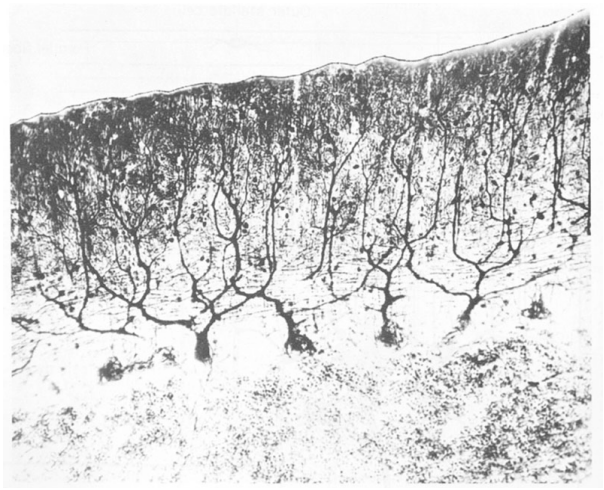
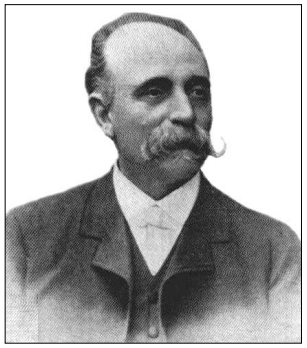


Camillo Golgi (1843 – 1926)



Camillo Golgi

- Pioneer histologist
- Developed the silver stain for staining the
- Proposed the "Reticular Theory" of nervous system organization – wrong.
- Shared Nobel Prize in Medicine (1906) with Ramon Y Cajal (his arch rival)

Purkinje Cell (Rat Cerebellum)

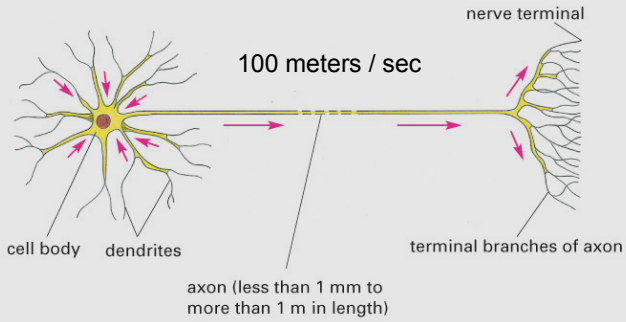
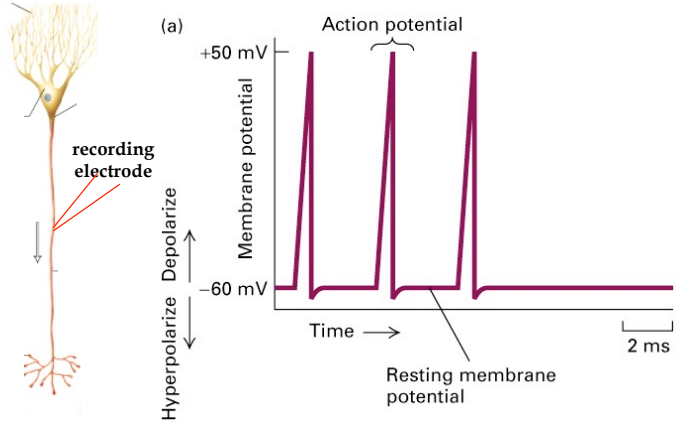
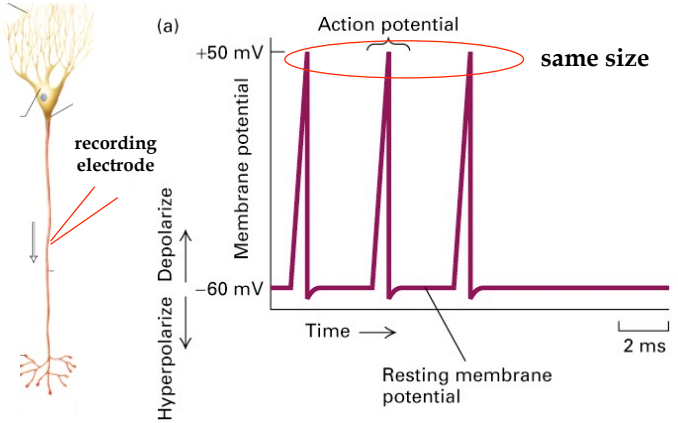


Figure 12-30 Essential Cell Biology, 2/e. (© 2004 Garland Science)

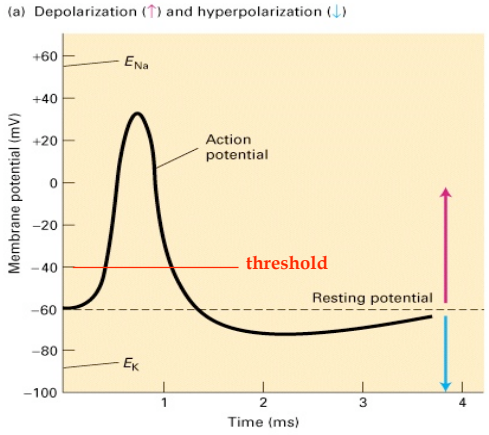
Action potentials are waves of depolarization that travel along the axon



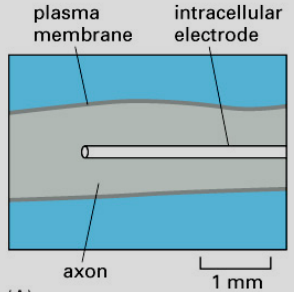
Action potentials are waves of depolarization that travel along the axon

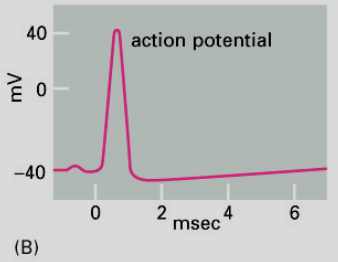


Changes in membrane potential during an action potential.

