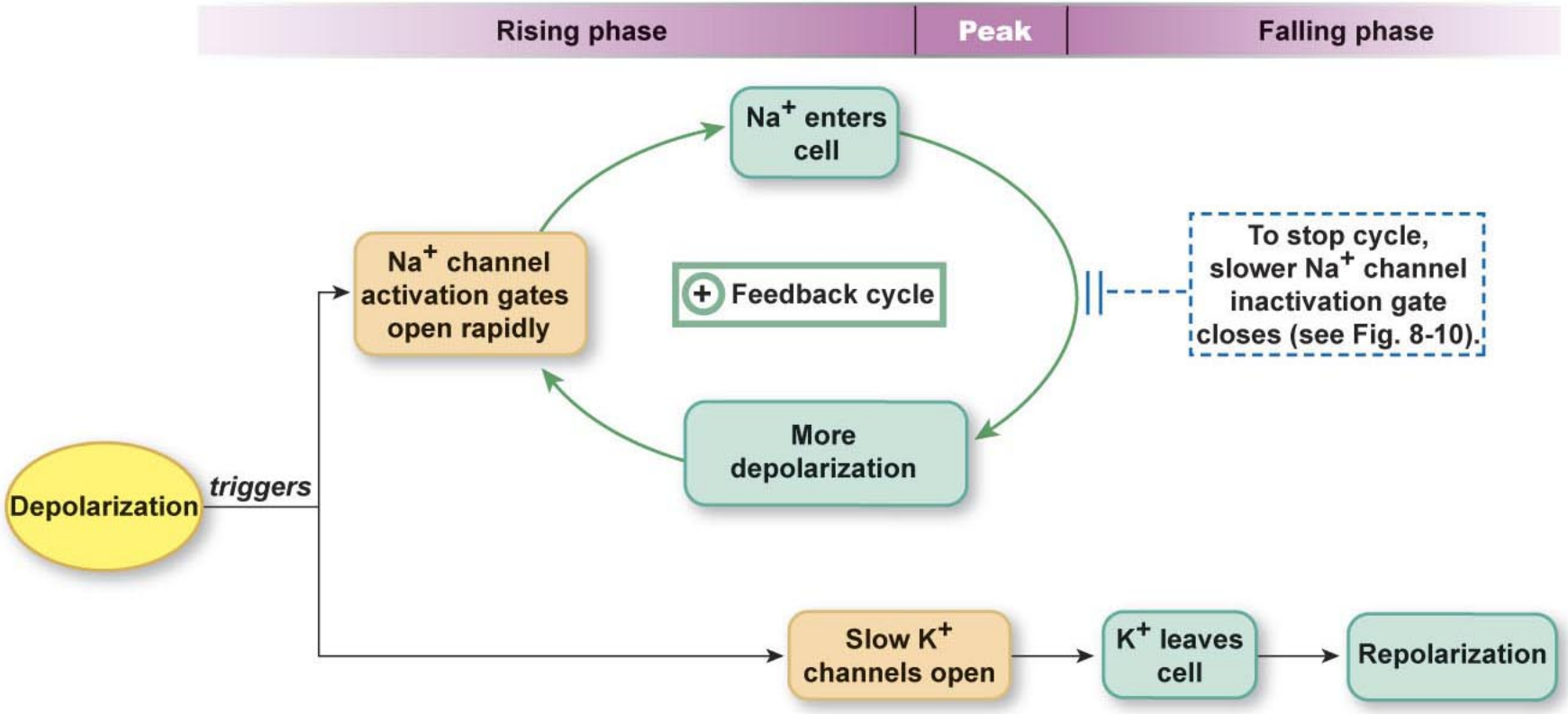


Figure 8-12

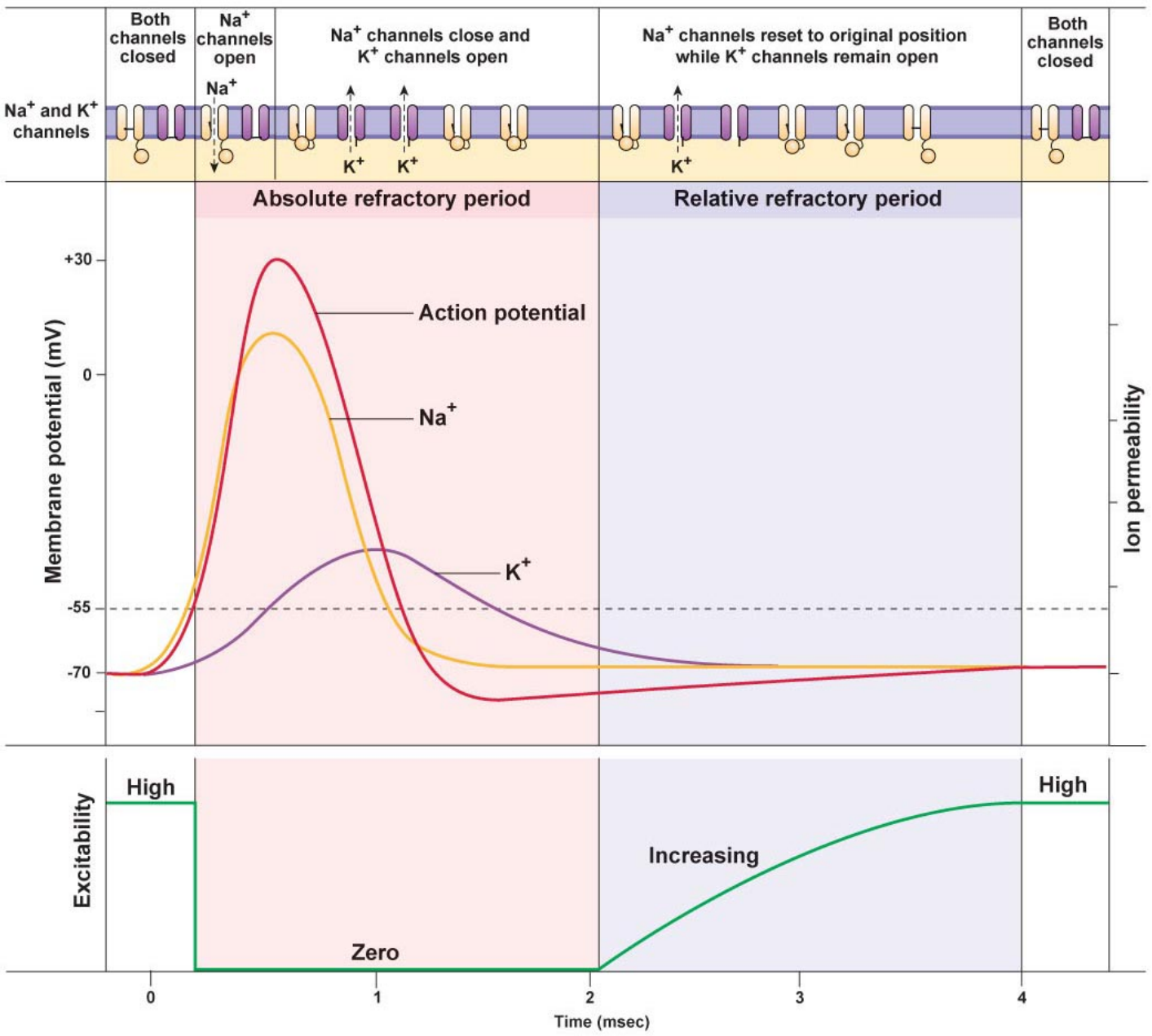


Figure 8-13

