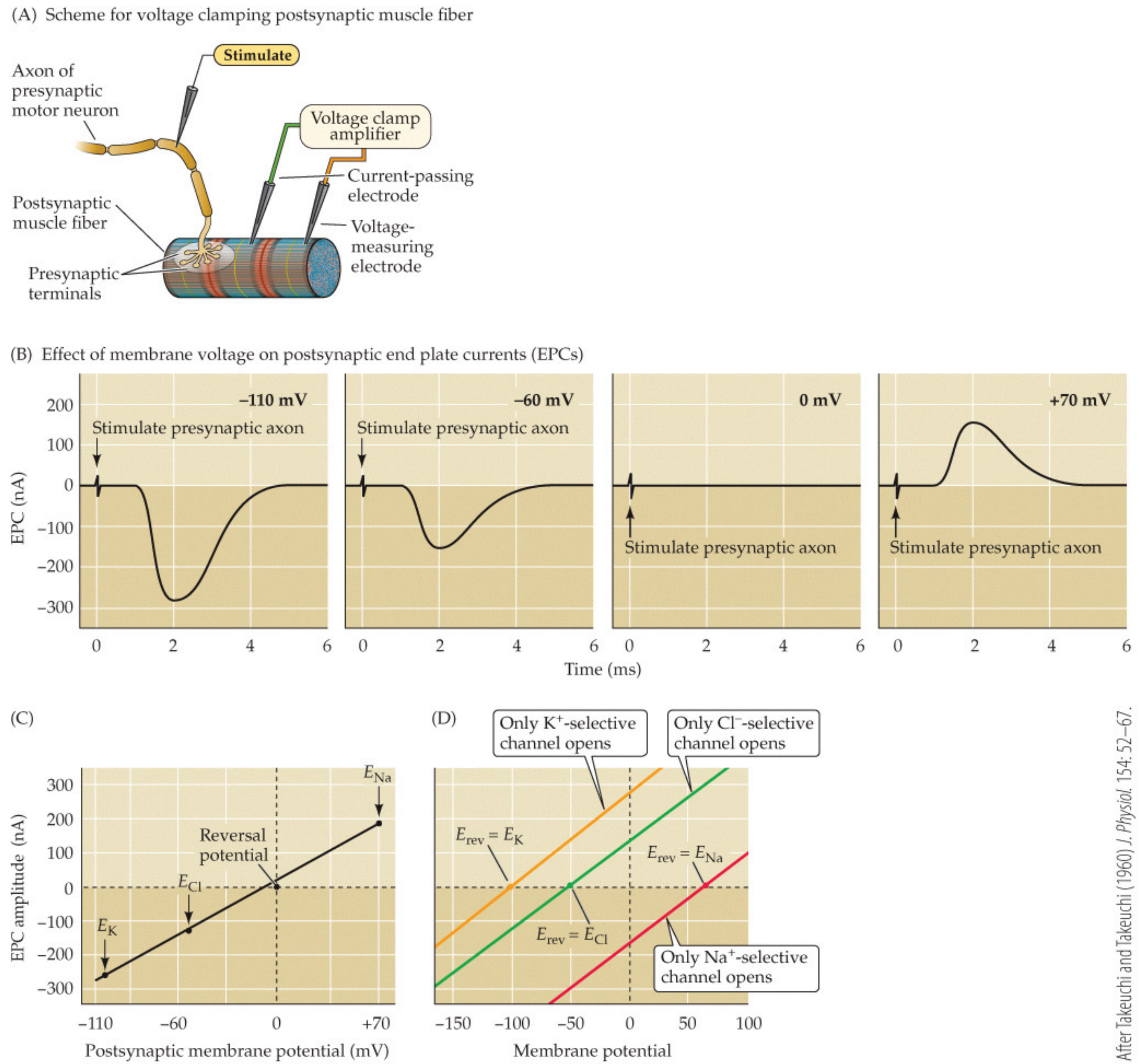
BMD ENG 301Quantitative Systems Physiology (Nervous System)

