

# 7

## PART A

# The Nervous System

PowerPoint® Lecture Slide Presentation by Jerry L. Cook, Sam Houston University



## ESSENTIALS OF HUMAN ANATOMY & PHYSIOLOGY

EIGHTH EDITION

ELAINE N. MARIEB

# 3 main Functions of the Nervous System

1. Sensory input – gathering information
  - To monitor changes occurring inside and outside the body
2. Integration
  - To process and interpret sensory input and decide if action is needed
3. Motor output
  - The response activates muscles or glands

# 2 parts of the Nervous System

- Central nervous system (CNS)
  - Brain
  - Spinal cord
- Peripheral nervous system (PNS)
  - Nerve outside the brain and spinal cord

# Function of the Peripheral Nervous System

## 1. Sensory input division

- Nerve fibers that carry information to the central nervous system

## 2. Motor output division

- Nerve fibers that carry impulses away from the central nervous system

Figure 7.1

# Functional Classification of the Peripheral Nervous System

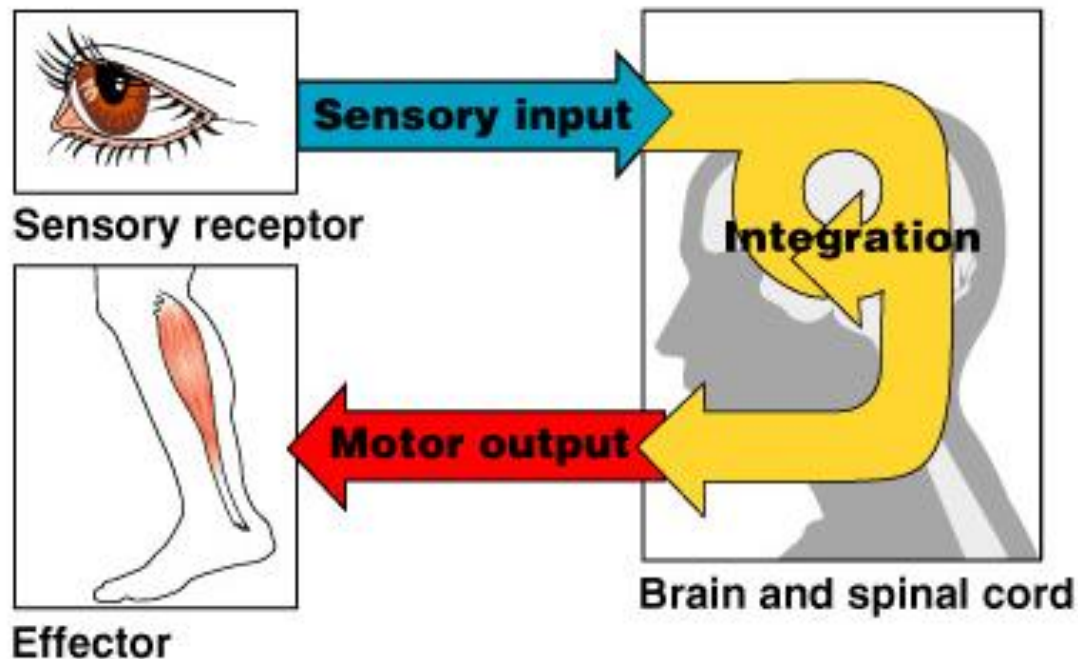


Figure 7.1

## 2 subdivisions of the motor division

1. Somatic nervous system = voluntary
  - \* Skeletal muscles
2. Autonomic nervous system = involuntary
  - \* Cardiac and Smooth muscles