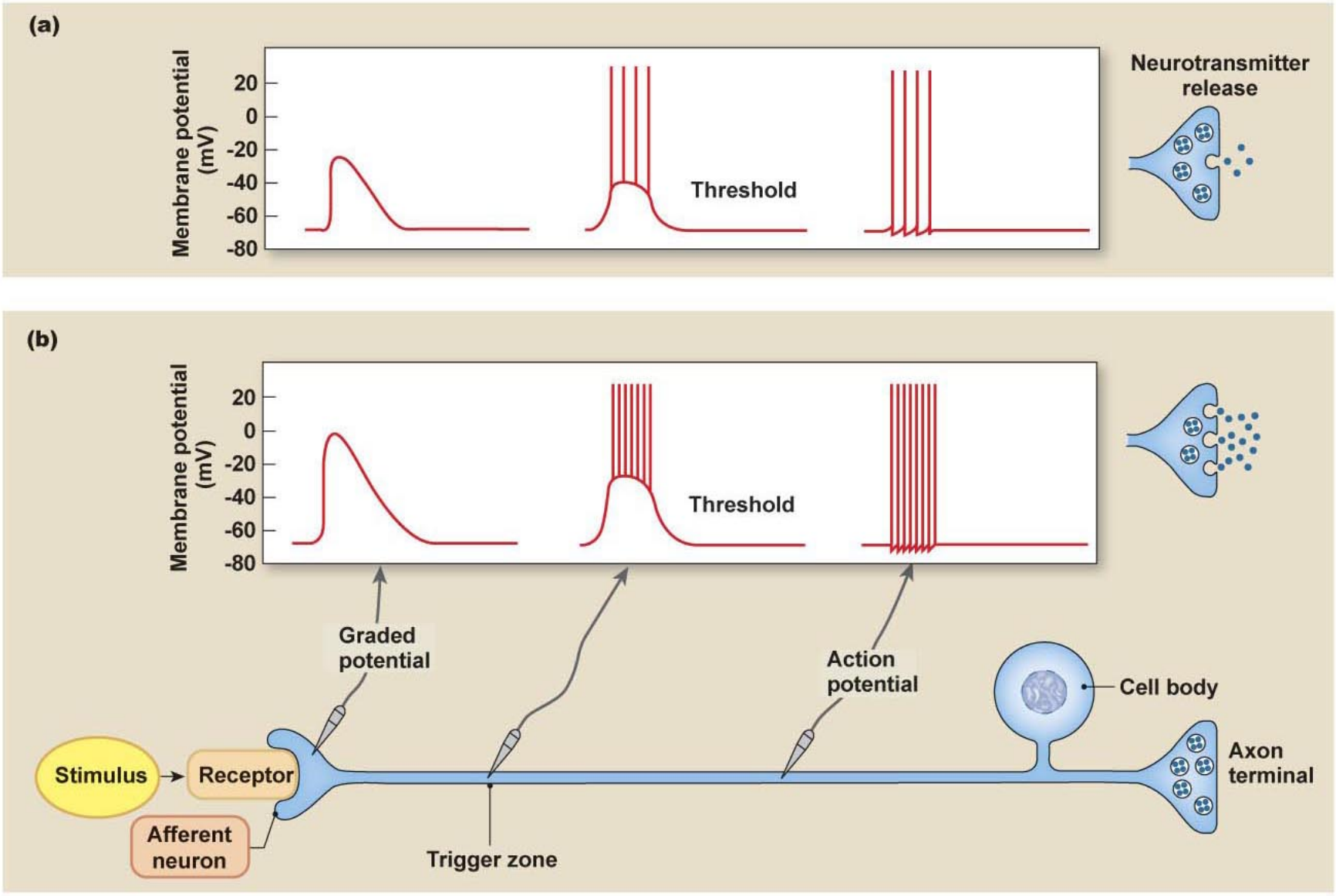


Figure 8-14

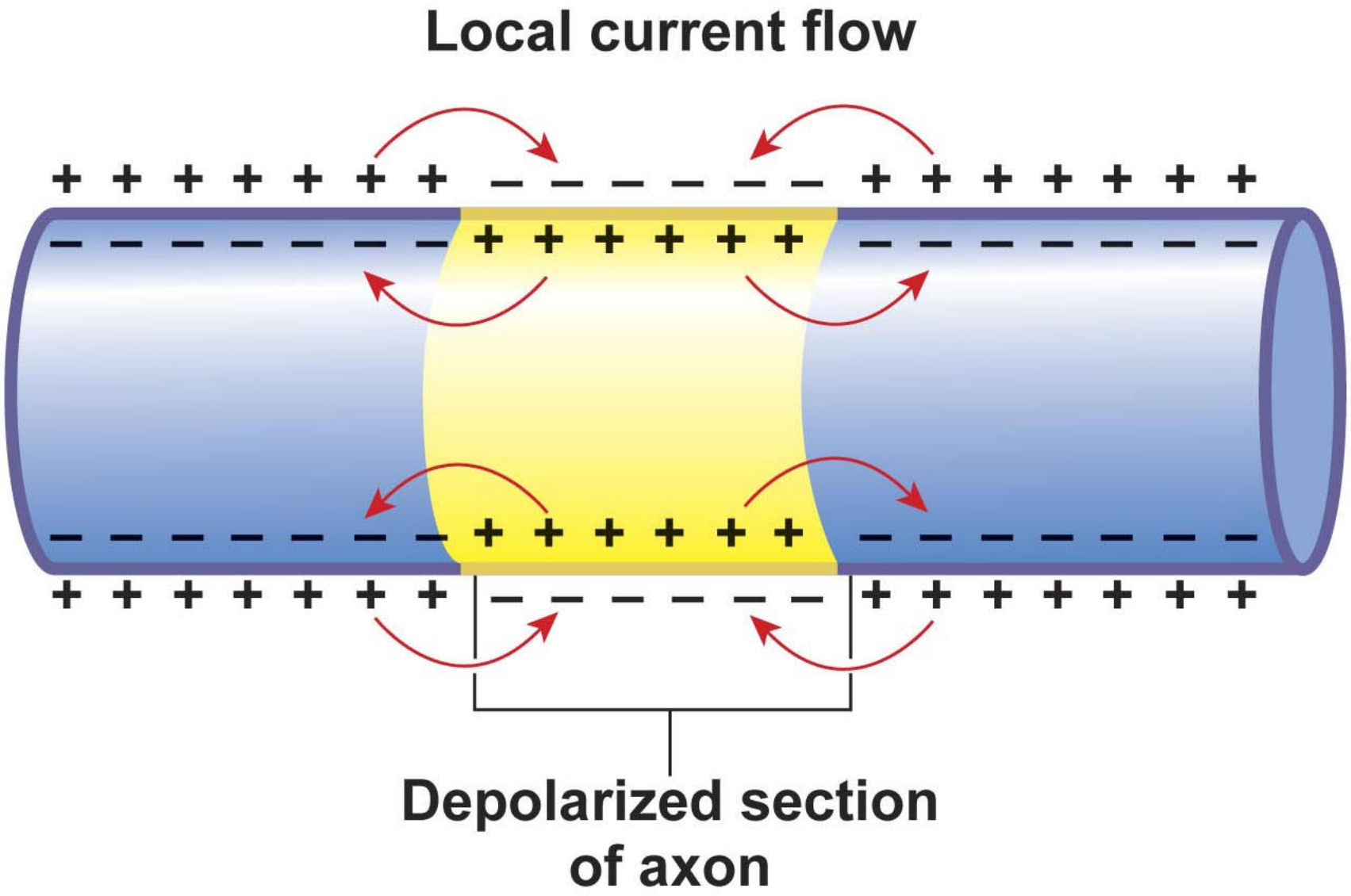


Figure 8-15, overview