Midterm Review
2022_v3

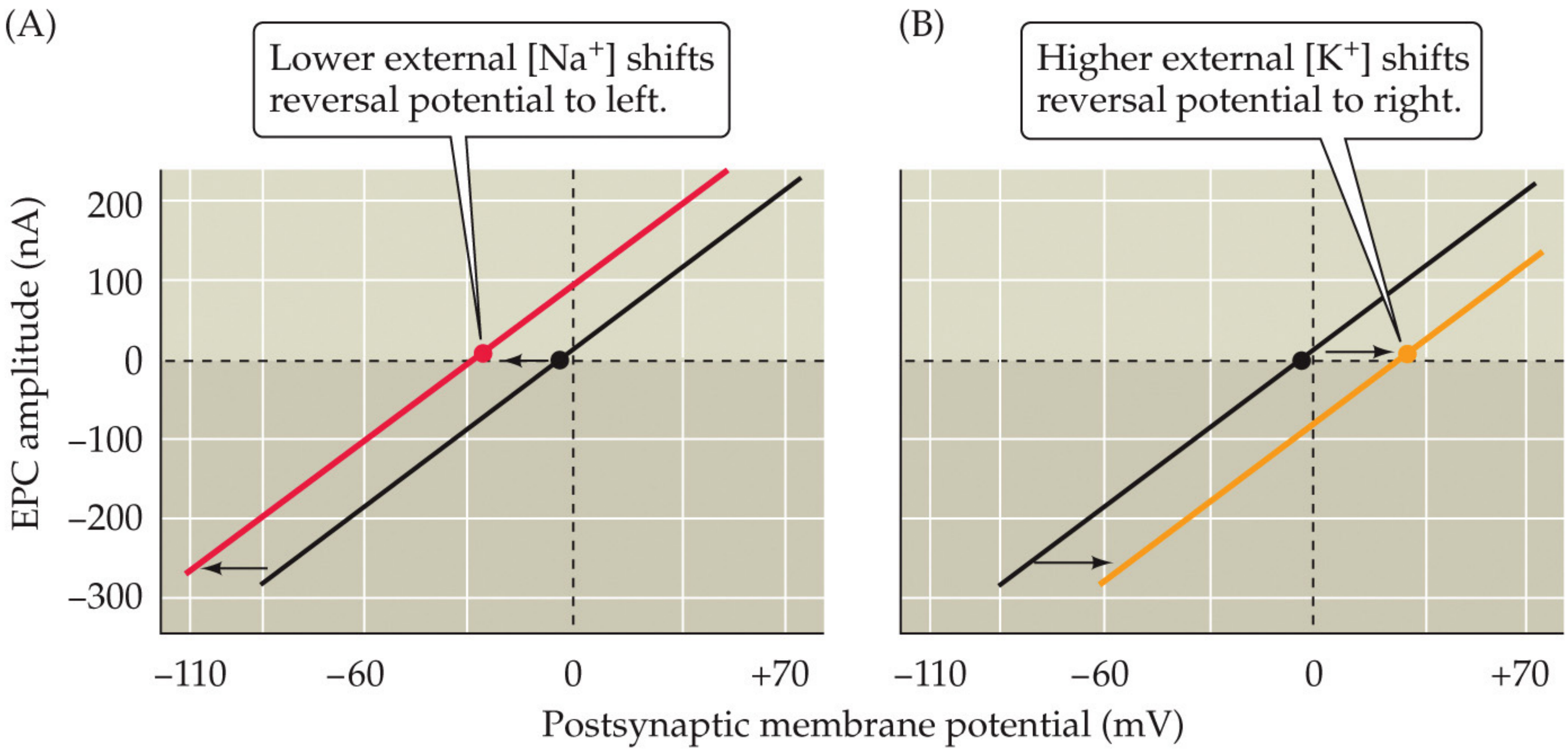
Professor Malcolm A. MacIver

Influence of the postsynaptic membrane potential on end plate currents



NEUROSCIENCE 6e, Figure 5.16

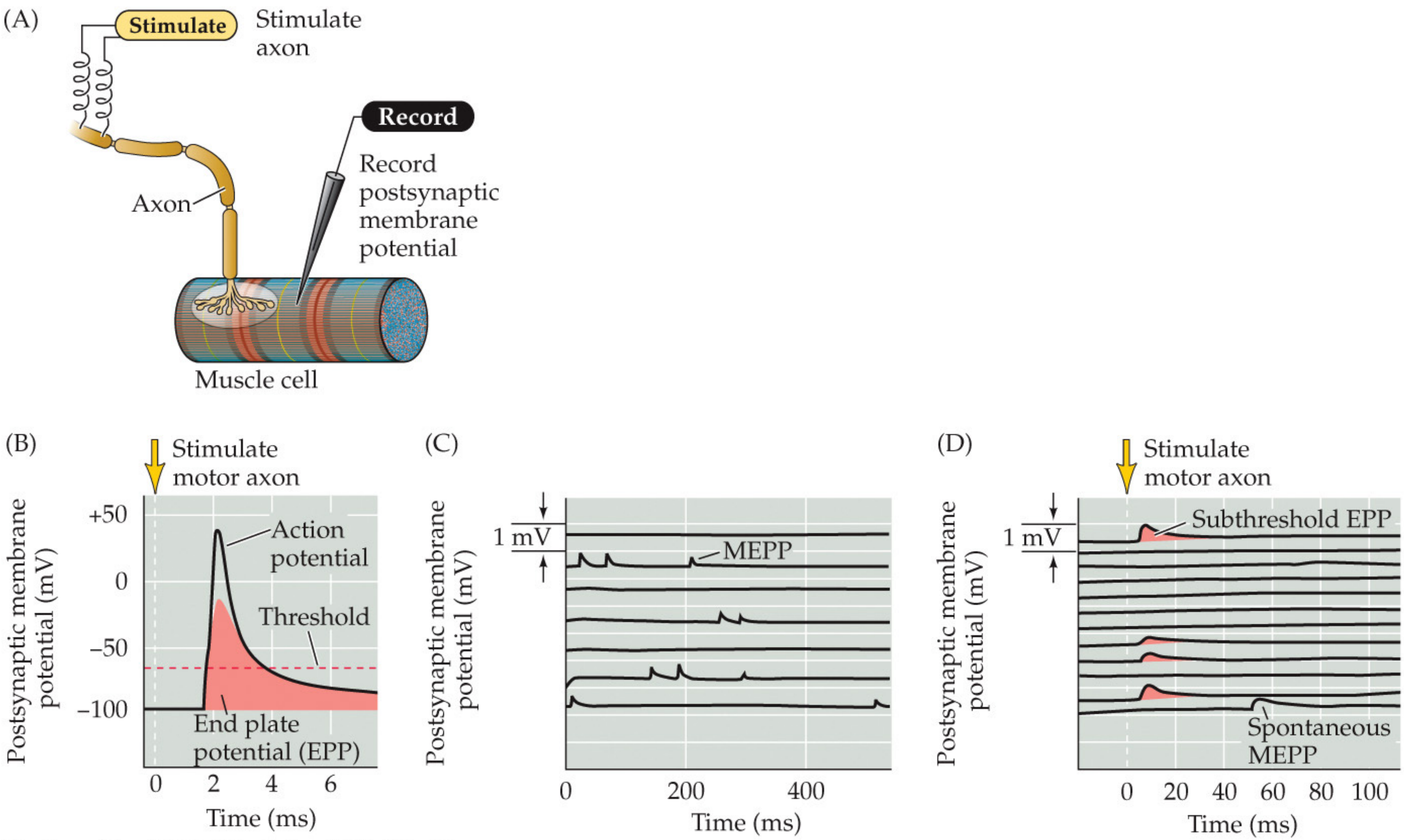
Reversal potential of the end plate current changes when ion gradients change



After Takeuchi and Takeuchi (1960) *J. Physiol.* 154: 52–67.

***NEUROSCIENCE 6e*, Figure 5.17**

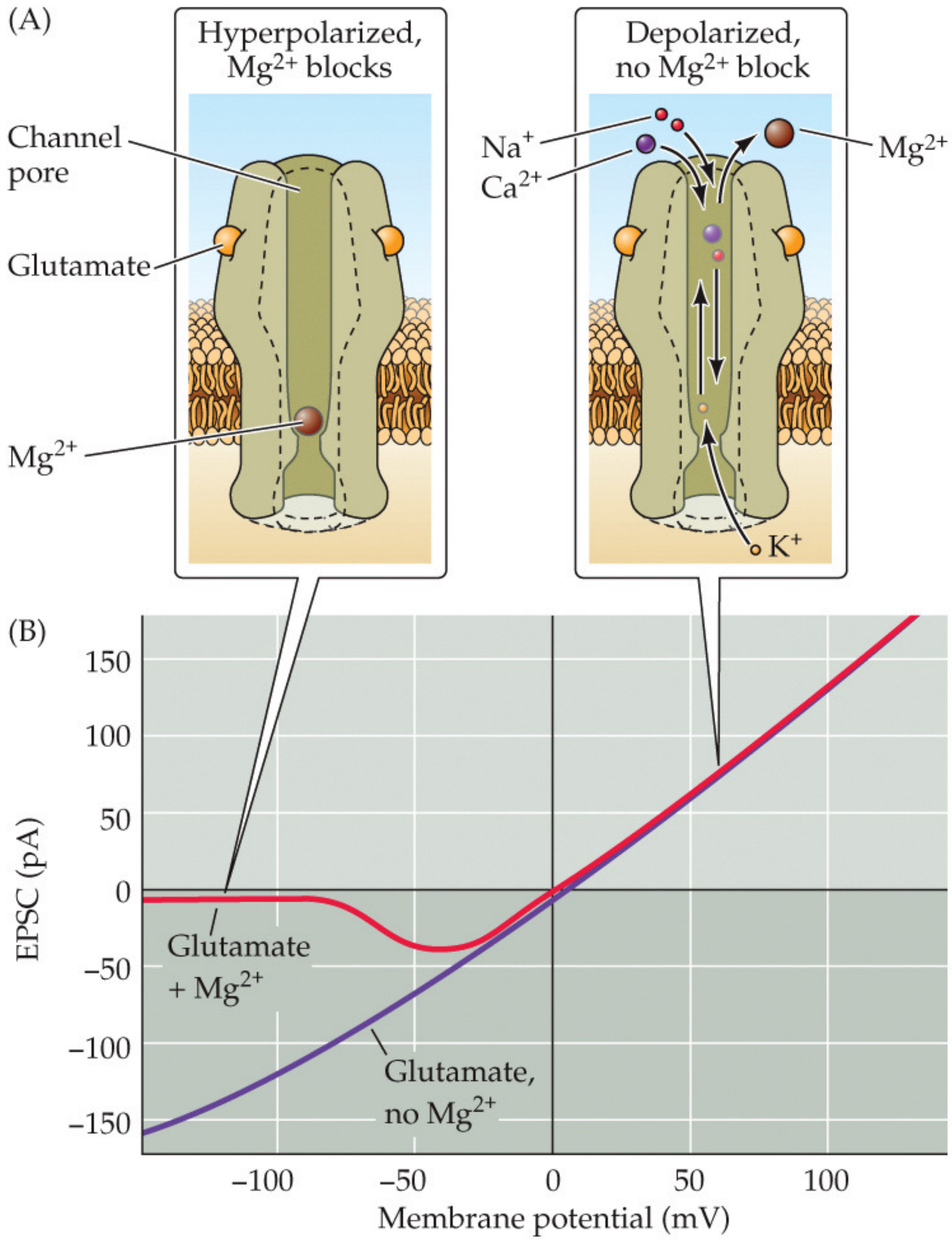
FIGURE 5.5 Synaptic transmission at the neuromuscular junction



After Fatt and Katz (1952) *J. Physiol.* (Lond.) 117: 109–127.