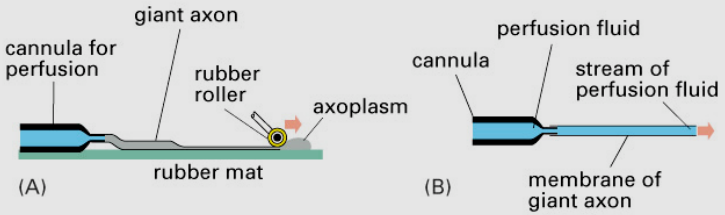


Squid Giant Axon Preparation

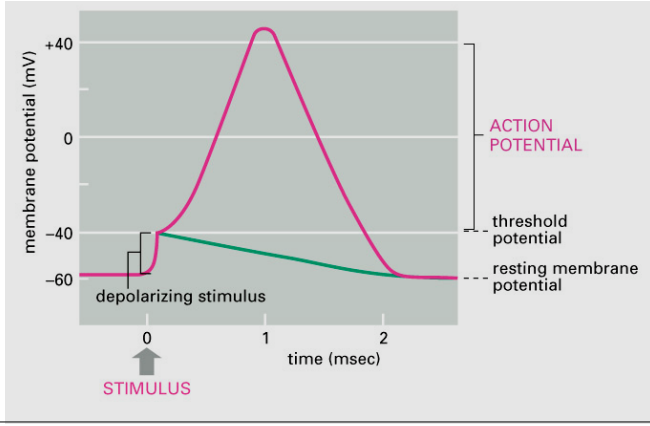




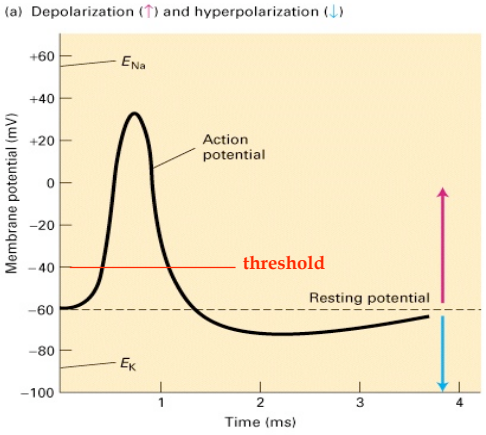
Squid Giant Axon Preparation



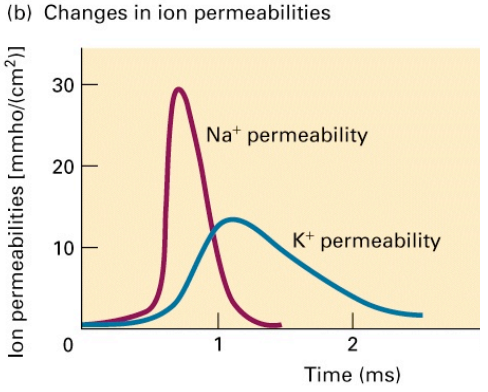
Only sodium present (no potassium ions)

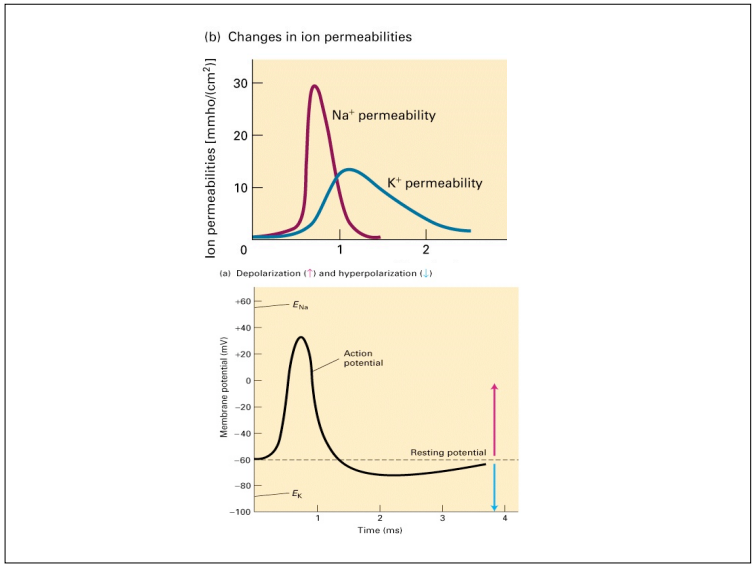


Changes in membrane potential during an action potential.

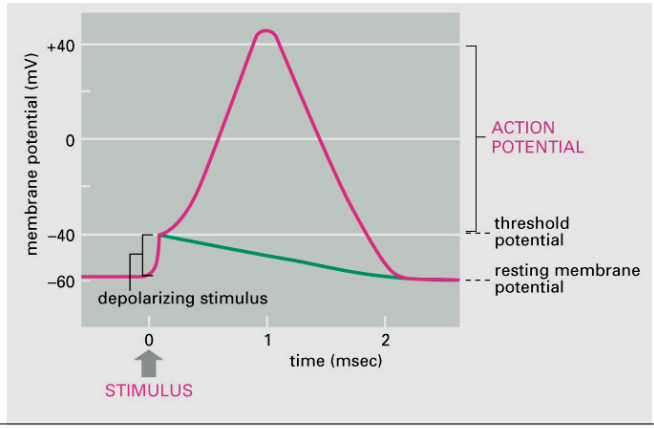


Changes in permeability during an action potential.





Only sodium present (no potassium ions)



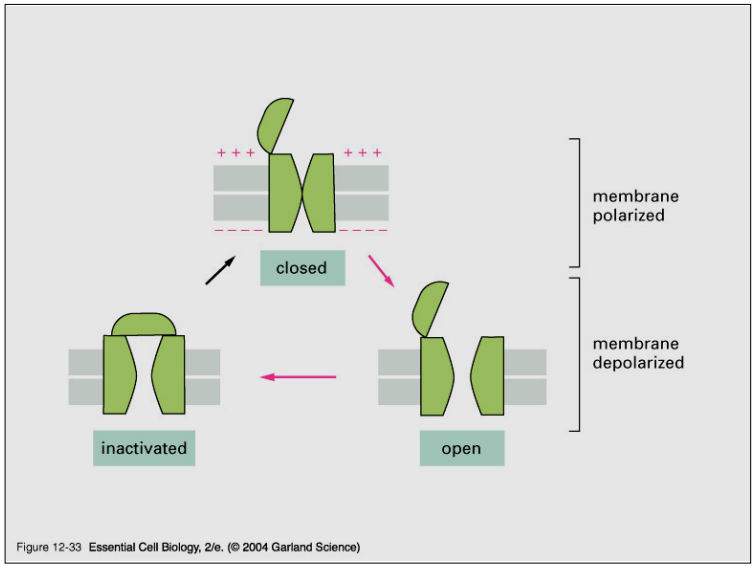


Figure 12-33 Essential Cell Biology, 2/e. (© 2004 Garland Science)

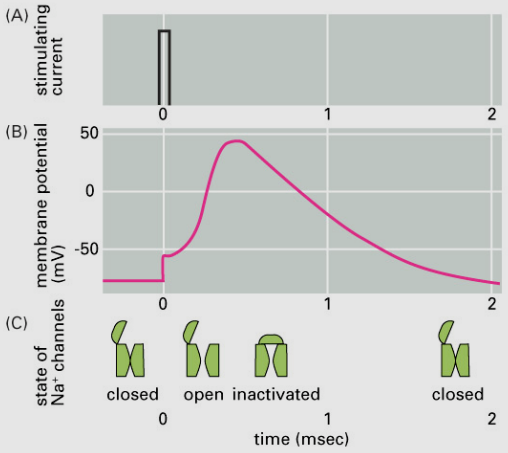
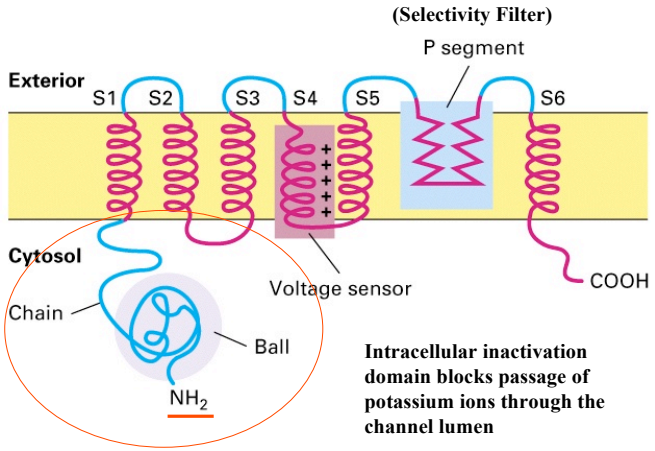


Figure 12-34 Essential Cell Biology, 2/e. (© 2004 Garland Science)

K+ channel subunit (1 of 4 total).