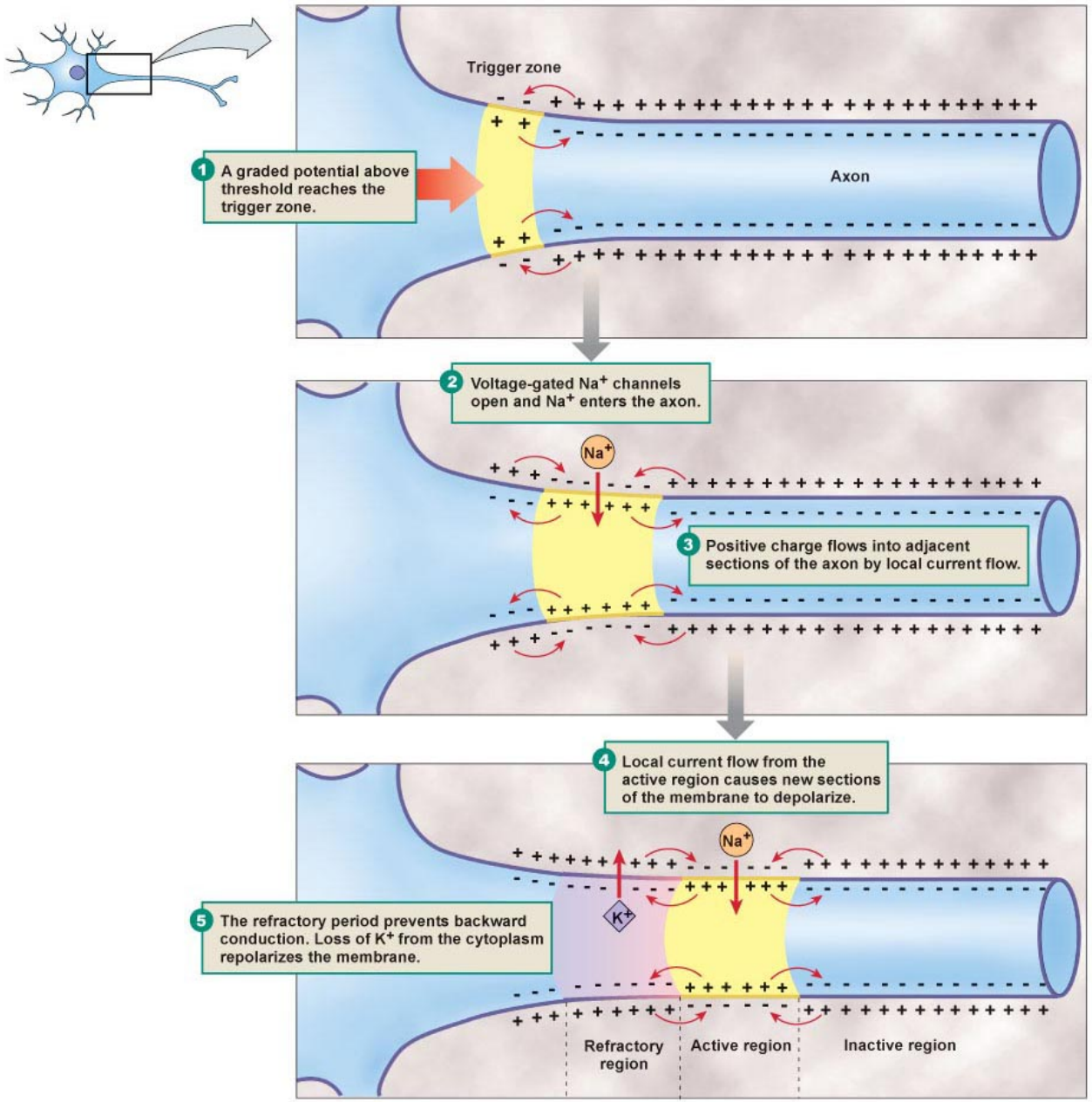


Figure 8-16a-b

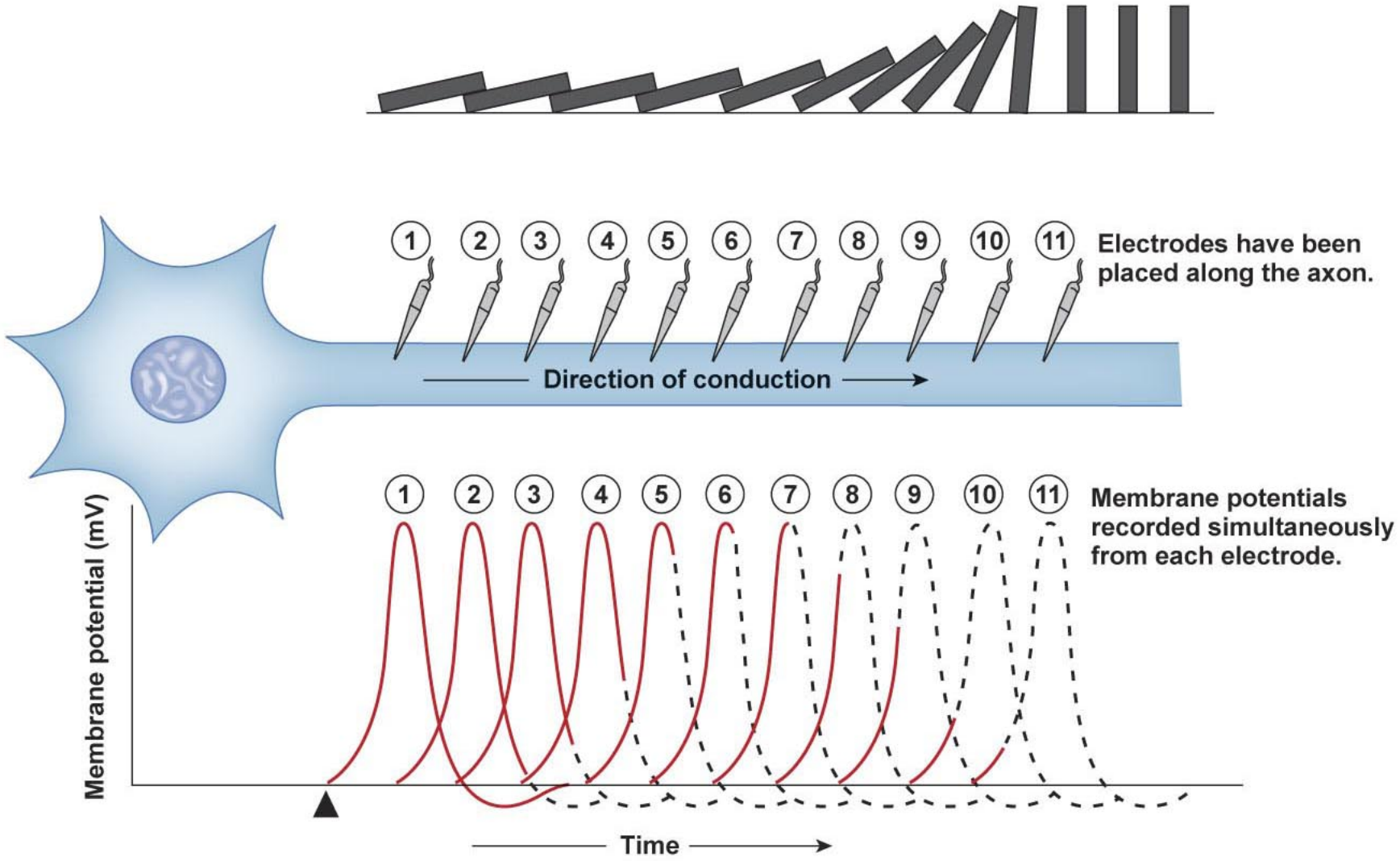
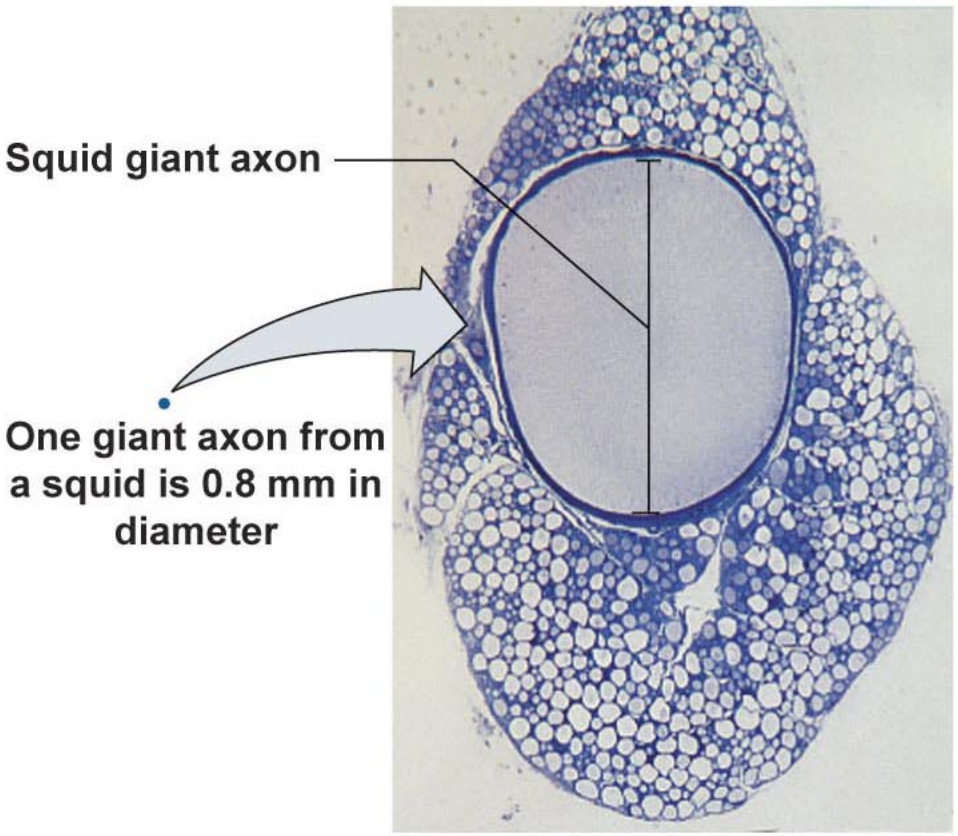