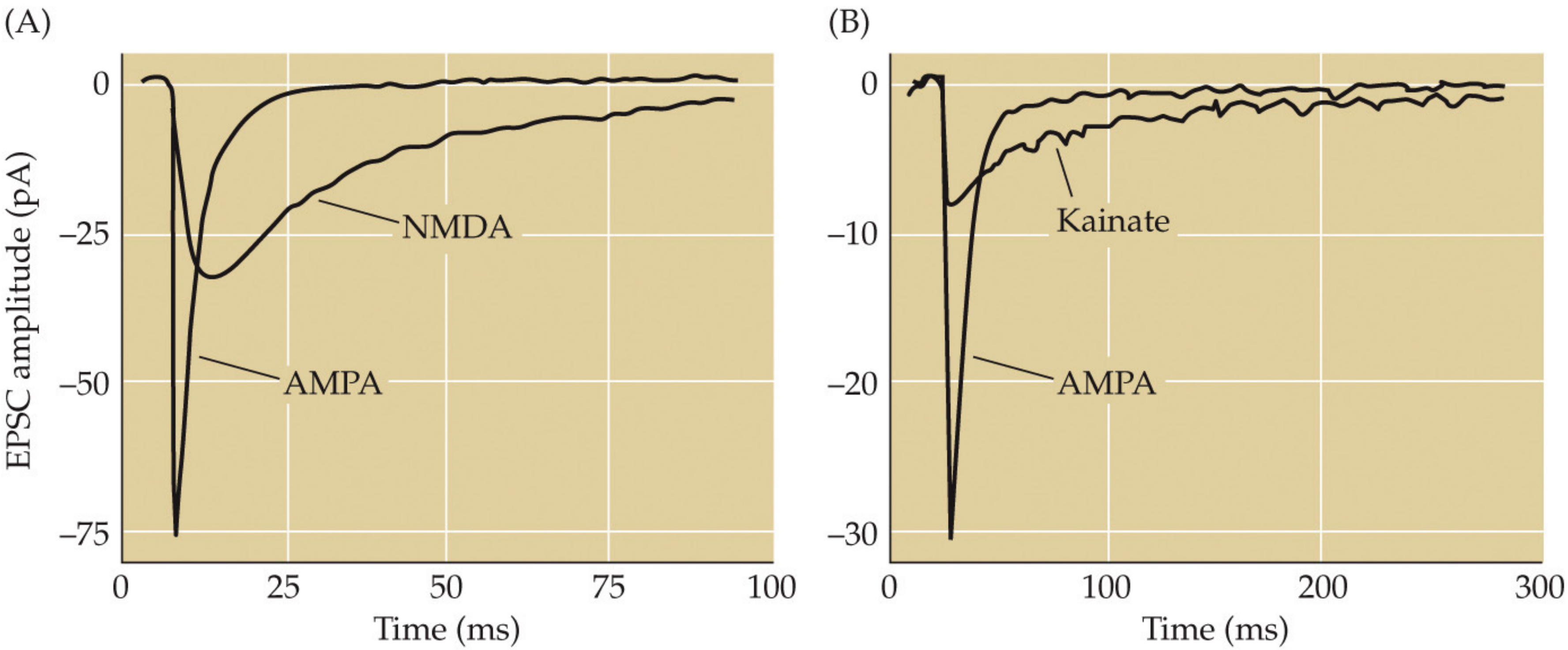
***NEUROSCIENCE 6e*, Figure 5.5**

FIGURE 6.8 Function and structure of the NMDA receptor (Part 1)



NEUROSCIENCE 6e, Figure 6.8 (Part 1)

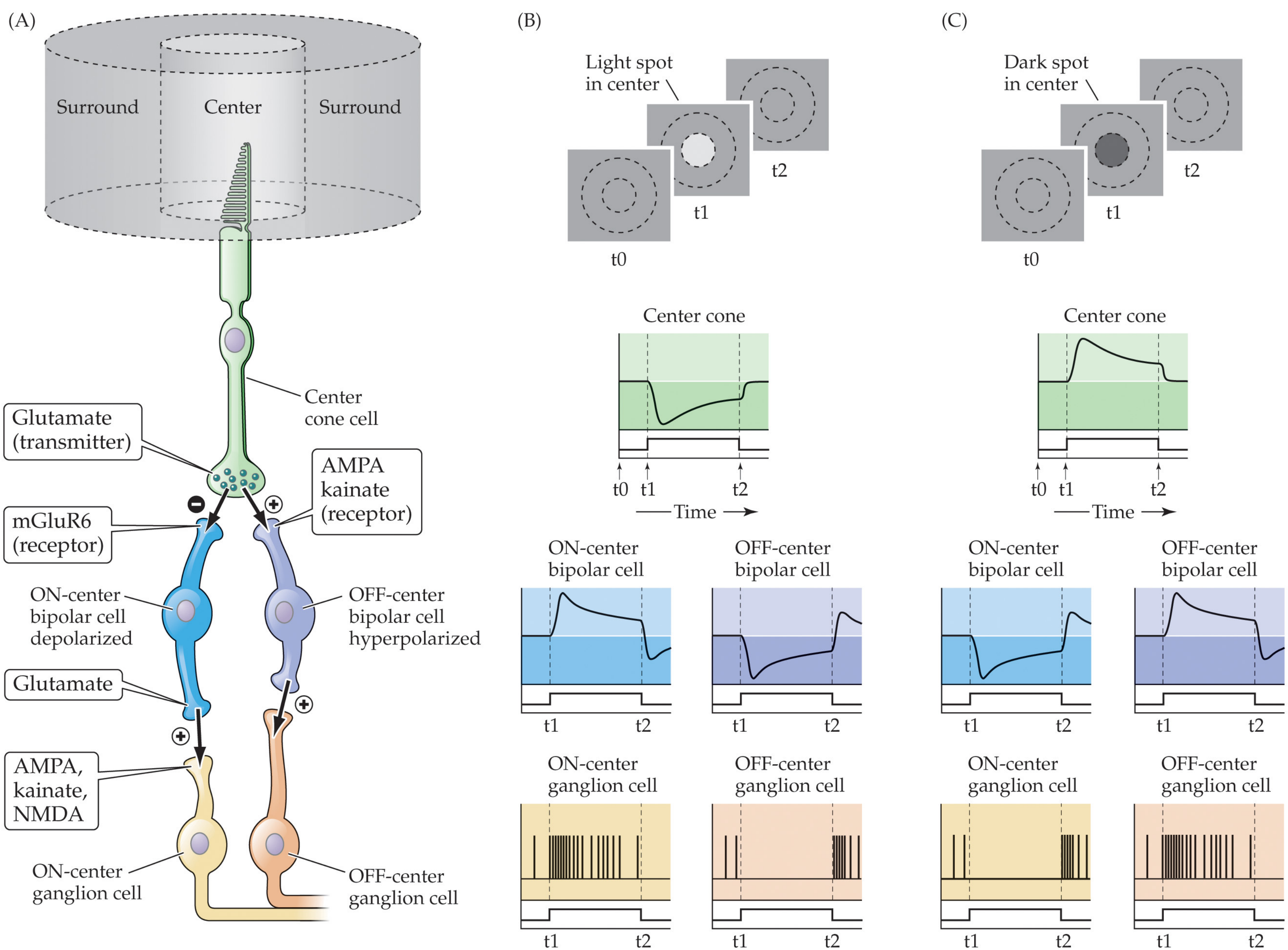
FIGURE 6.6 Postsynaptic responses mediated by ionotropic glutamate receptors



A after Watanabe et al. (2005) *J. Neurosci.* 25: 1024–1033. B from Mott et al. (2008) *J. Neurosci.* 28: 1659–1671.

***NEUROSCIENCE 6e*, Figure 6.6**

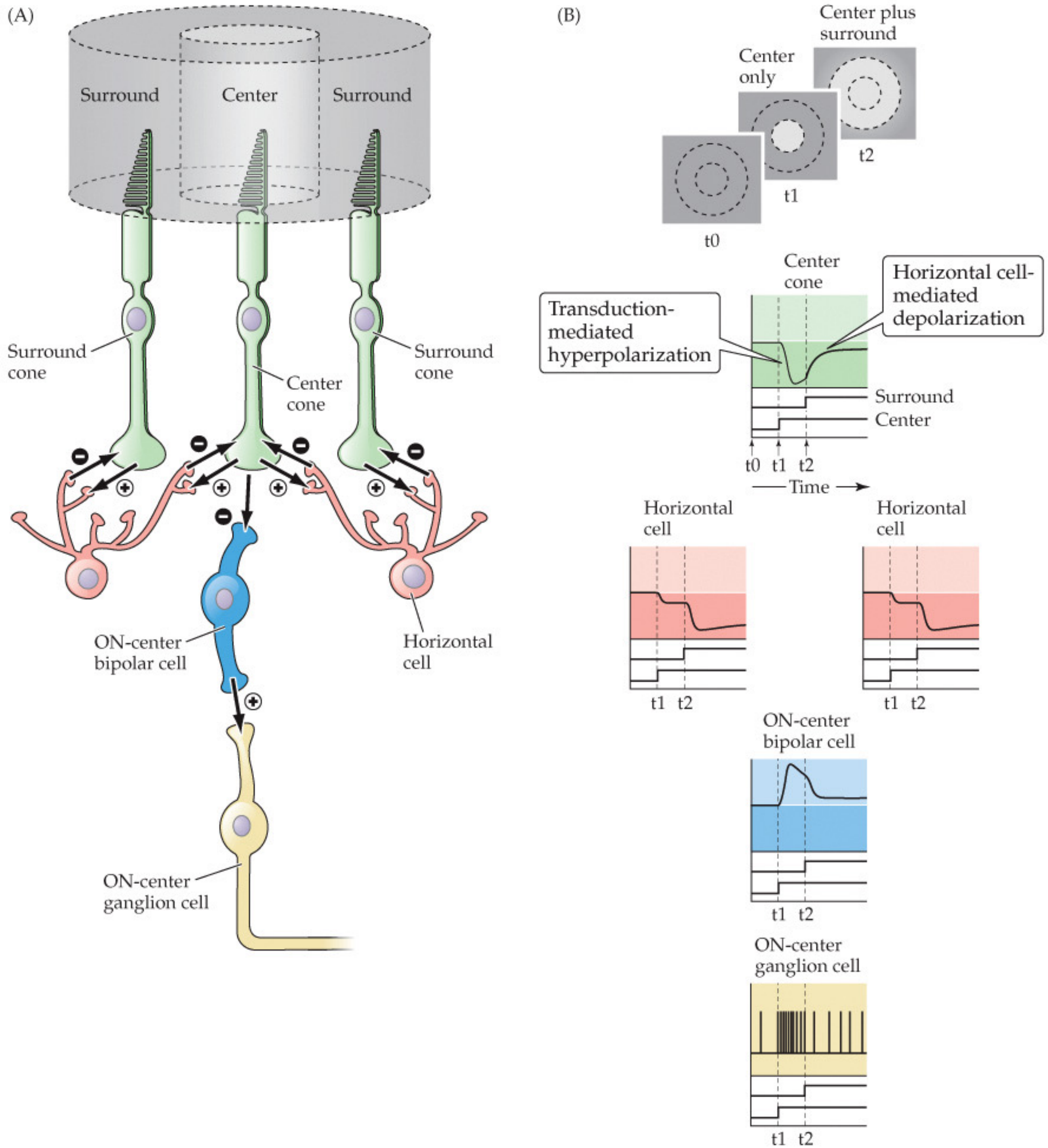
FIGURE 11.18 Circuitry responsible for generating receptive field center responses of retinal ganglion cells