Figure 7.1

# Organization of the Nervous System

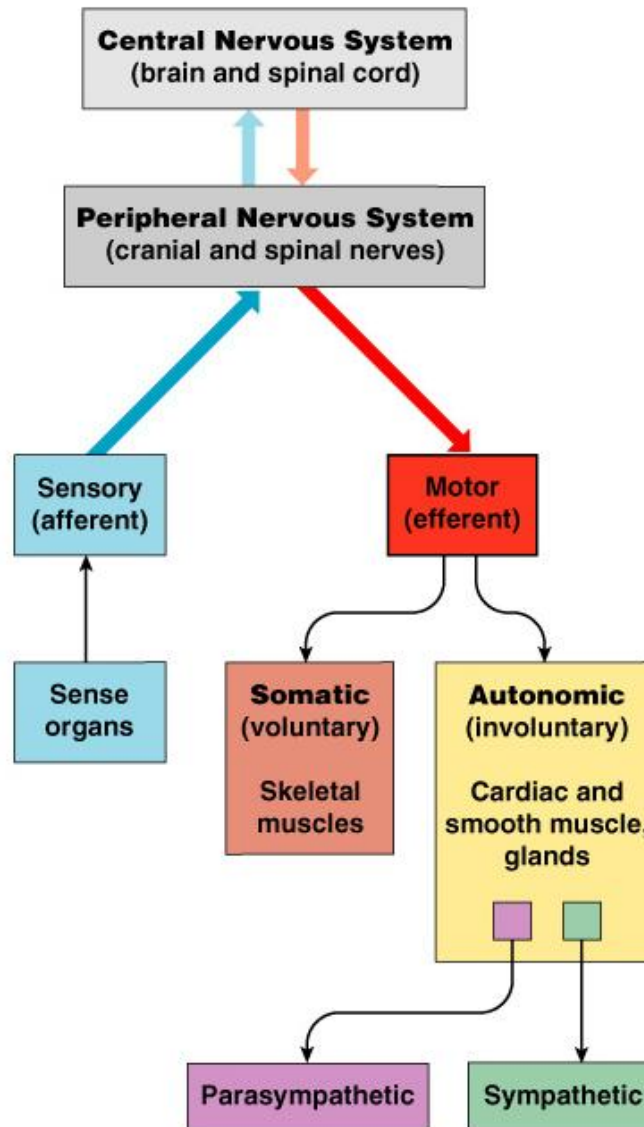
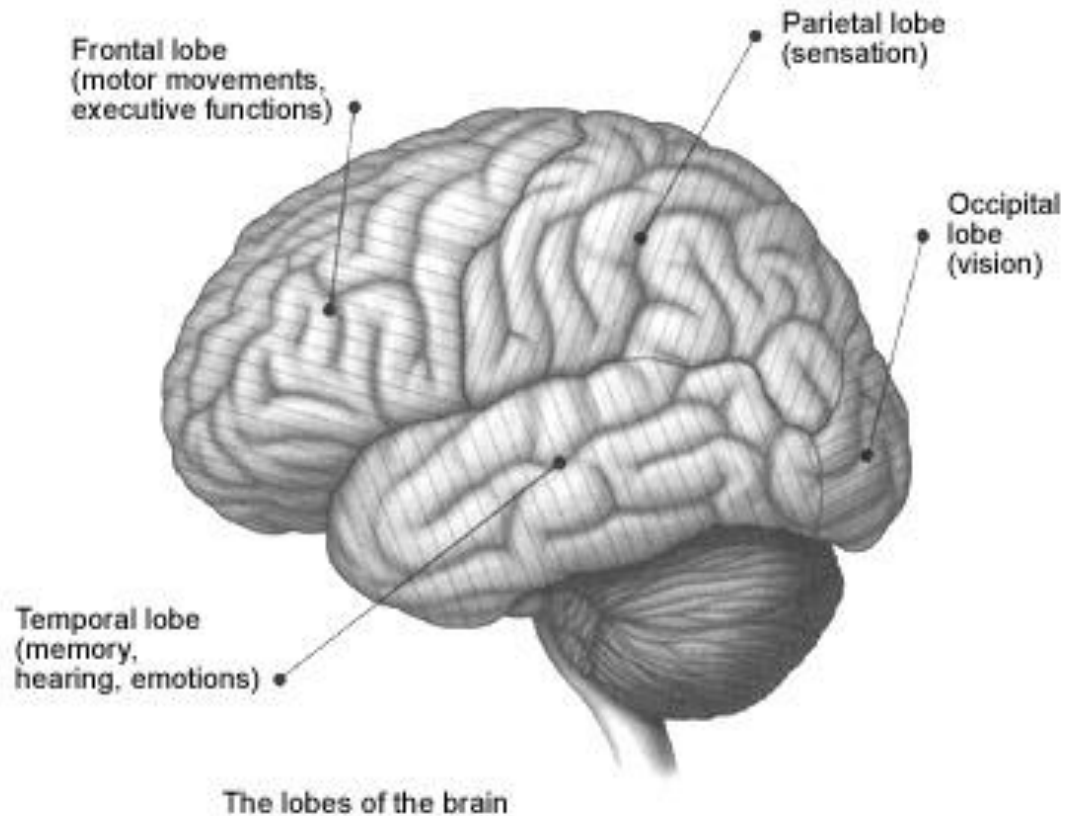
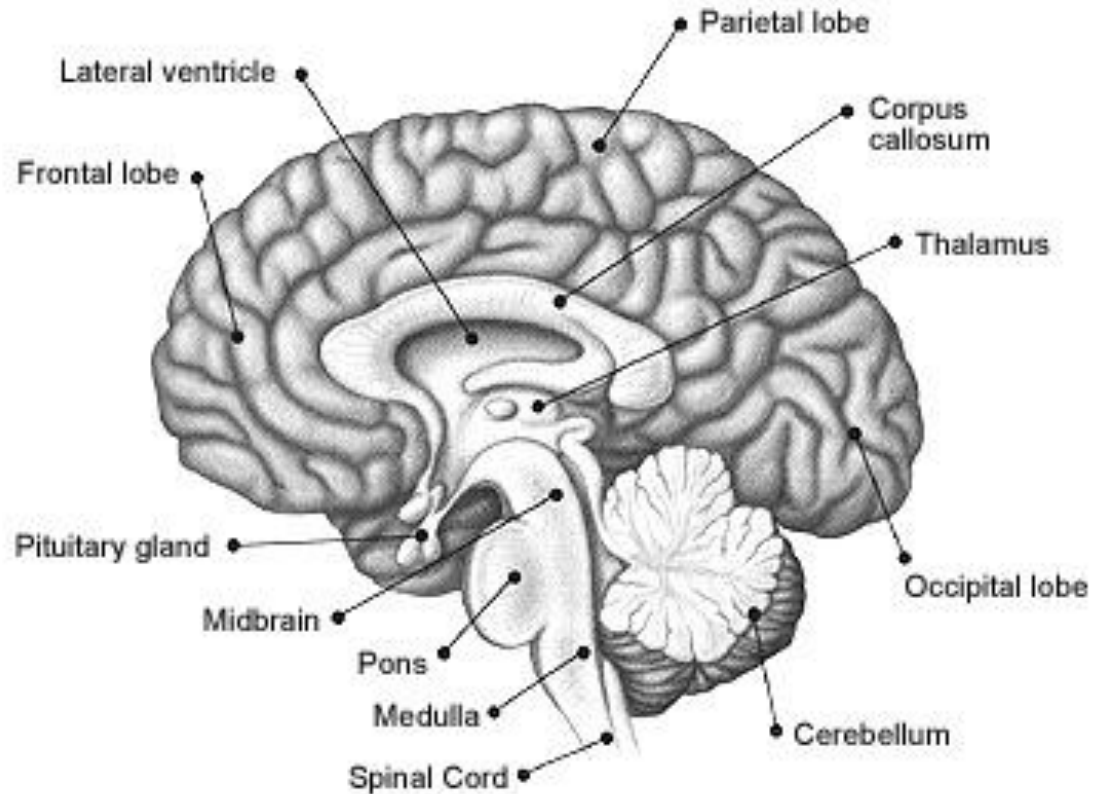