Intracellular inactivation domain blocks passage of potassium ions through the channel lumen

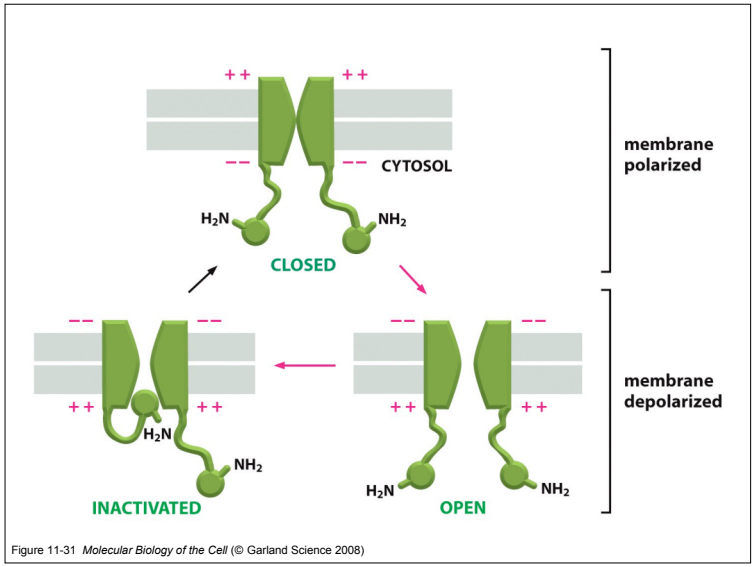
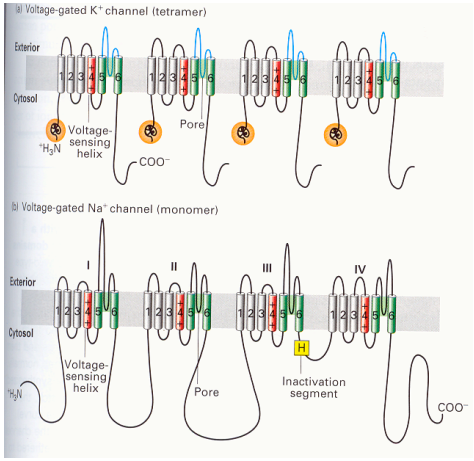


Figure 11-31 *Molecular Biology of the Cell* (© Garland Science 2008)

Structure of voltage-gated channels



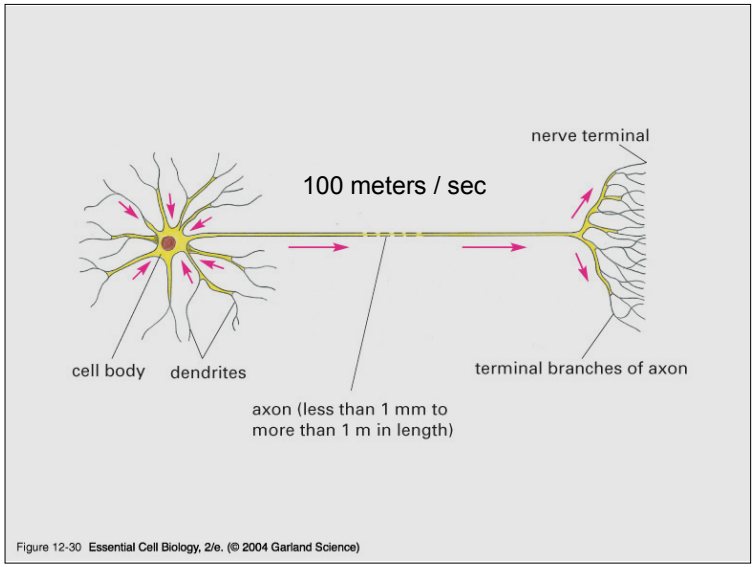
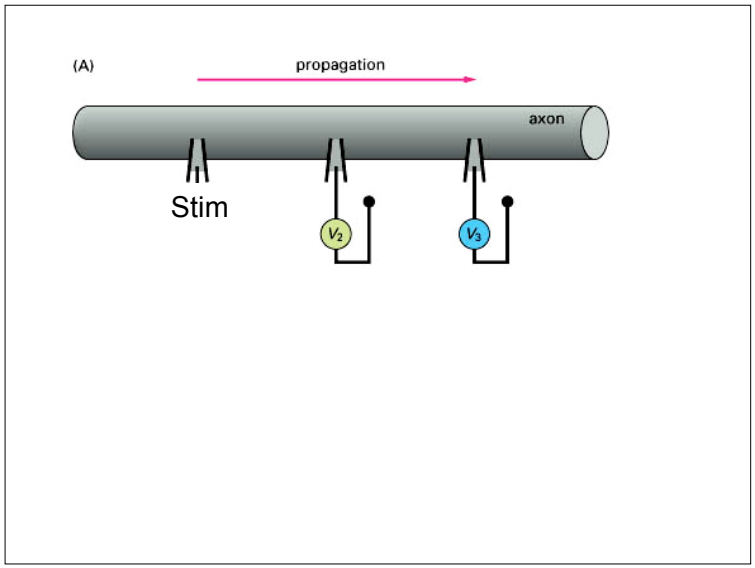
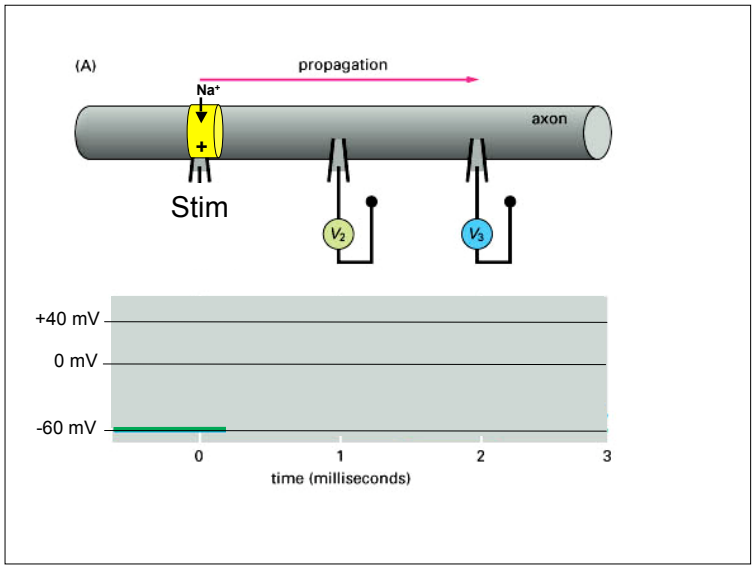
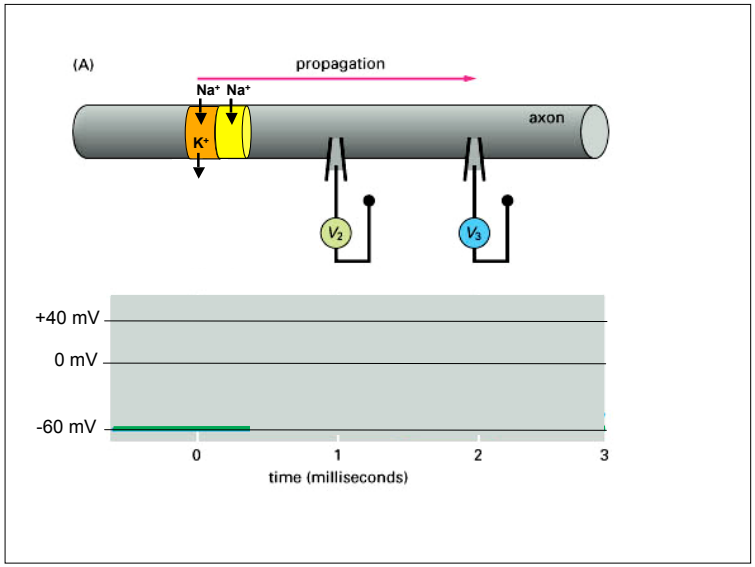
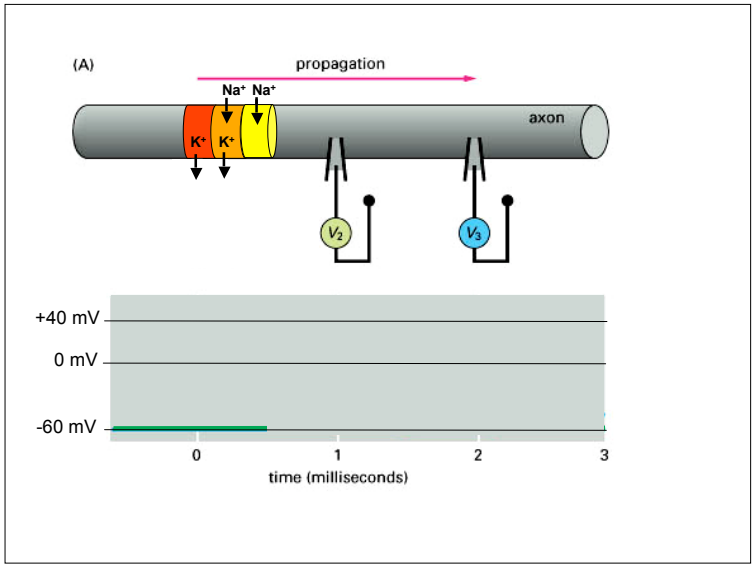