NEUROSCIENCE 6e, Figure 11.18

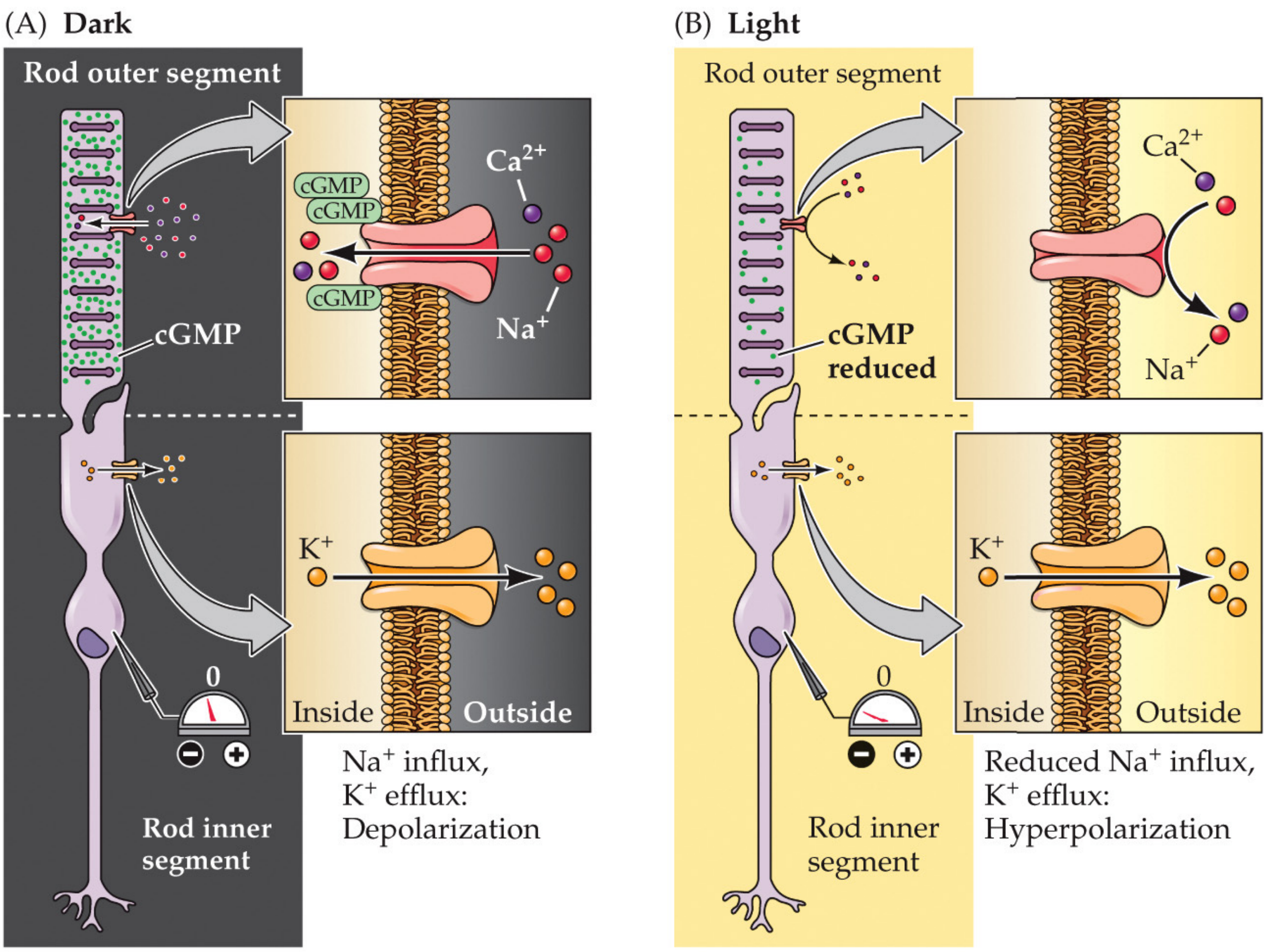
Chap 11, p. 253:

The selective response of ON- and OFF-center bipolar cells to light increments and decrements is explained by the fact that they express different types of glutamate receptors (see Figure 11.18A). OFF-center bipolar cells have ionotropic receptors (AMPA and kainate) that cause the cells to depolarize in response to glutamate released from photoreceptor terminals. In contrast, ON-center bipolar cells express a G-protein-coupled metabotropic glutamate receptor (mGluR6). When bound to glutamate, these receptors activate an intracellular cascade that closes cGMP-gated Na^+ channels, reducing inward current and hyperpolarizing the cell. Thus, glutamate has opposite effects on these two classes of cells, depolarizing OFF-center bipolar cells and hyperpolarizing ON-center cells. Photoreceptor synapses



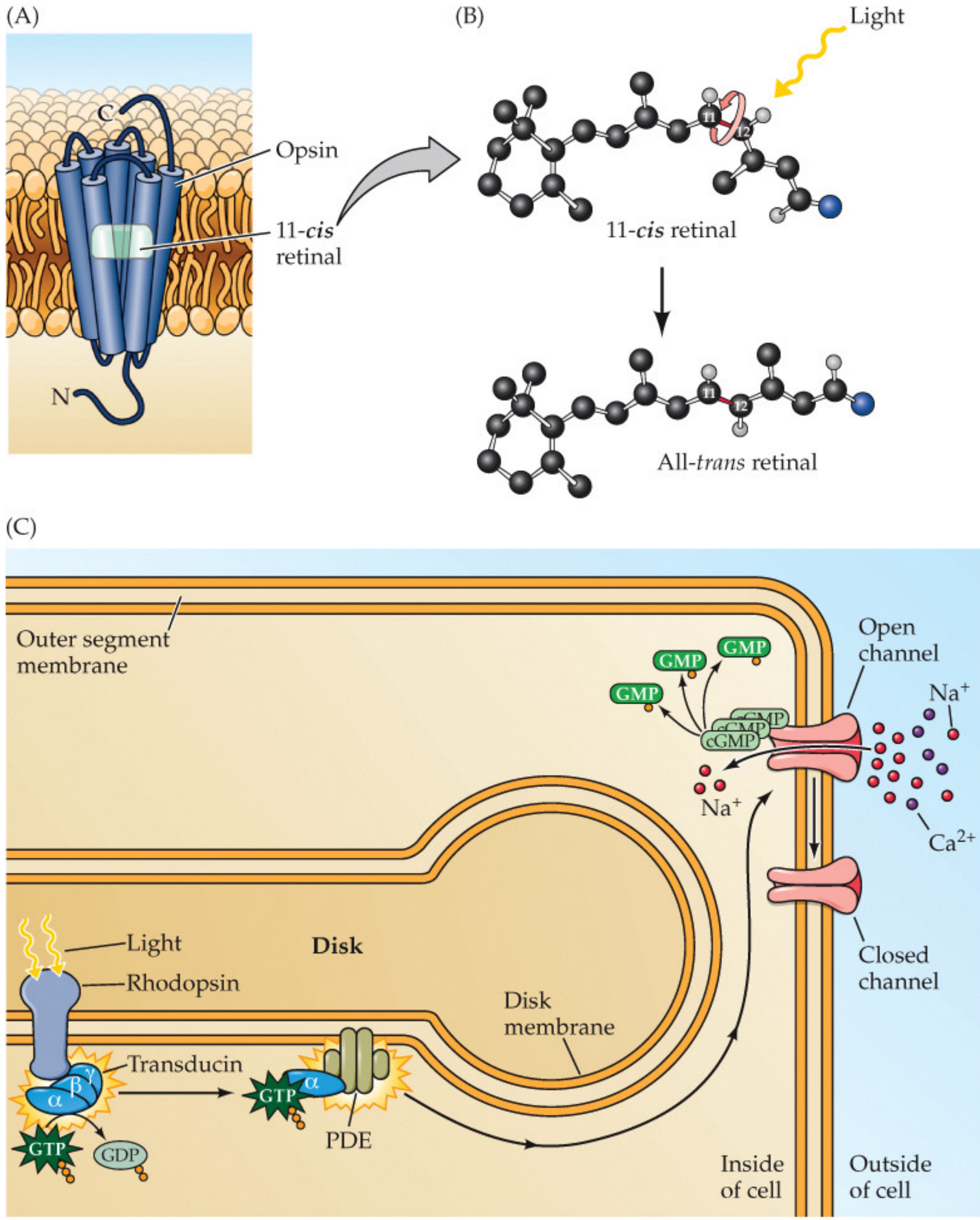
NEUROSCIENCE 6e, Figure 11.21

FIGURE 11.8 Cyclic GMP–gated channels and light-induced changes in the electrical activity of photoreceptors