Figure 7.2

# Lobes of the brain



# Inner parts of the brain



The different parts of the brain

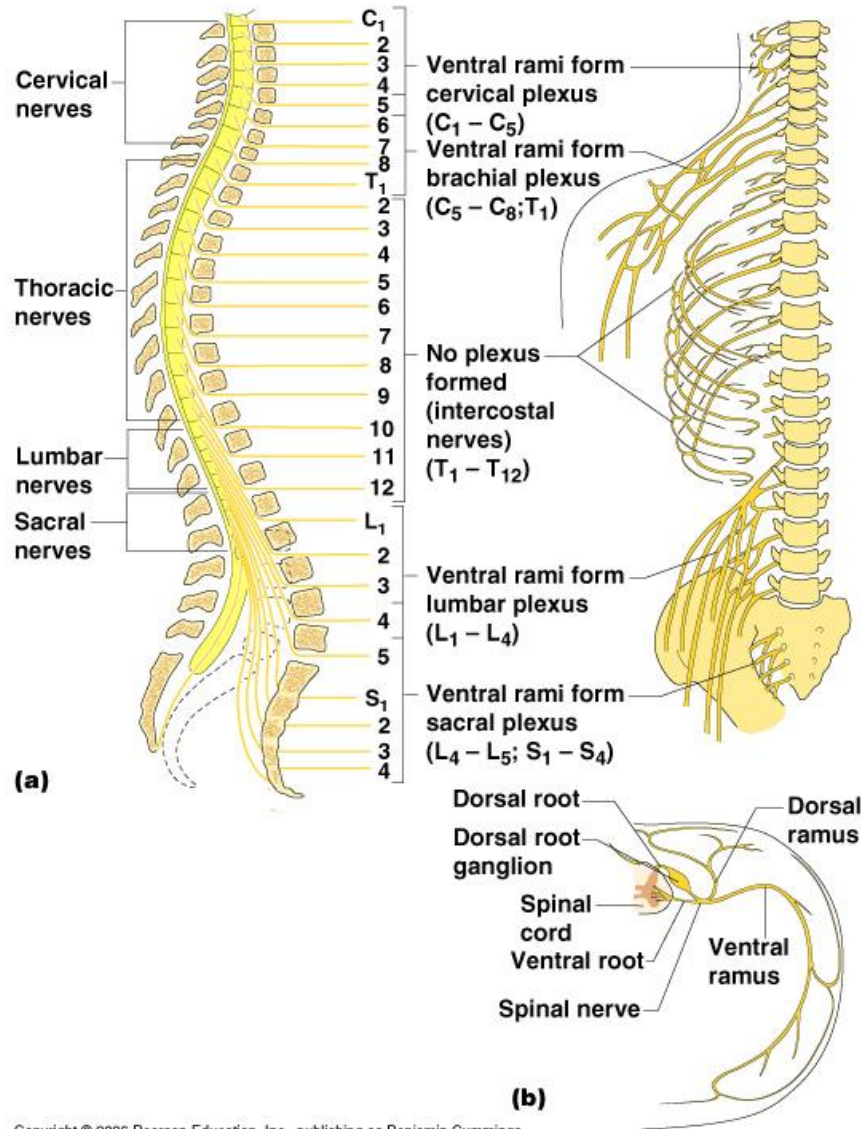
# What part does what?

- Cerebrum
- Thalamus
- Hypothalamus
- Brain Stem
- Medulla Oblongata
- Midbrain
- Pons

# Spinal cord

- There is a pair of spinal nerves at the level of each vertebrae for a total of 31 pairs
- Spinal nerves are named for the region from which they arise

# Spinal cord



Copyright © 2006 Pearson Education, Inc., publishing as Benjamin Cummings.

# Nervous Tissue: Neurons

- Neurons = nerve cells
  - Cells specialized to transmit messages

## 2 Major regions of neurons

- Cell body – nucleus and metabolic center of the cell
- Processes – fibers that extend from the cell body