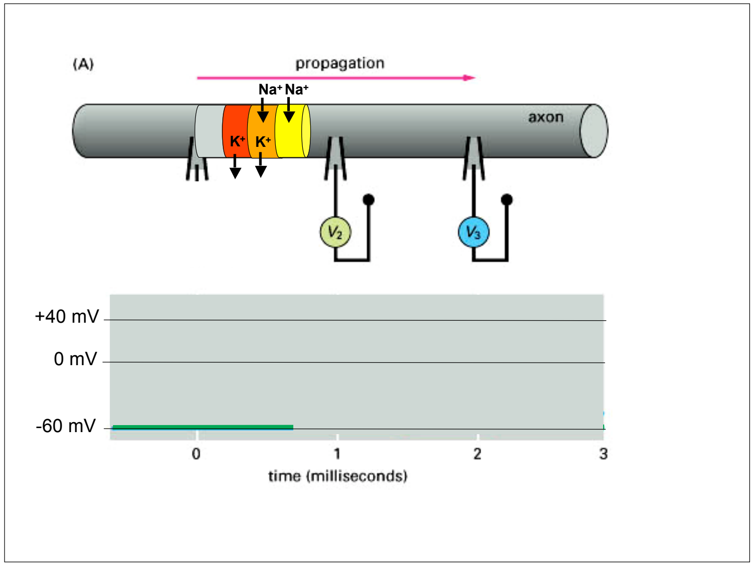
Figure 12-30 Essential Cell Biology, 2/e. (© 2004 Garland Science)

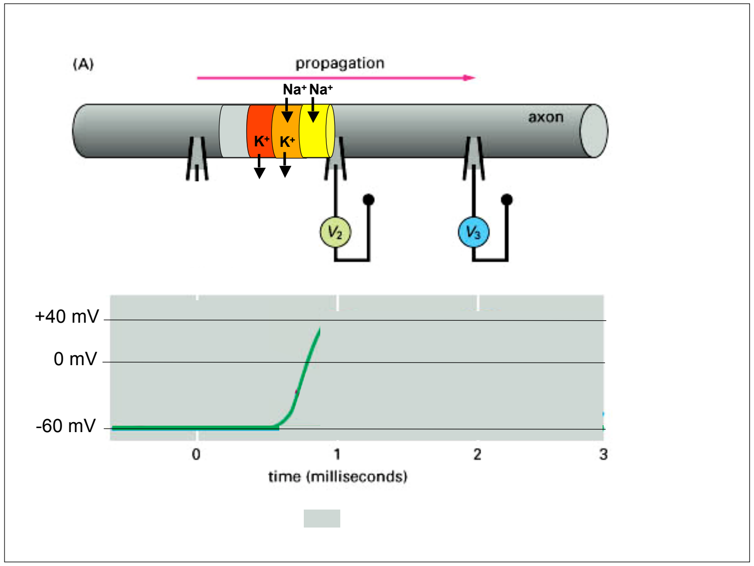

(A)
propagation
axon
Stim
V_2
V_3

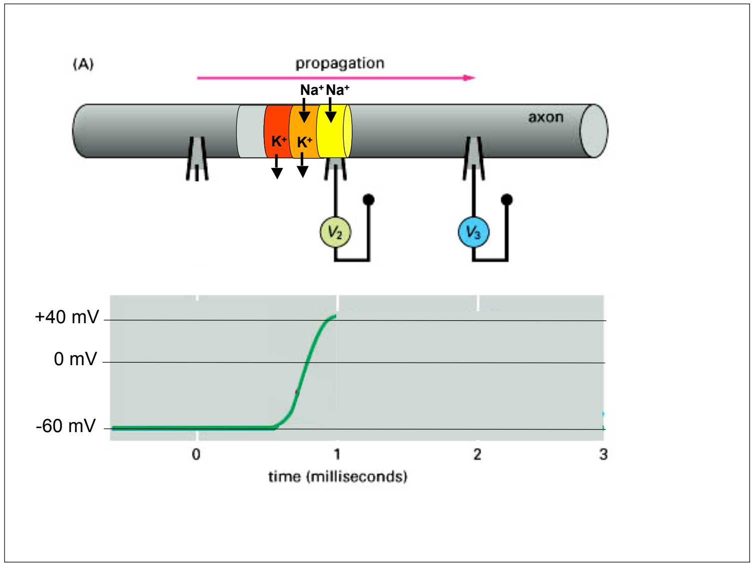

(A)
propagation
Na+
+
axon
Stim
V_2
V_3
+40 mV
0 mV
-60 mV
0
1
2
3
time (milliseconds)

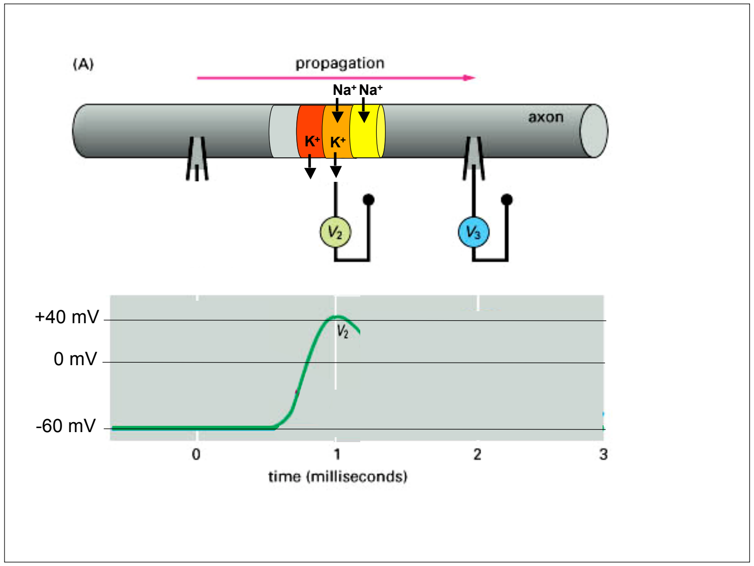

(A)
propagation
Na+ Na+
K+
axon
V_2
V_3
+40 mV
0 mV
-60 mV
0
1
2
3
time (milliseconds)