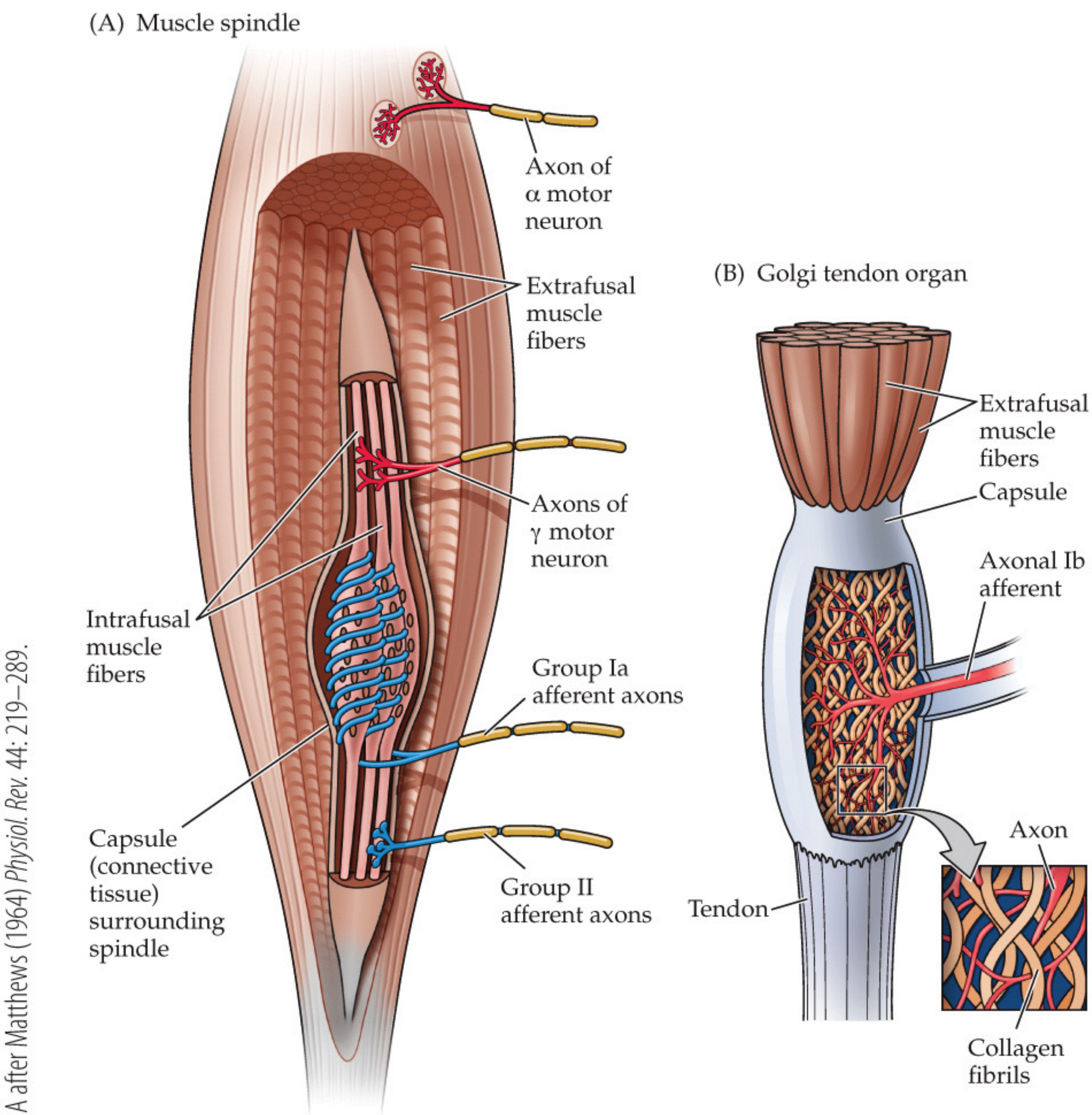
NEUROSCIENCE 6e, Figure 11.8

FIGURE 11.9 Phototransduction in rod photoreceptors



A, B after Oyster (1999) and Stryer (1986).