# Neuron Anatomy

- Cell body
  - Nucleus
  - Large nucleolus

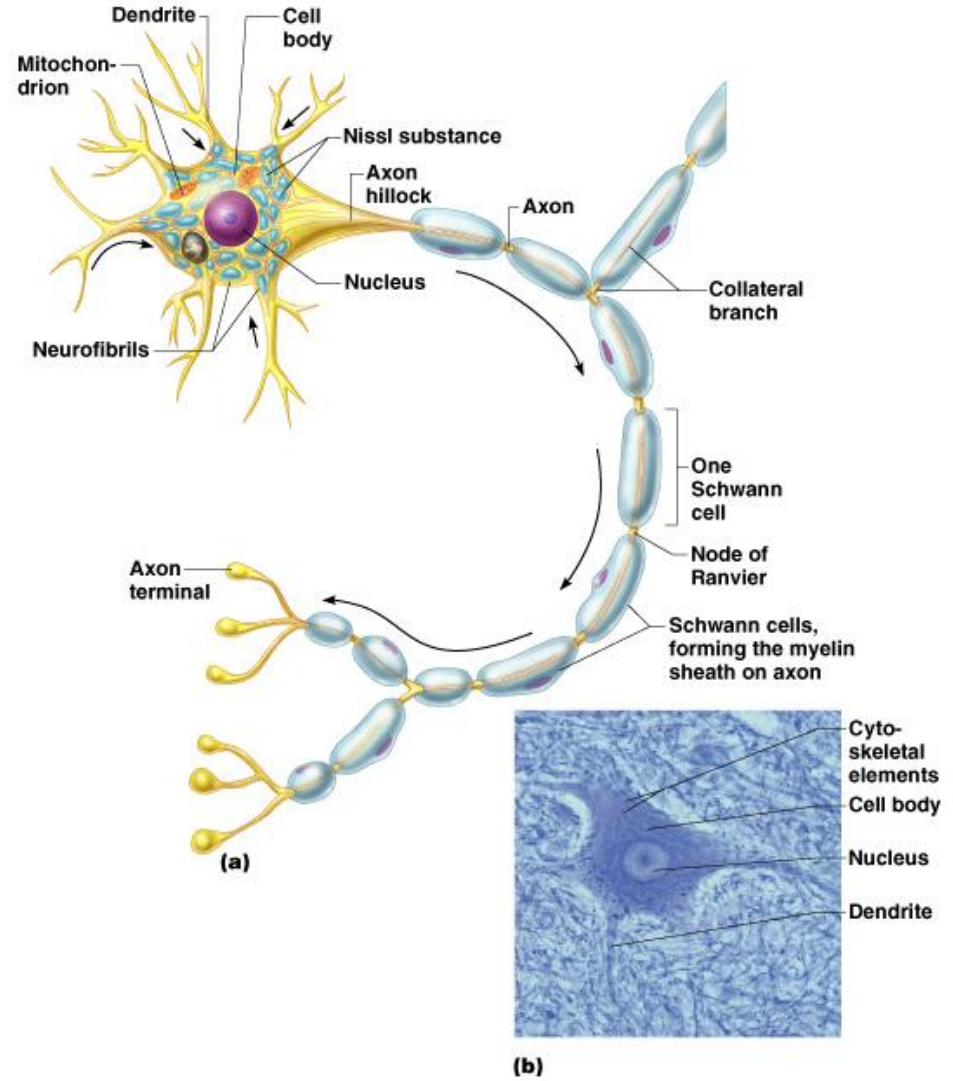


Figure 7.4a–b

# Neuron Anatomy

## 2 Extensions outside the cell body