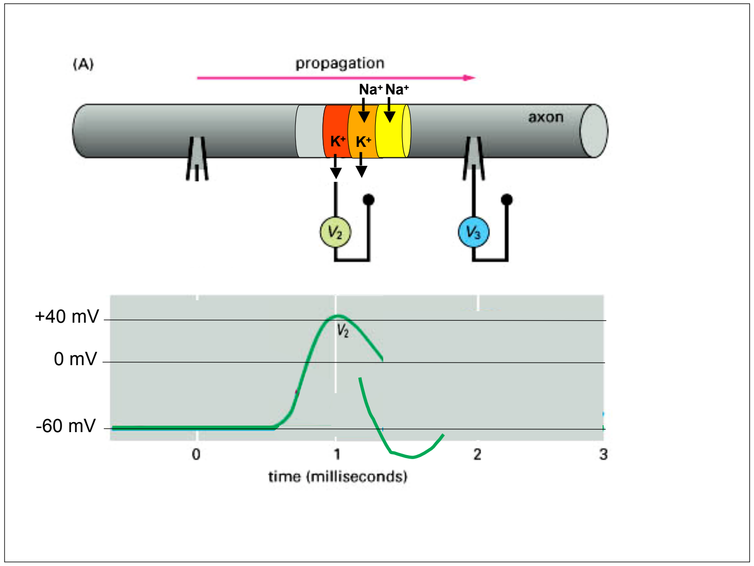

(A)
propagation
Na+ Na+
K+ K+
axon
V_2
V_3
+40 mV
0 mV
-60 mV
0
1
2
3
time (milliseconds)

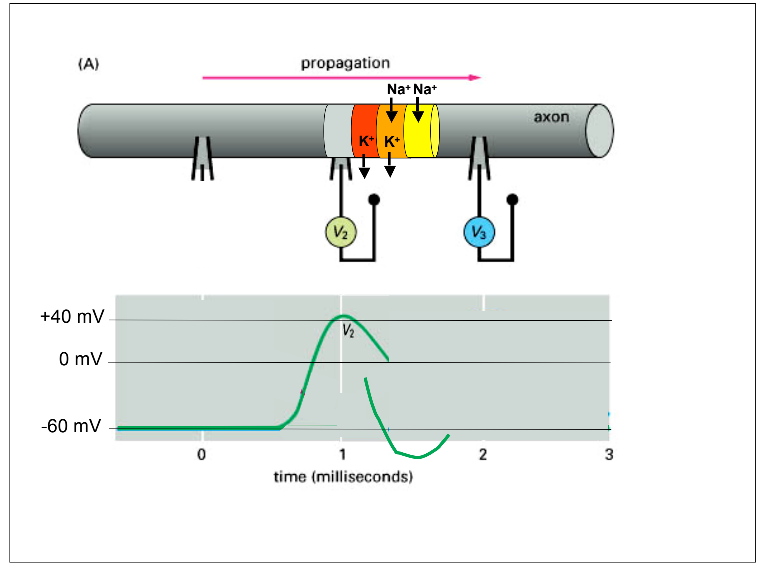

(A)
propagation
Na+ Na+
K+ K+
axon
V2
V3
+40 mV
0 mV
-60 mV
0
1
2
3
time (milliseconds)

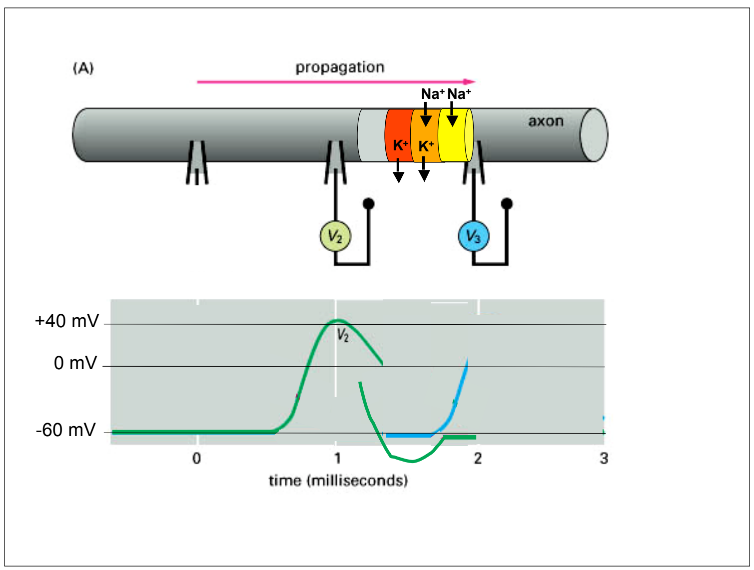

(A)
propagation
Na+ Na+
K+ K+
axon
V2
V3
+40 mV
0 mV
-60 mV
0
1
2
3
time (milliseconds)

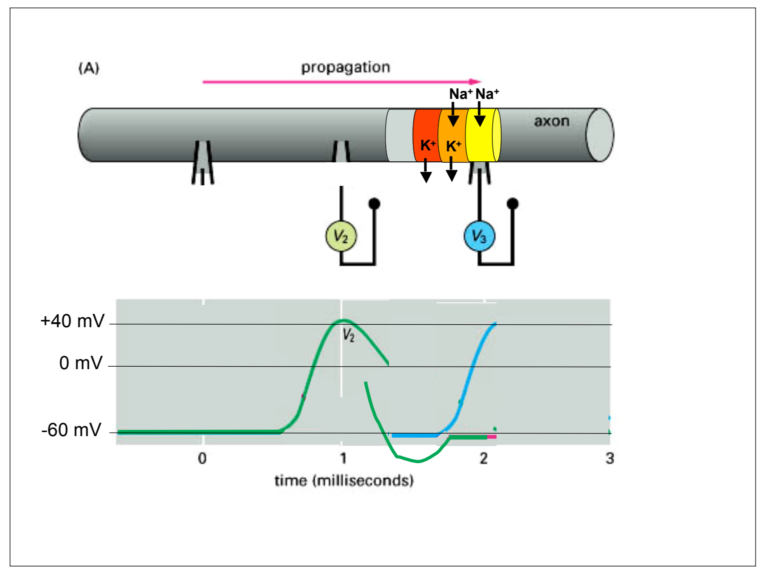

(A)
propagation
Na+ Na+
K+ K+
axon
V2
V3
+40 mV
0 mV
-60 mV
0
1
2
3
time (milliseconds)

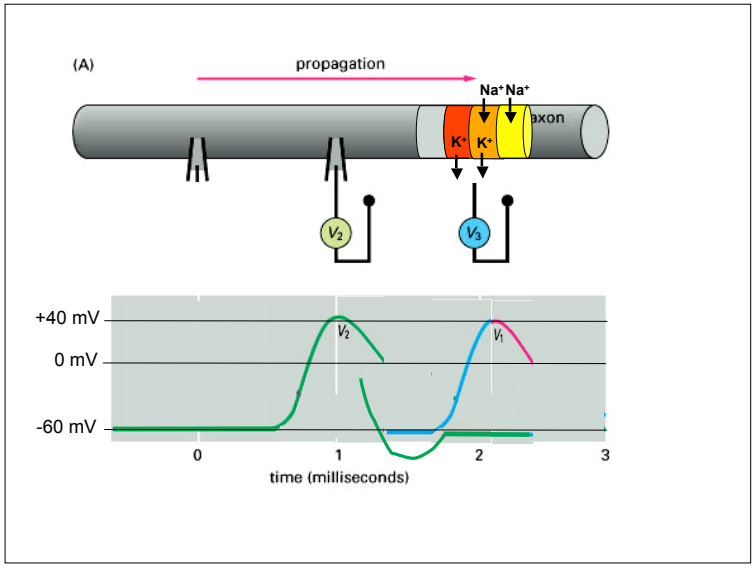

(A)
propagation
Na+ Na+
K+ K+
axon
V2
V3
+40 mV
0 mV
-60 mV
V2
0
1
2
3
time (milliseconds)