Figure 8-17



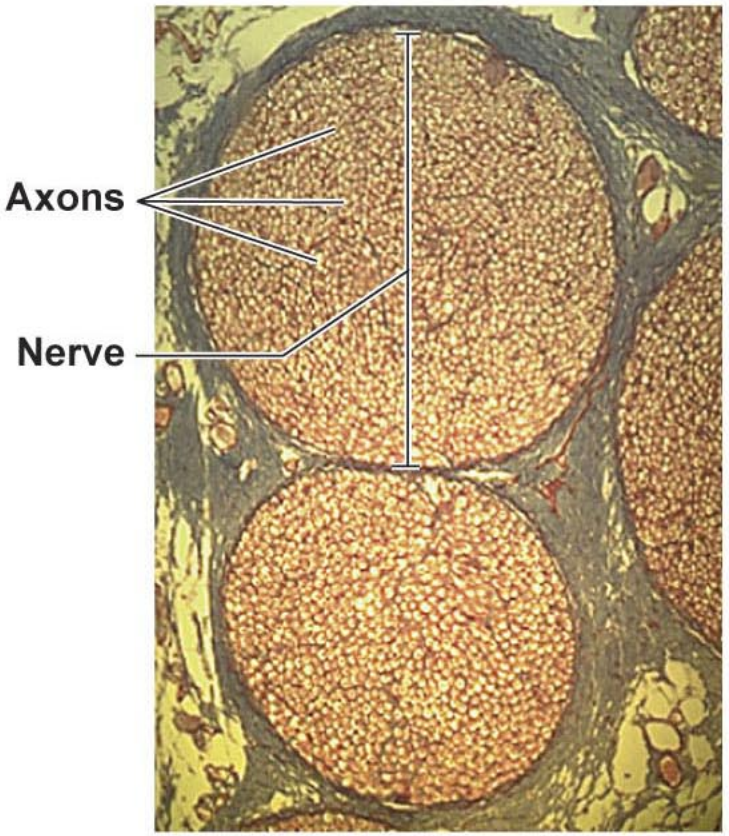
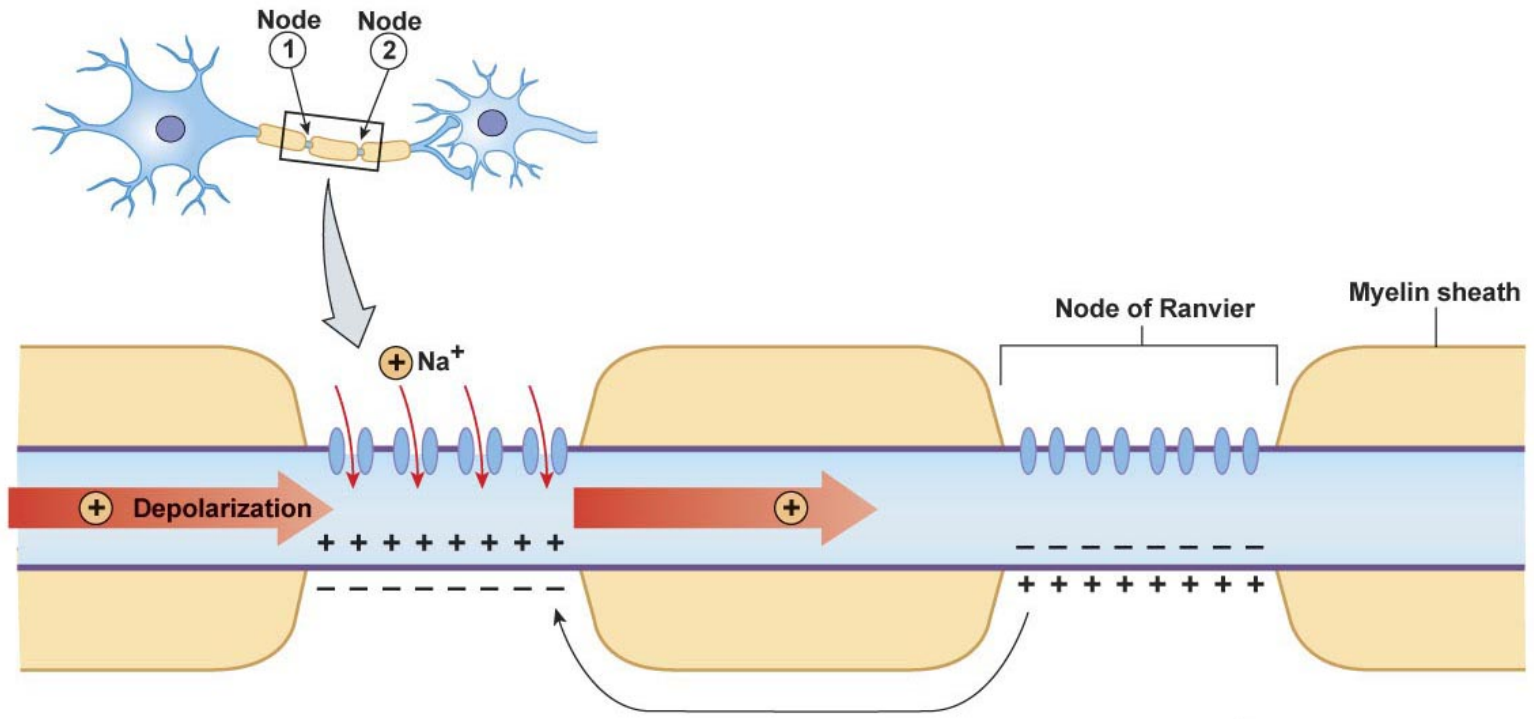
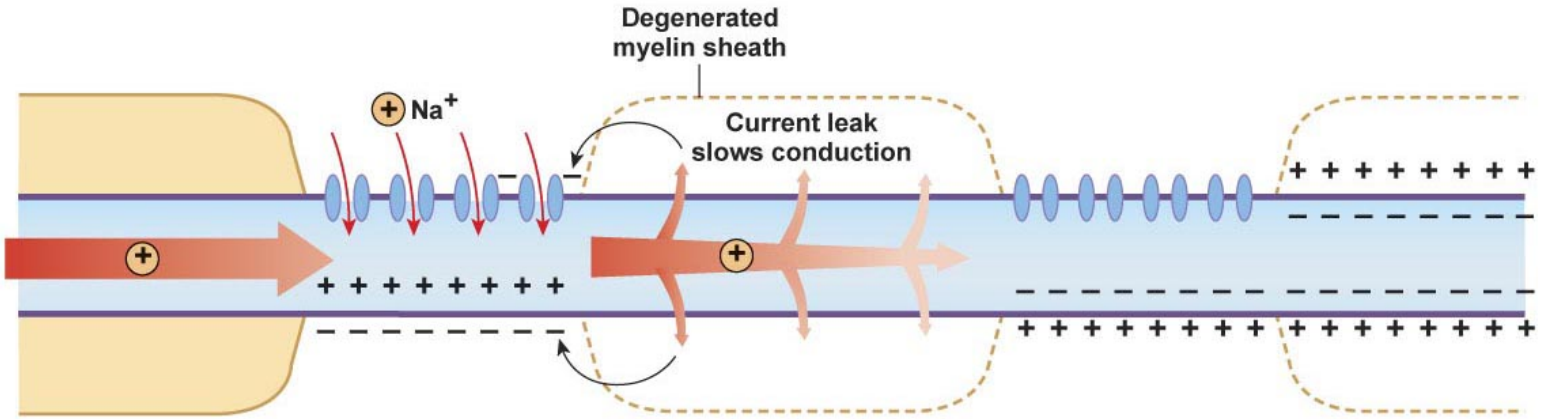


Figure 8-18



(a) Action potentials appear to jump from one node of Ranvier to the next. Only the nodes have Na^+ voltage-gated channels.



(b) In demyelinating diseases, conduction slows when current leaks out of the previously insulated regions between the nodes.