NEUROSCIENCE 6e, Figure 11.9



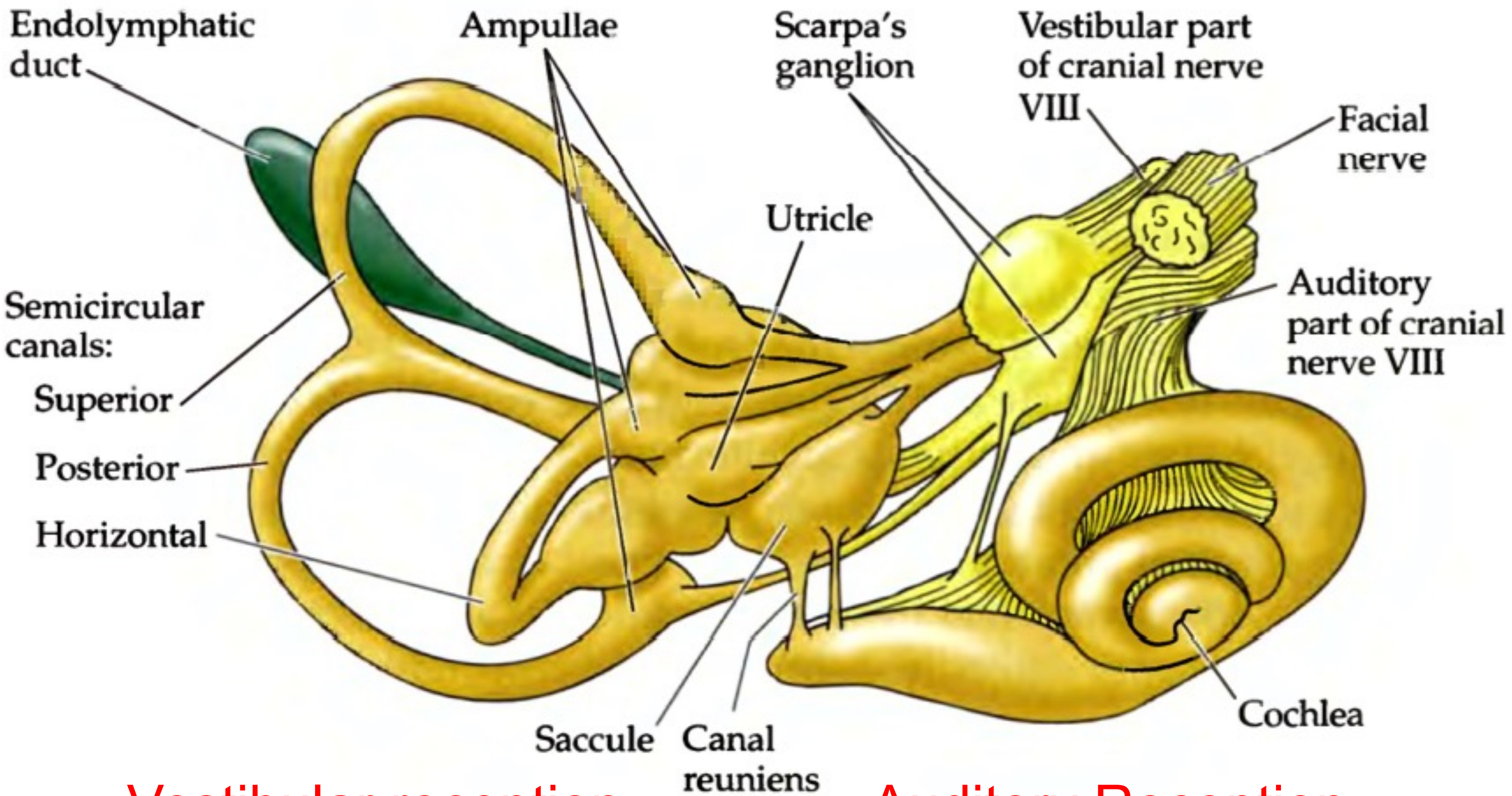
NEUROSCIENCE 6e, Figure 9.7

<u>Muscle spindle</u>

Changes in muscle contraction – steady change and rate of change

<u>Golgi tendon organ</u>

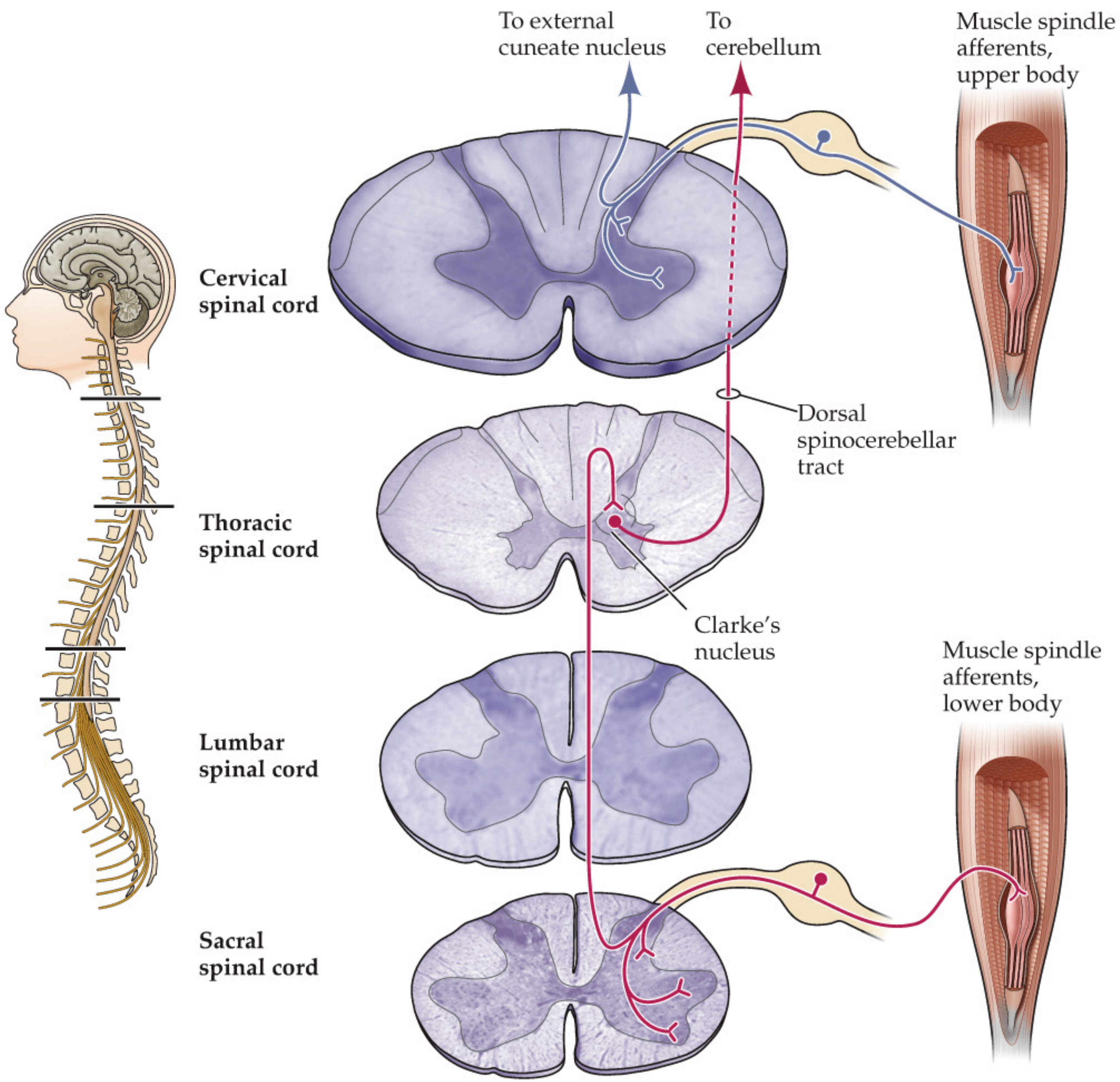
Change in muscle tension (force)