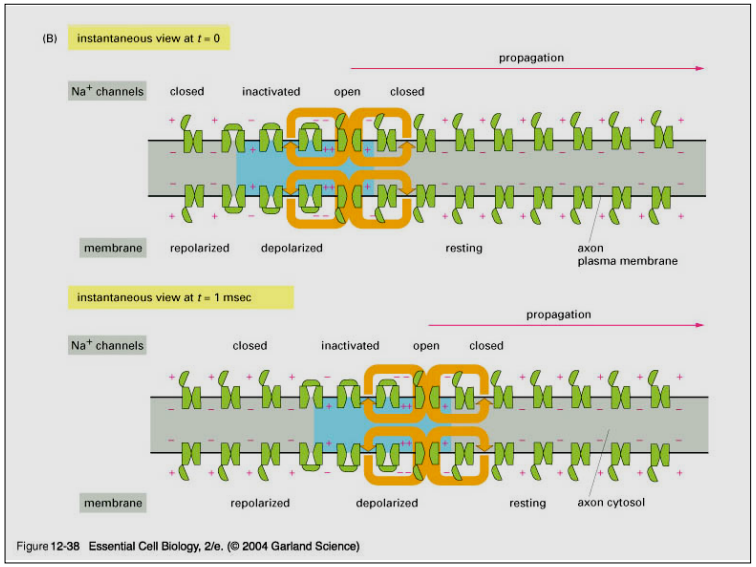

(A)
propagation
Na^+ Na^+
axon
K^+ K^+
V_2
V_3
+40 mV
0 mV
-60 mV
V_2
0
1
2
3
time (milliseconds)


(A)
propagation
Na^+ Na^+
axon
K^+ K^+
V_2
V_3
+40 mV
0 mV
-60 mV
V_2
0
1
2
3
time (milliseconds)

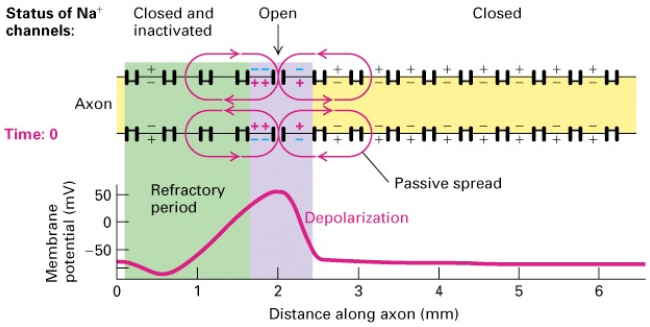

(A)
propagation
Na^+ Na^+
axon
K^+ K^+
V_2
V_3
+40 mV
0 mV
-60 mV
V_2
0
1
2
3
time (milliseconds)

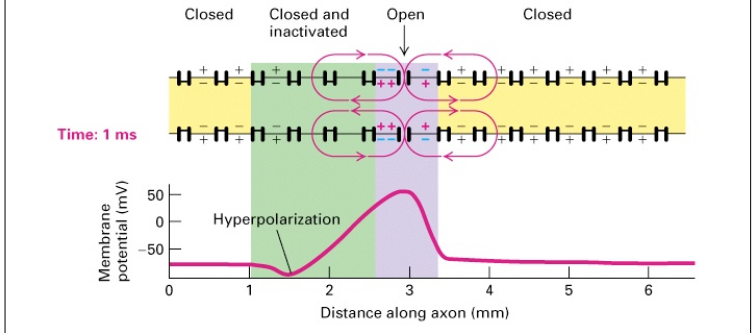

(A)
propagation
Na^+ Na^+
axon
K^+ K^+
V_2
V_3
+40 mV
0 mV
-60 mV
V_2
0
1
2
3
time (milliseconds)

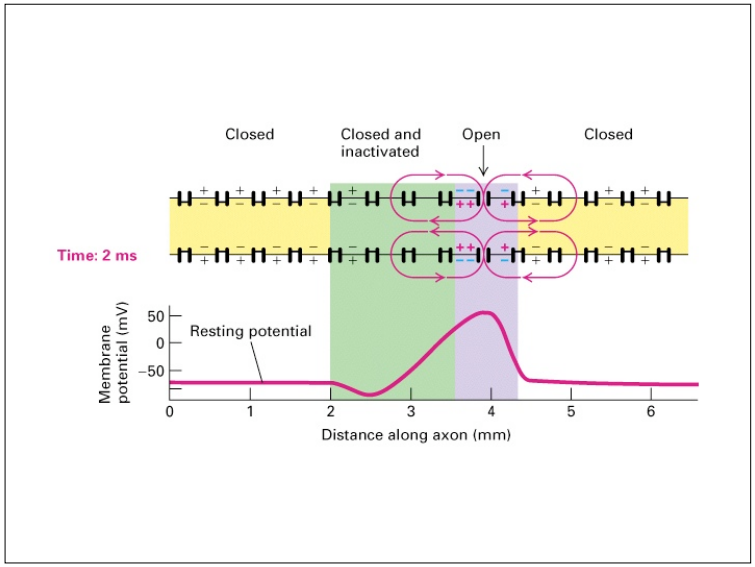


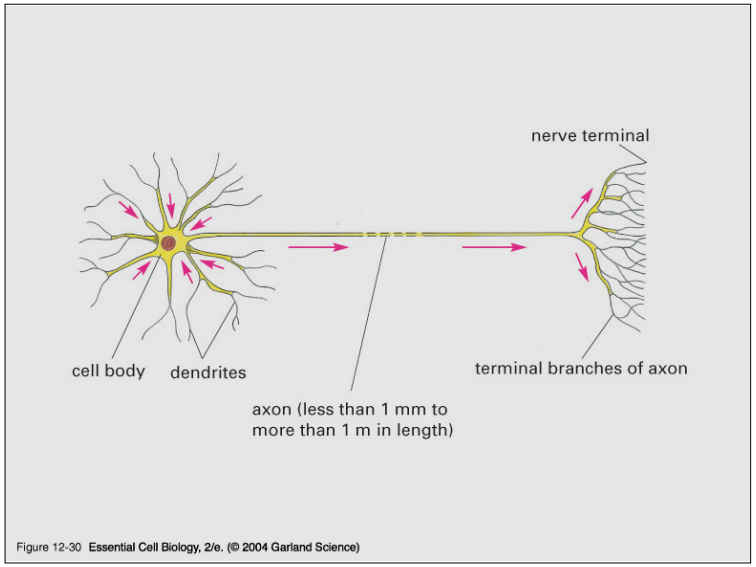


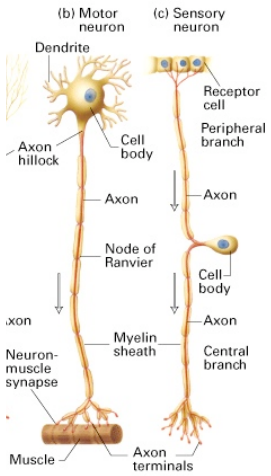
Anterograde conduction of an action potential.



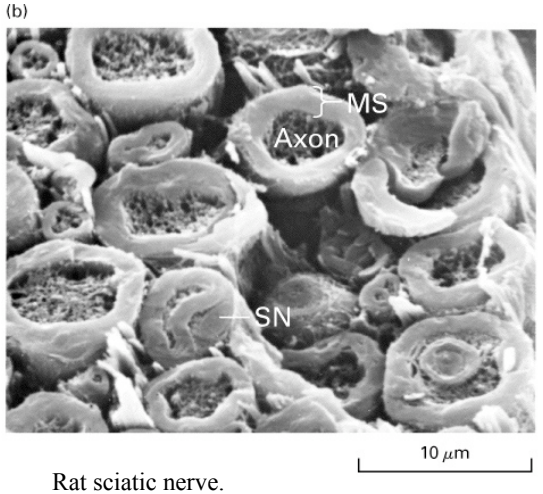








To speed conduction of action potentials most motor neurons and many sensory neurons have myelinated axons



Rat sciatic nerve.