- Dendrites – conduct impulses toward the cell body
- Axons – conduct impulses away from the cell body

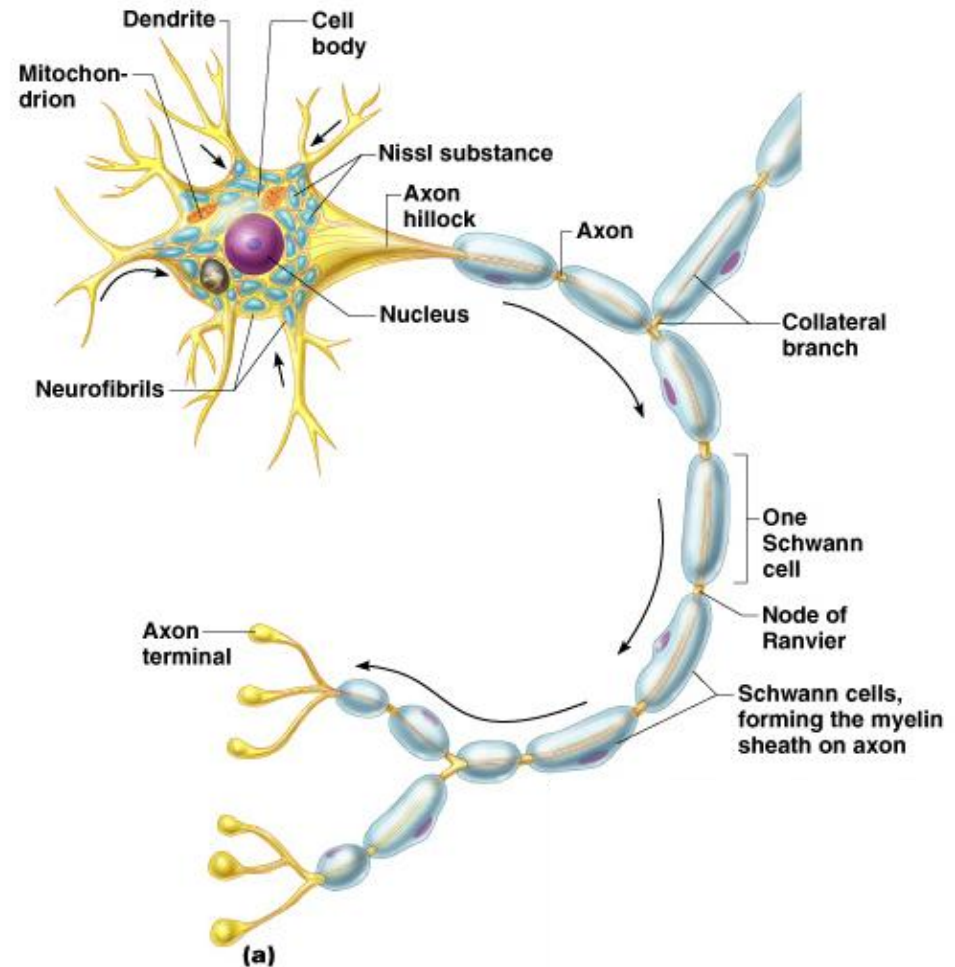
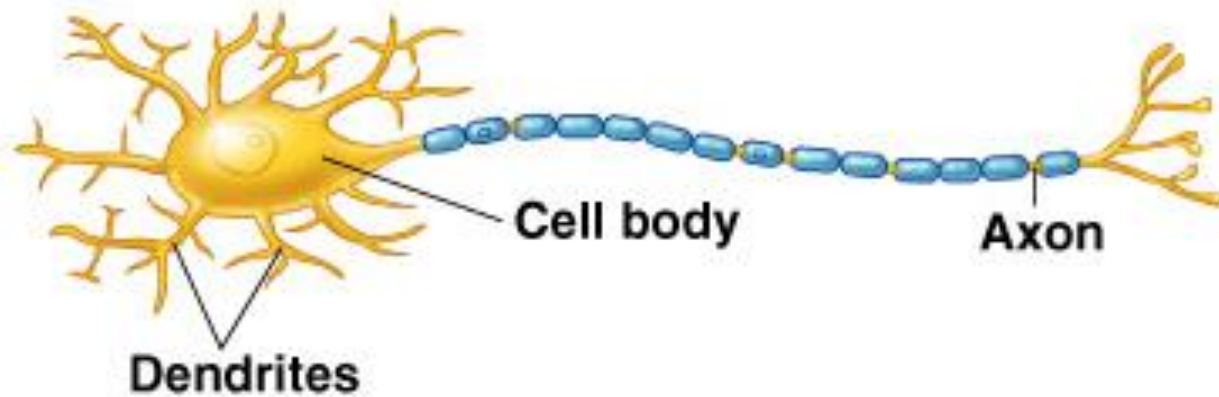