Vestibular reception

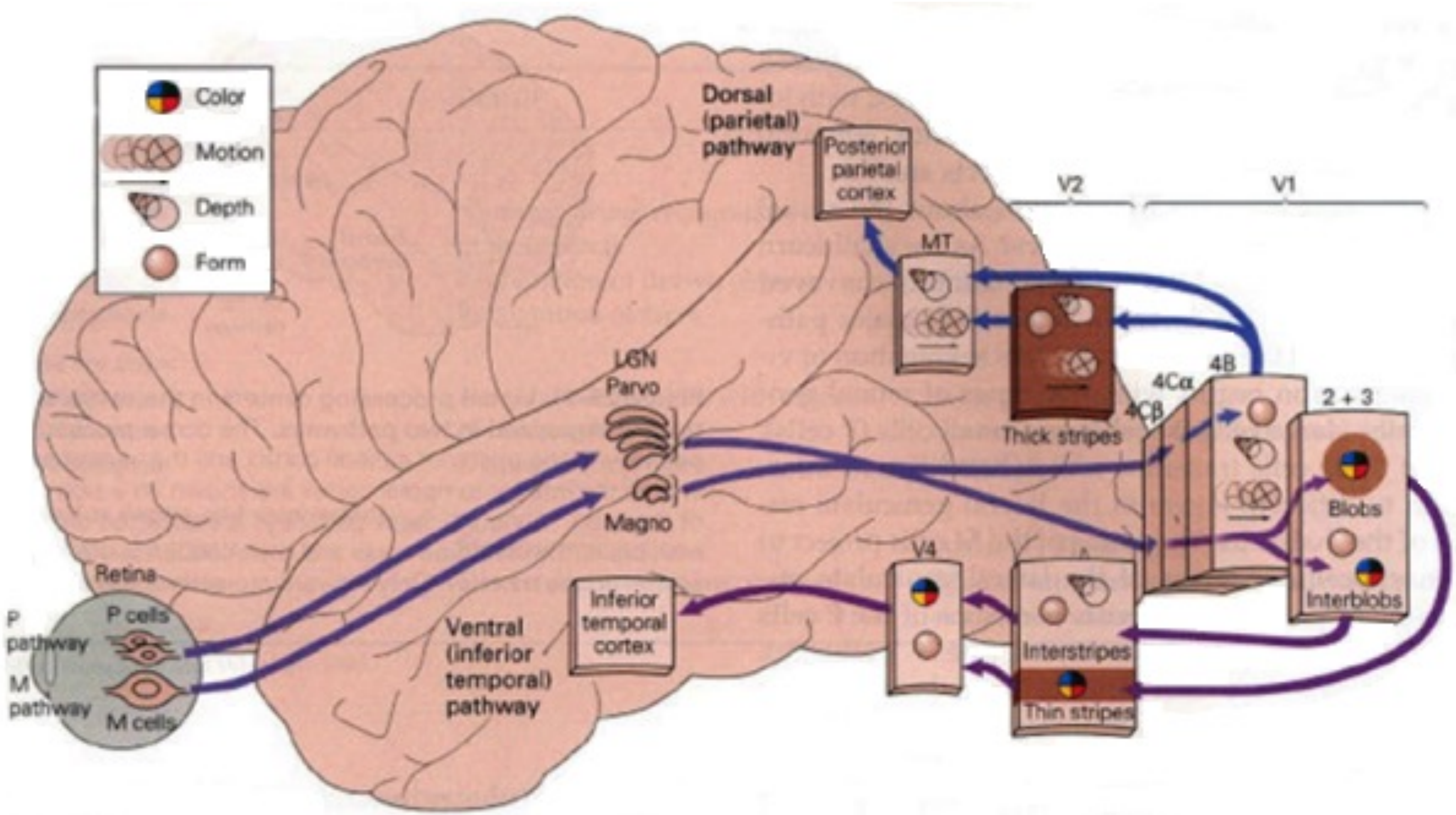
Auditory Reception

FIGURE 9.9 Proprioceptive pathways for the upper and lower body

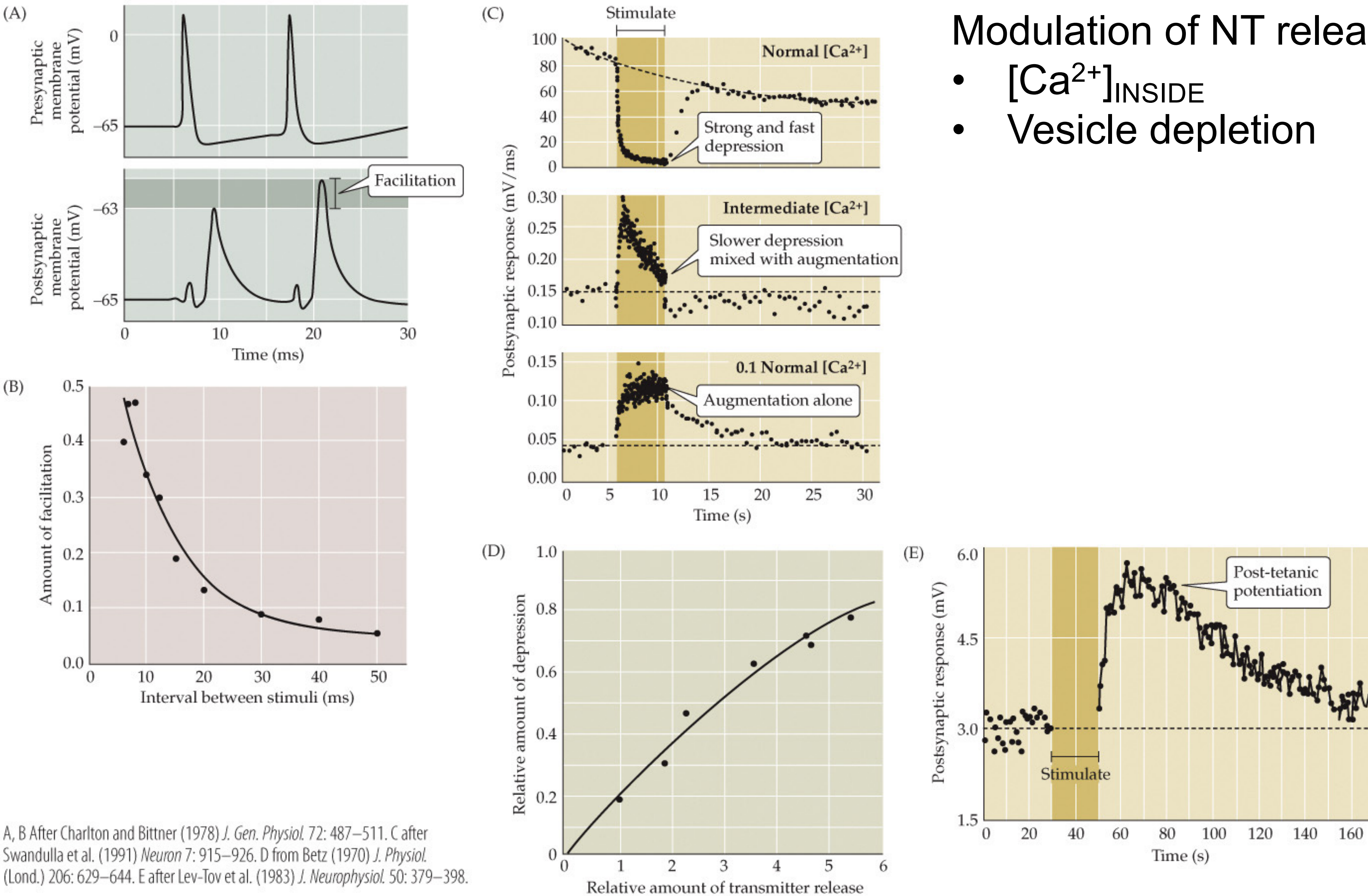


NEUROSCIENCE 6e, Figure 9.9

Visual Cortical Areas



Forms of short-term synaptic plasticity



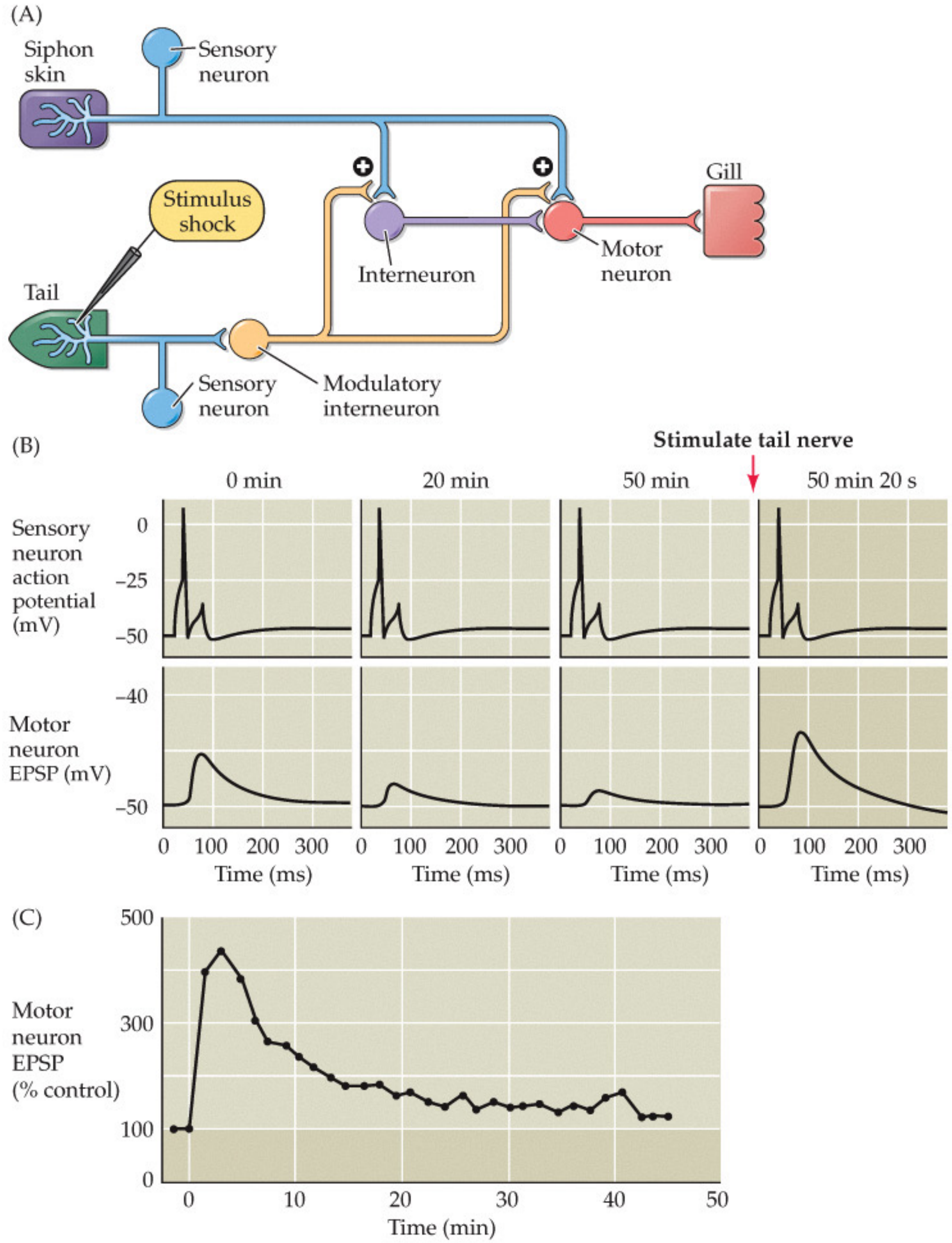
A, B After Charlton and Bittner (1978) *J. Gen. Physiol.* 72: 487–511. C after Swandulla et al. (1991) *Neuron* 7: 915–926. D from Betz (1970) *J. Physiol.* (Lond.) 206: 629–644. E after Lev-Tov et al. (1983) *J. Neurophysiol.* 50: 379–398.