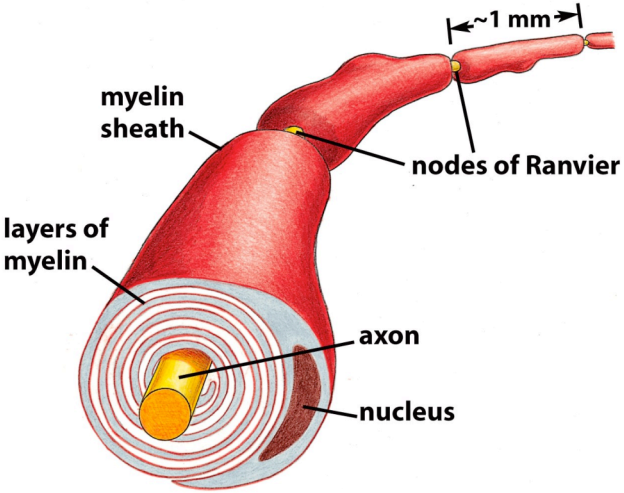
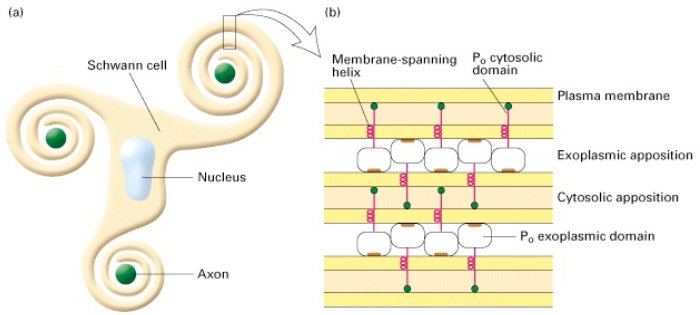


Figure 11-32a *Molecular Biology of the Cell* (© Garland Science 2008)

Myelination improves conduction velocity



Cytosol gets squeezed out to form compact layers, due to Po protein formed only in myelinating Schwann cells.

Figure 11-32b *Molecular Biology of the Cell* (© Garland Science 2008)

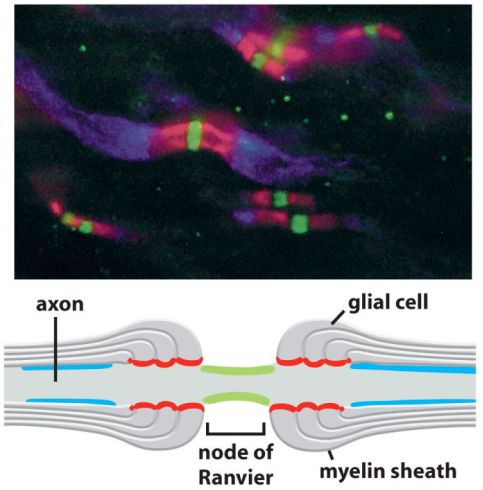
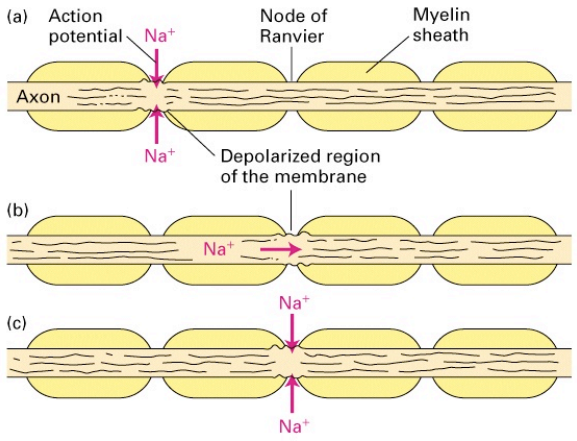


Figure 11-32c *Molecular Biology of the Cell* (© Garland Science 2008)

Regeneration of action potentials at the nodes



"Saltatory" conduction

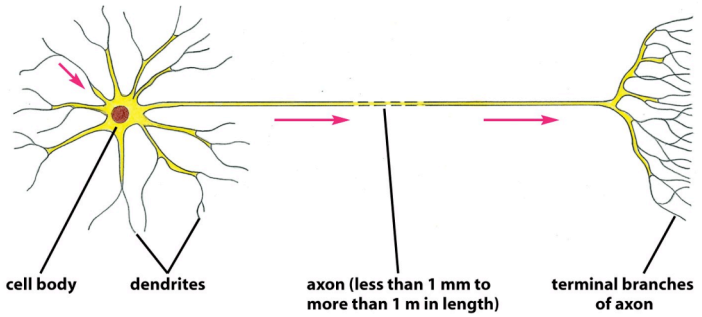


Figure 11-28 *Molecular Biology of the Cell* (© Garland Science 2008)

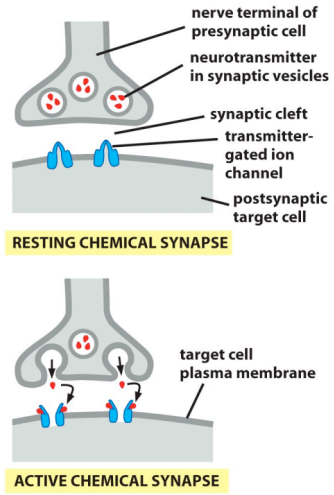


Figure 11-35a *Molecular Biology of the Cell* (© Garland Science 2008)

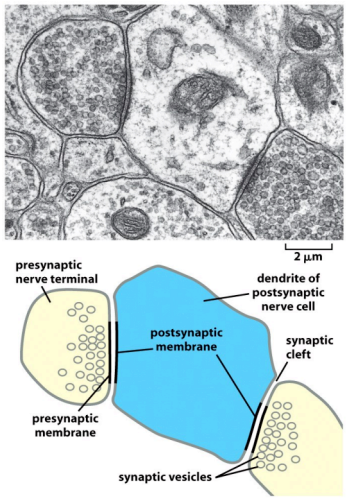


Figure 11-35b *Molecular Biology of the Cell* (© Garland Science 2008)

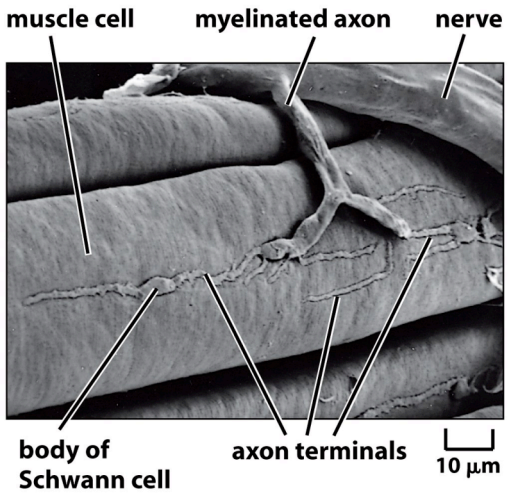


Figure 11-36 *Molecular Biology of the Cell* (© Garland Science 2008)