Figure 8-20

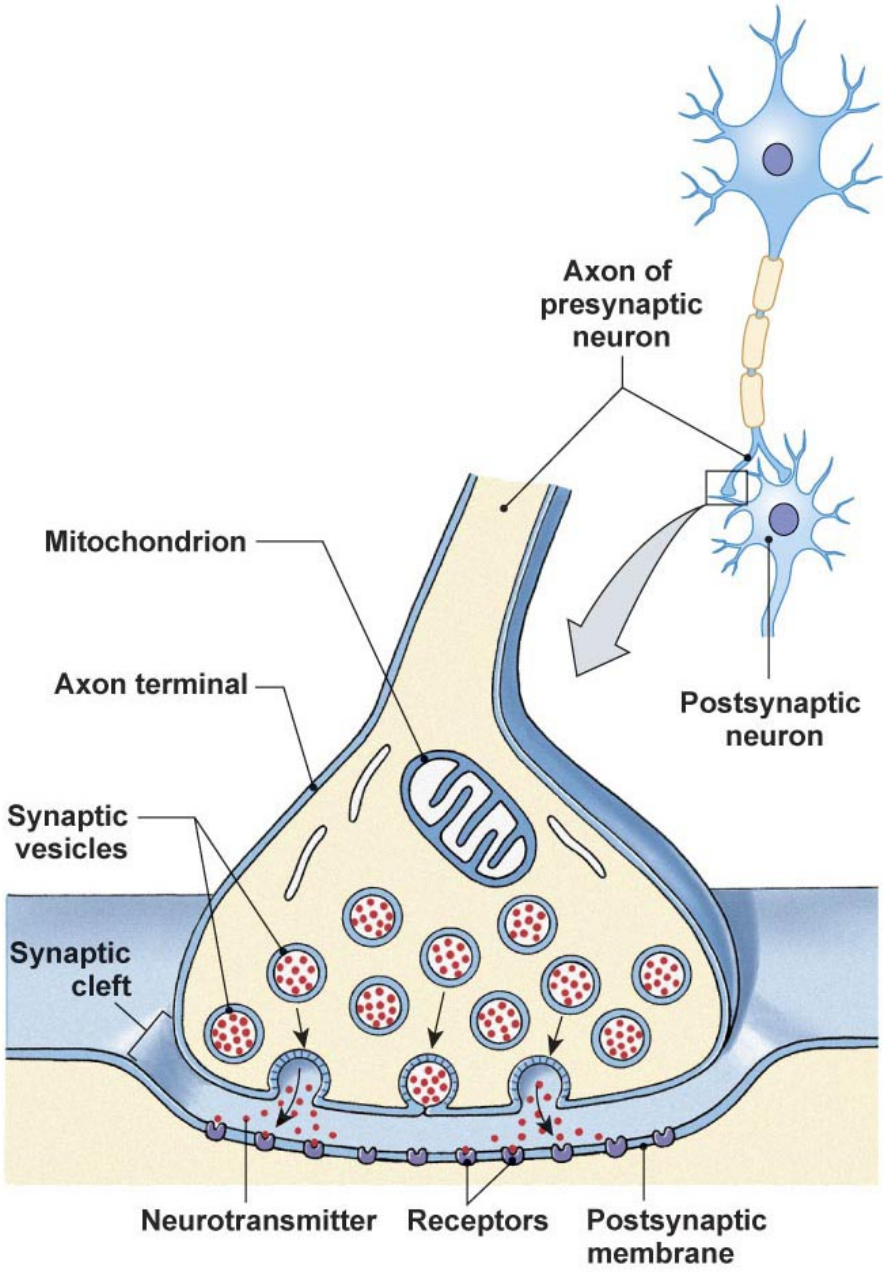


Figure 8-21, overview

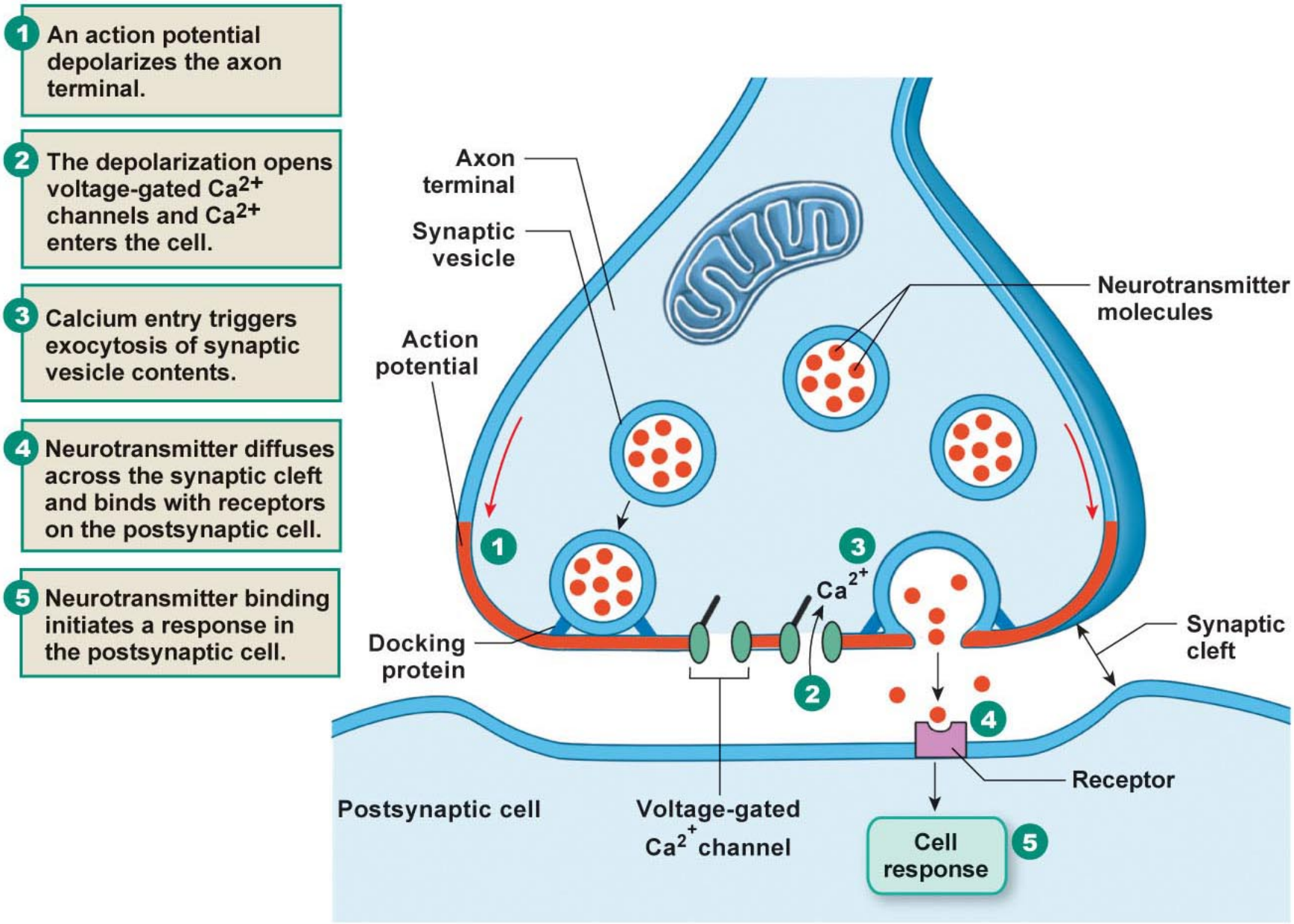
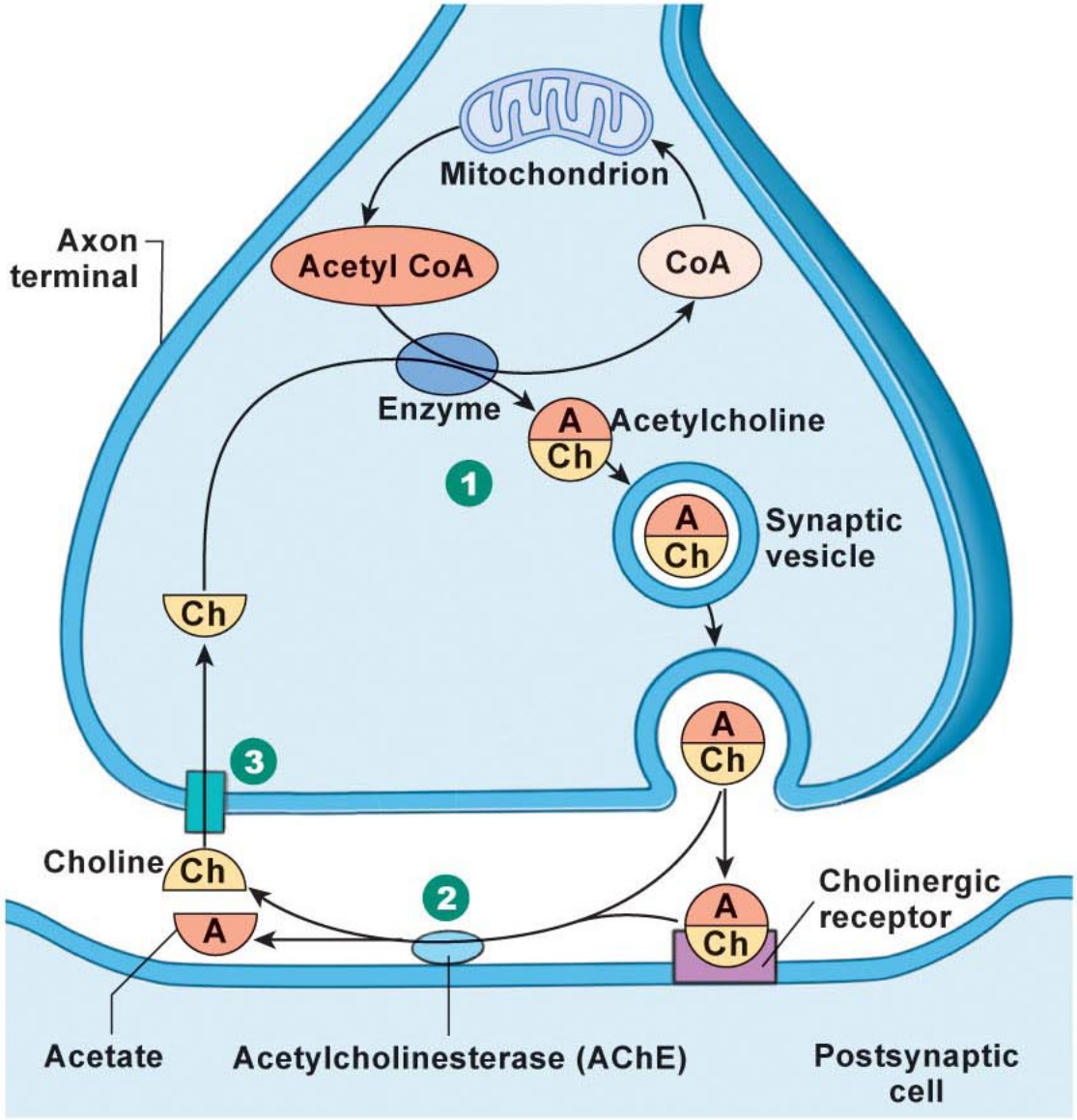


Figure 8-22, overview



1 **Acetylcholine** (ACh) is made from choline and acetyl CoA.