***NEUROSCIENCE 6e*, Figure 8.1**

Modulation of NT release

- $[Ca^{2+}]_{INSIDE}$
- Vesicle depletion

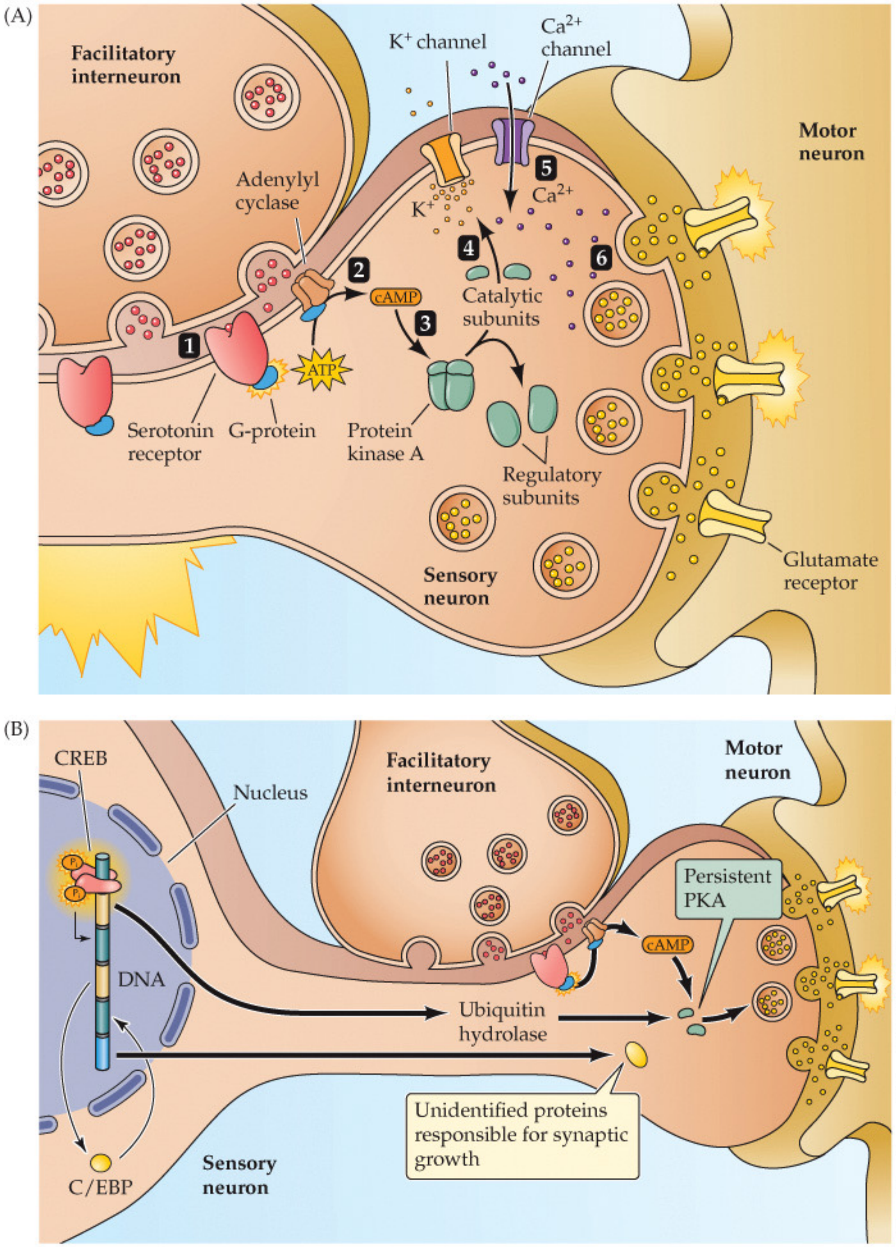
Synaptic mechanisms underlying short-term sensitization



NEUROSCIENCE 6e, Figure 8.4

A, B after Squire and Kandel (1999) New York: Scientific American Library, 54. C after Squire and Kandel (1999) New York: Scientific American Library, 57.

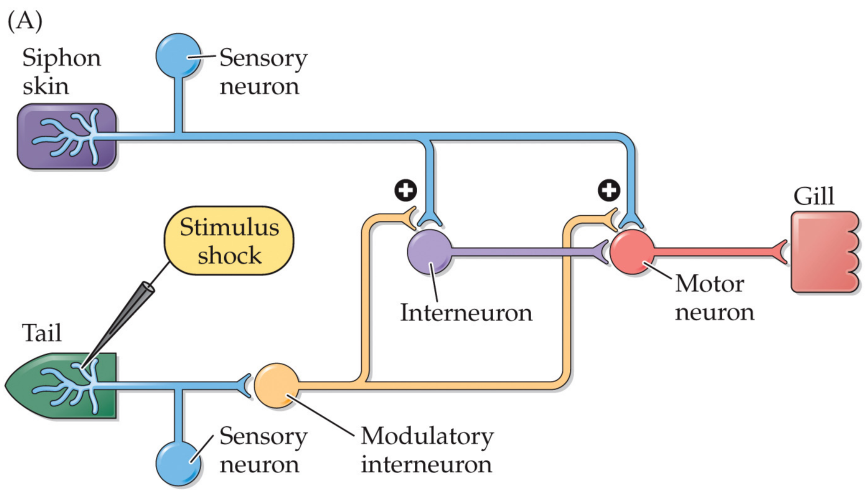
Mechanisms of presynaptic enhancement underlying behavioral sensitization



After Squire and Kandel (1999) New York: Scientific American Library, 60.

NEUROSCIENCE 6e, Figure 8.5

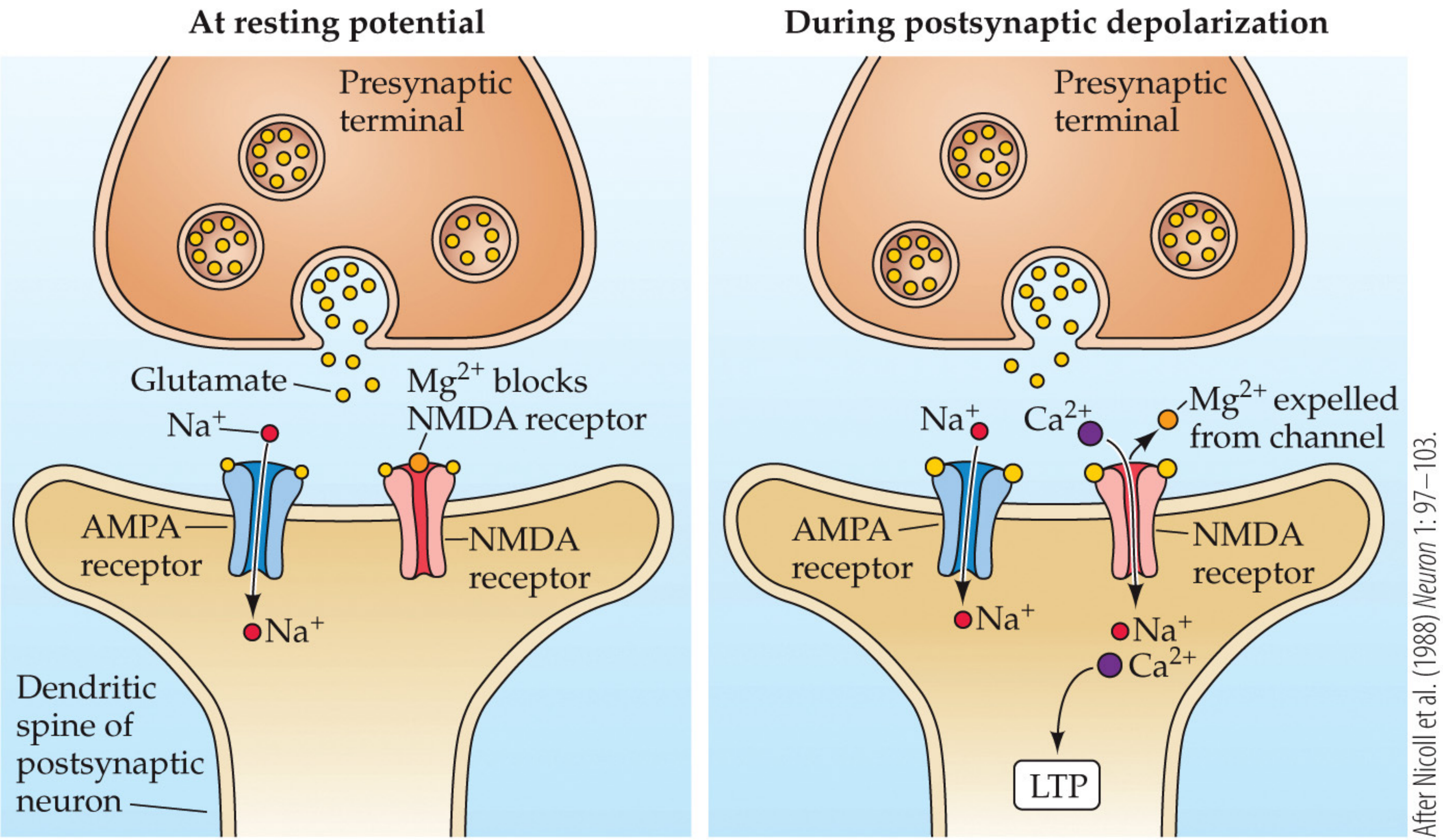
Short and long term effects



After Squire and Kandel (1999) New York: Scientific American Library, 54.

NEUROSCIENCE 6e, Figure 8.4 (Part 1)

The NMDA receptor channel can open only during depolarization of the postsynaptic neuron from its normal resting potential



NEUROSCIENCE 6e, Figure 8.10