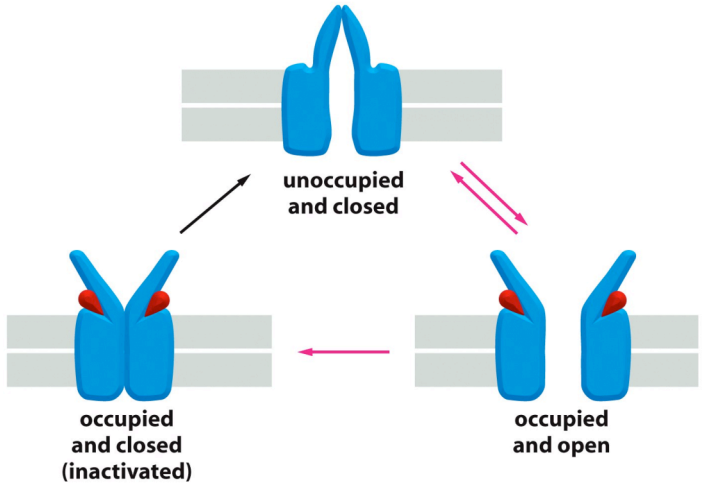


Figure 11-37 *Molecular Biology of the Cell* (© Garland Science 2008)

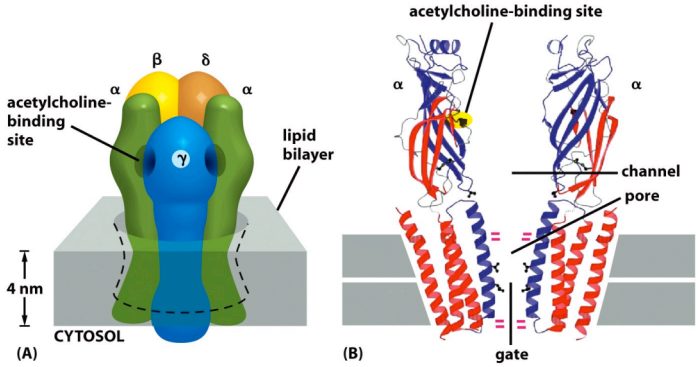


Figure 11-38 *Molecular Biology of the Cell* (© Garland Science 2008)

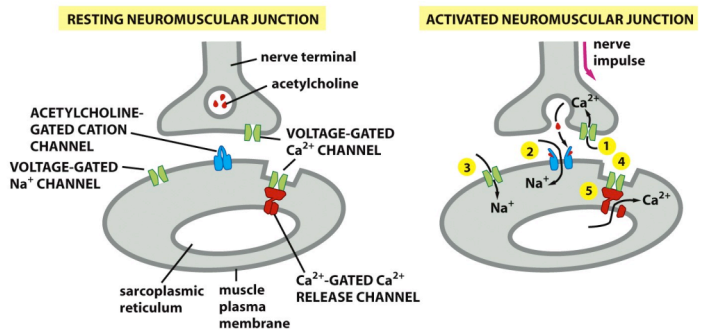
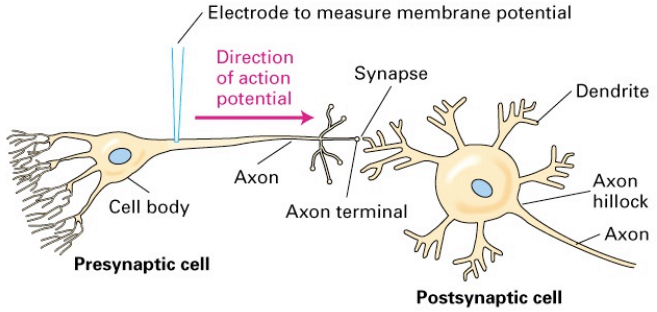


Figure 11-39 *Molecular Biology of the Cell* (© Garland Science 2008)



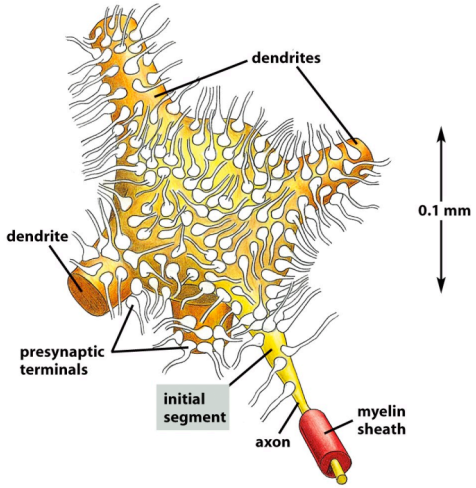


Figure 11-40a *Molecular Biology of the Cell* (© Garland Science 2008)

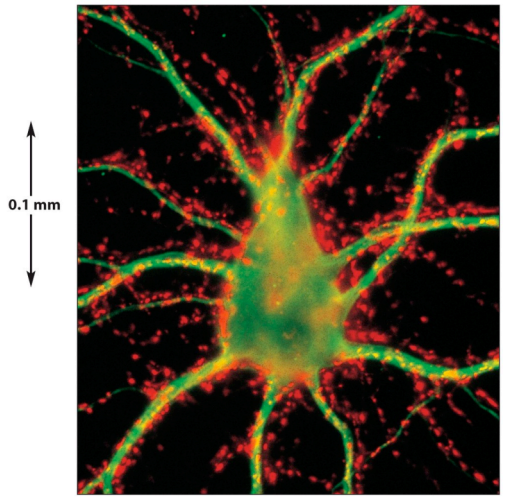


Figure 11-40b *Molecular Biology of the Cell* (© Garland Science 2008)

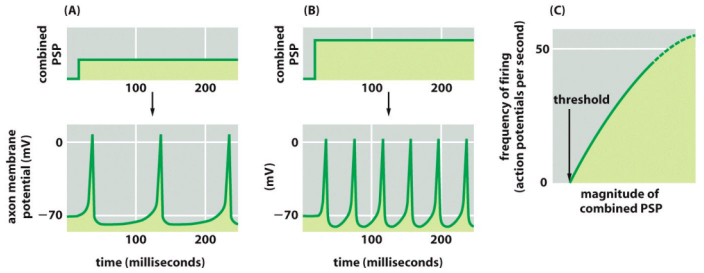


Figure 11-41 *Molecular Biology of the Cell* (© Garland Science 2008)

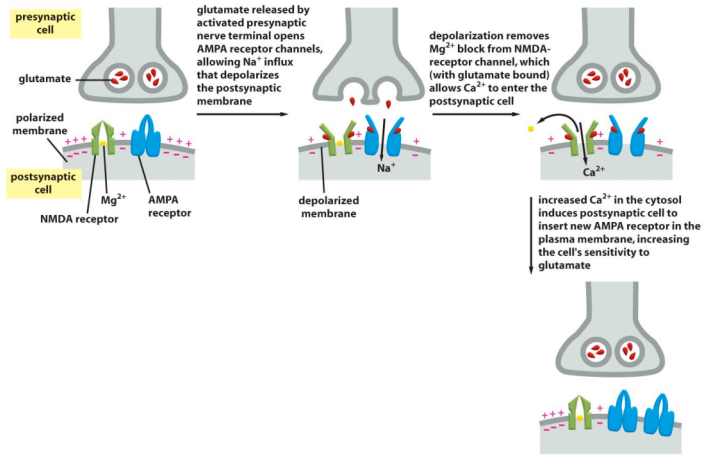


Figure 11-42 *Molecular Biology of the Cell* (© Garland Science 2008)

Table 11–2 Some Ion Channel Families

CHANNEL TYPE	REPRESENTATIVE EXAMPLE	
Voltage-gated cation channels	voltage-gated Na^+ channels	
	voltage-gated K^+ channels (including delayed and early)	
	voltage-gated Ca^{2+} channels	
Transmitter-gated ion channels	acetylcholine-gated cation channels	excitatory
	glutamate-gated Ca^{2+} channels	
	serotonin-gated cation channels	
	GABA-gated Cl^- channels	inhibitory
	glycine-gated Cl^- channels	

Table 11-2 *Molecular Biology of the Cell* (© Garland Science 2008)