2 In the synaptic cleft ACh is rapidly broken down by the enzyme **acetylcholinesterase.**

3 Choline is transported back into the axon terminal and is used to make more ACh.

Figure 8-23

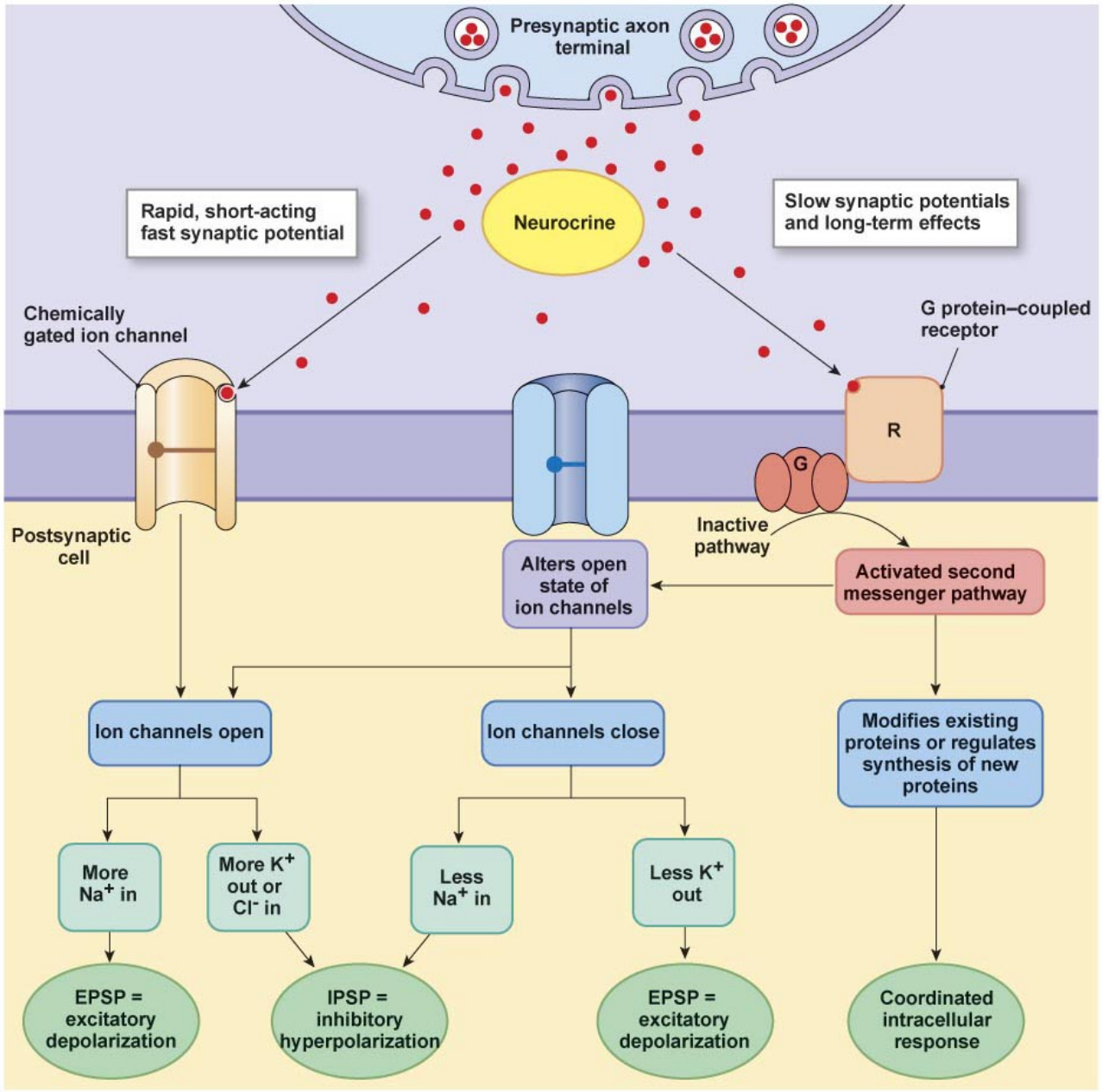


Figure 8-24, overview

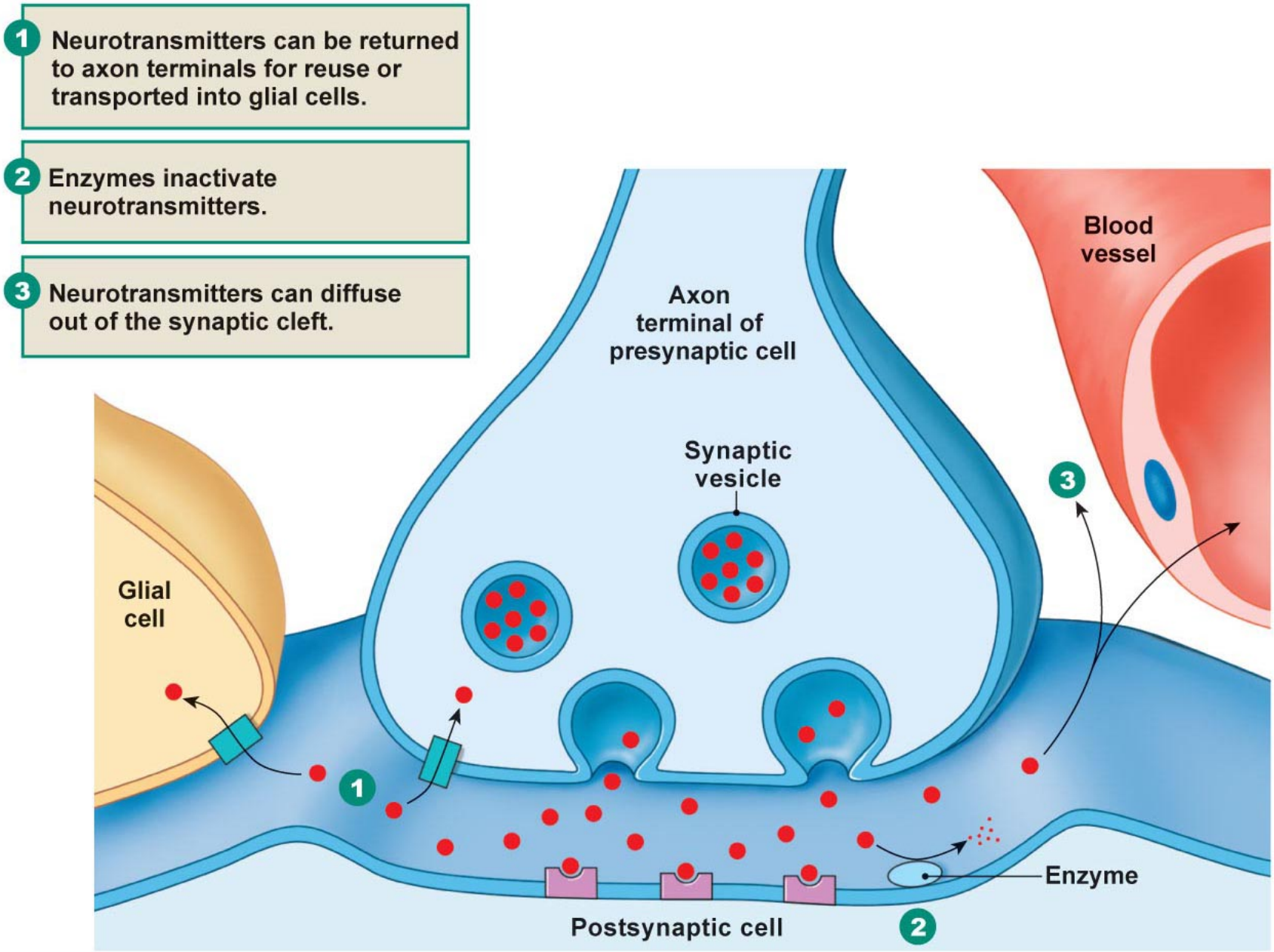


Figure 8-25

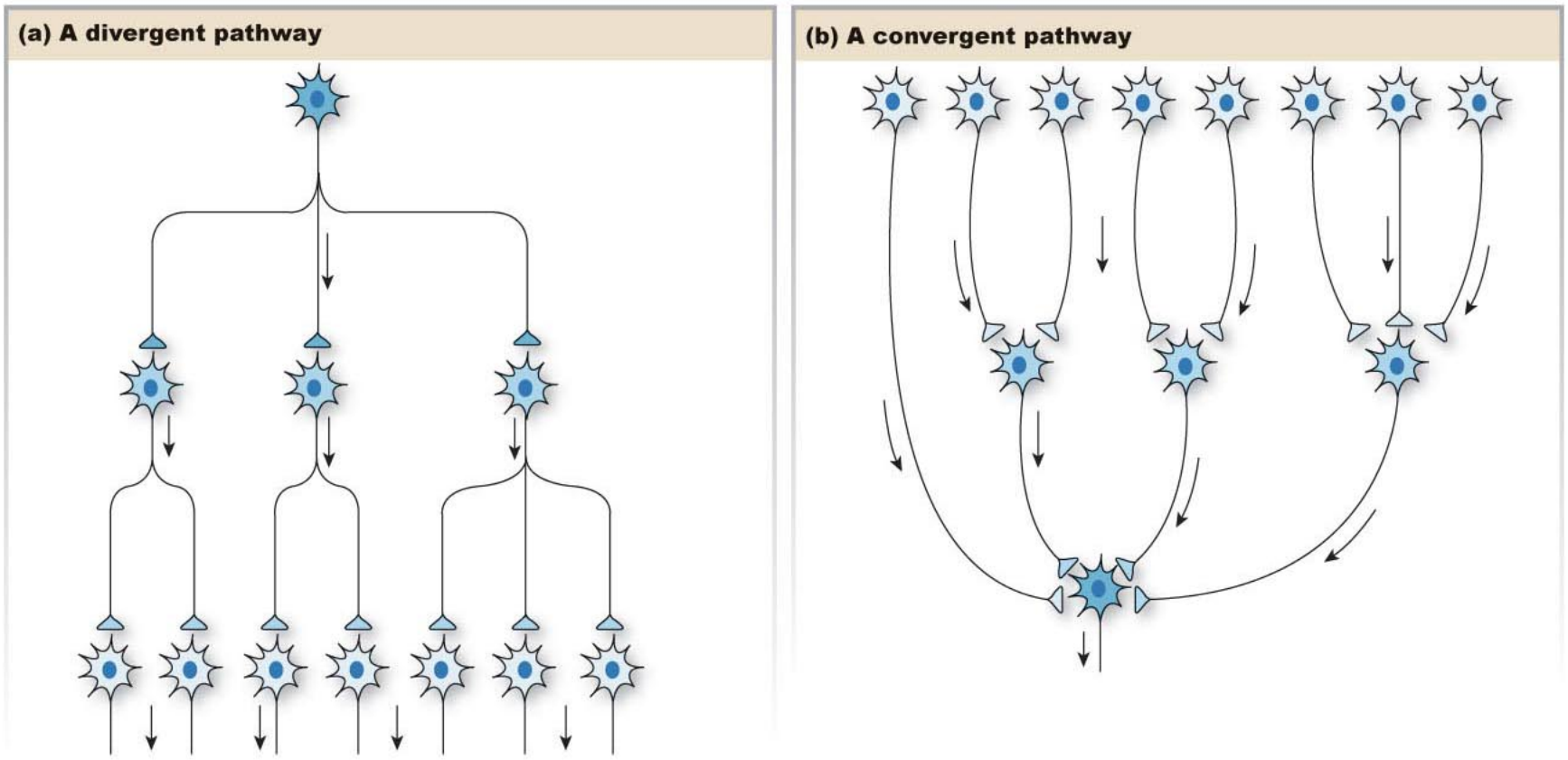


Figure 8-26

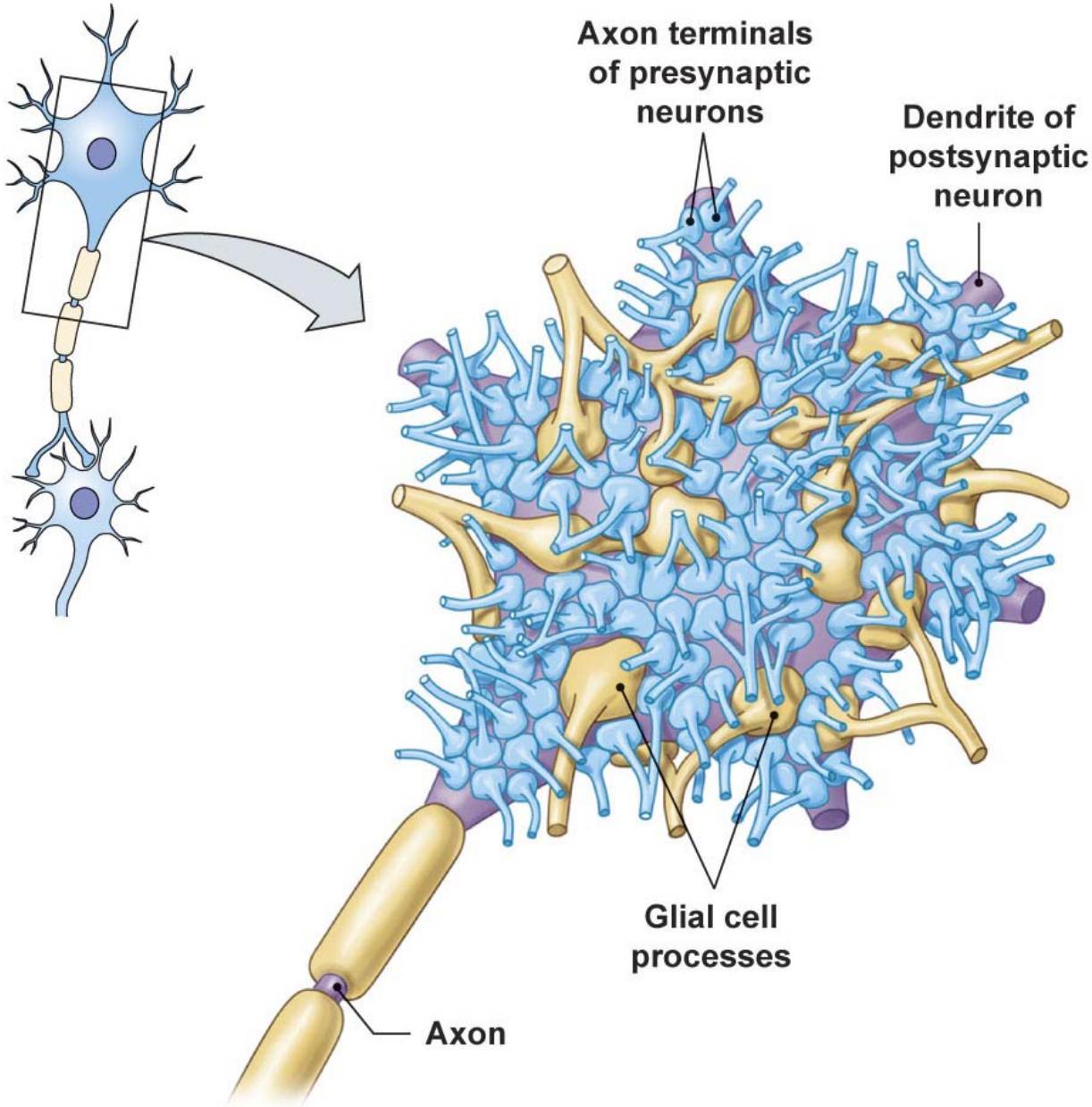


Figure 8-28a, overview

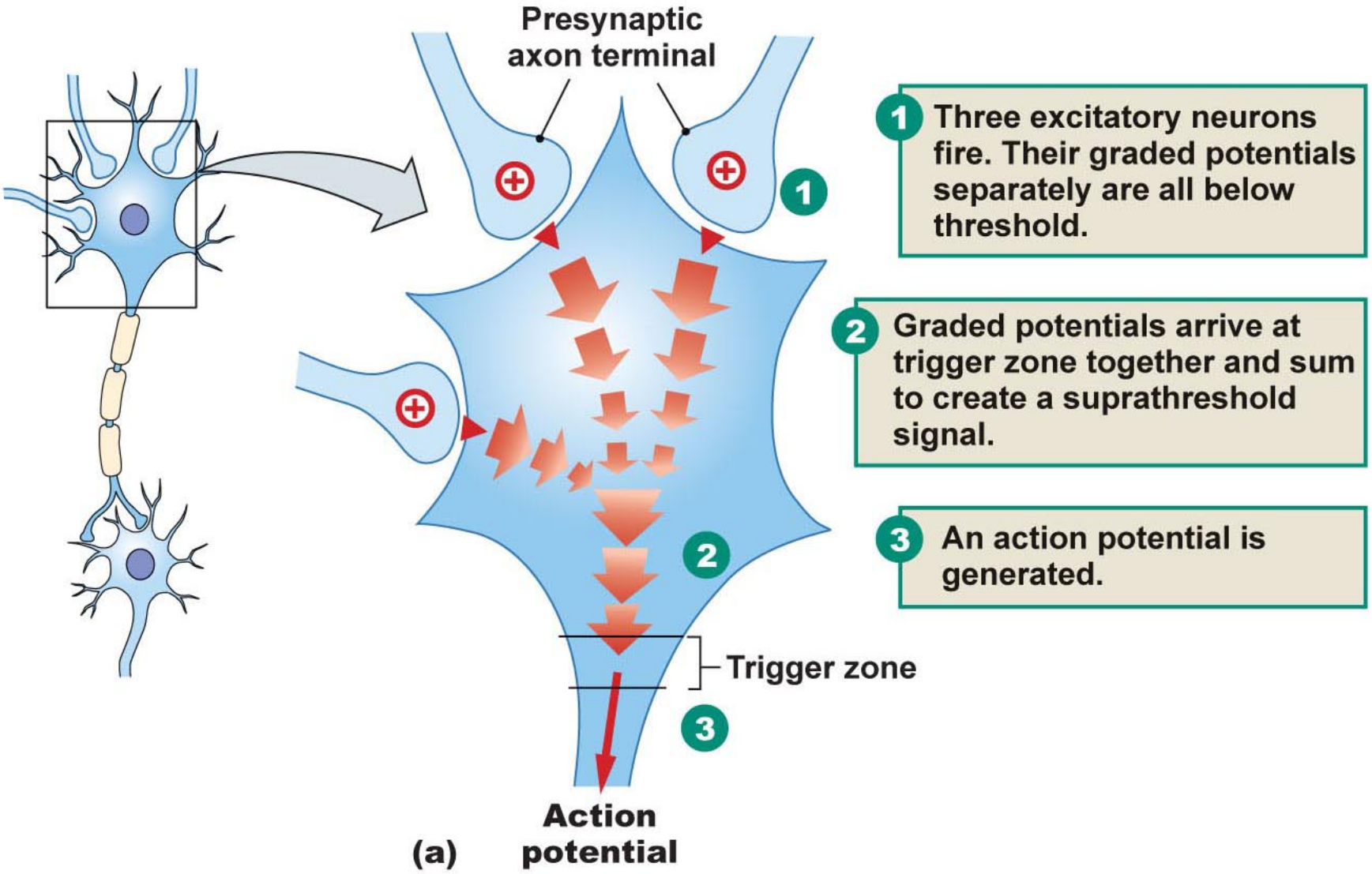


Figure 8-28b, overview

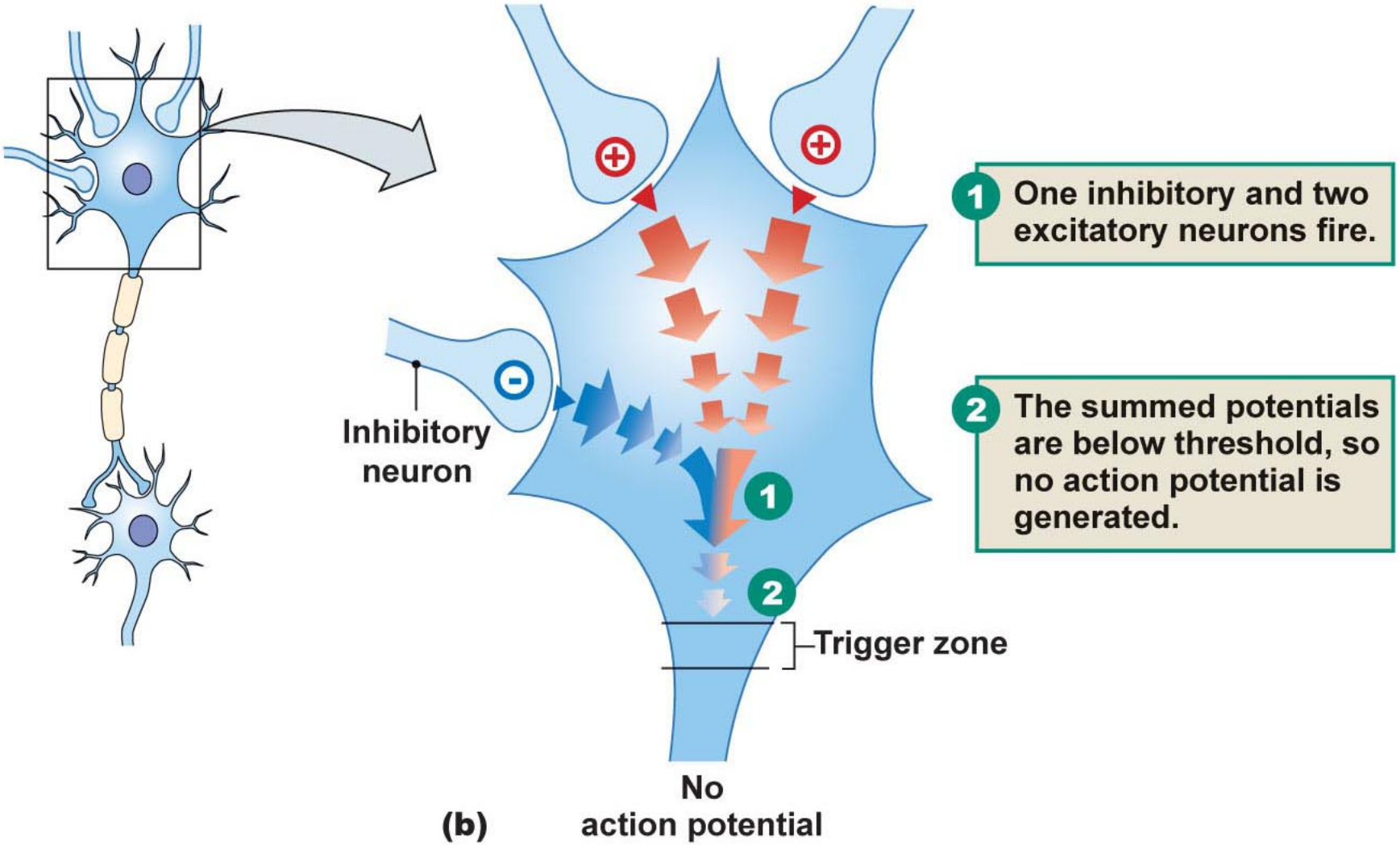
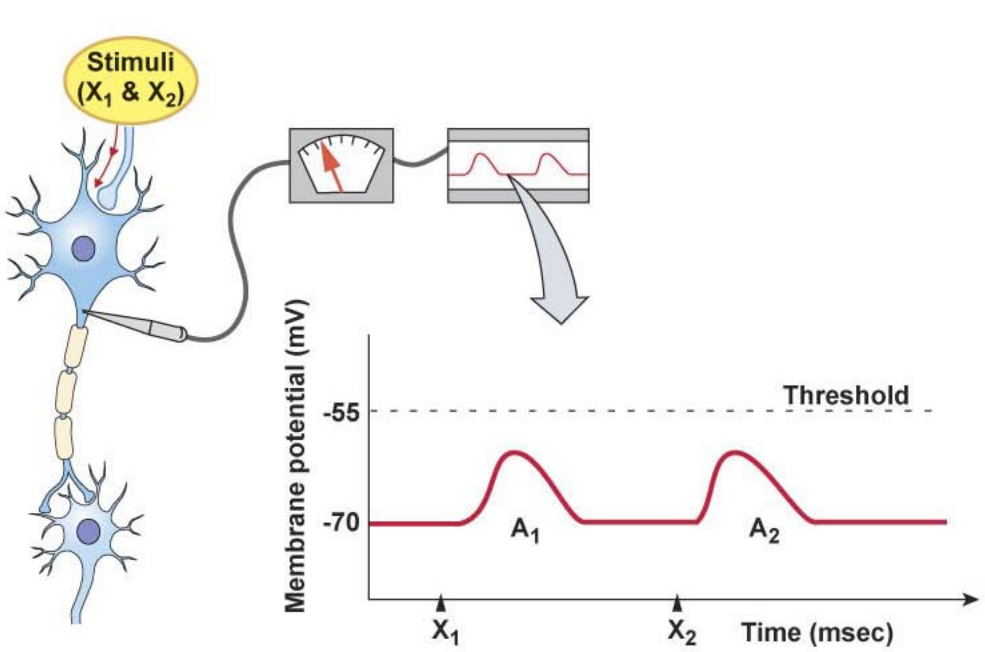
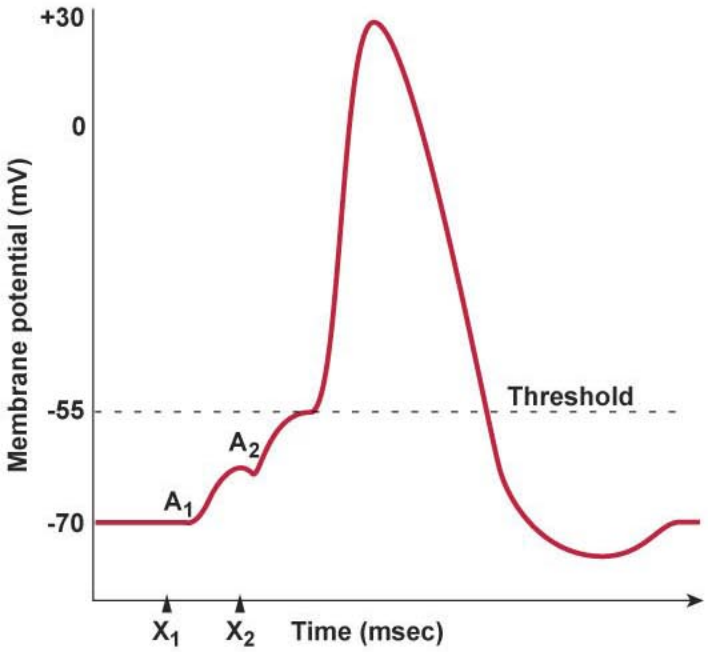


Figure 8-29



(a) No summation. Two subthreshold graded potentials will not initiate an action potential if they are far apart in time.



(b) Summation causing action potential. If two subthreshold potentials arrive at the trigger zone within a short period of time, they may sum and initiate an action potential.

Figure 8-31, overview