Figure 7.4a

# 3 Classification of Neurons

1. Multipolar neurons – many extensions from the cell body – motor neurons



**(a) Multipolar neuron**

# Structural Classification of Neurons

2. Bipolar neurons – one axon and one dendrite  
– neurons of the eyes and nose

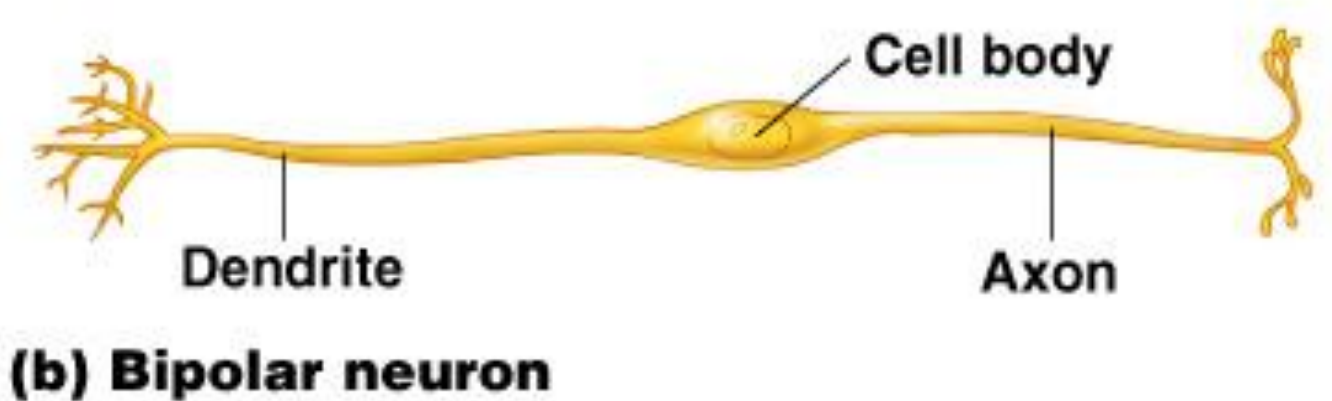


Figure 7.8b

# Structural Classification of Neurons

3. Unipolar neurons – have a short single process leaving the cell body – sensory neurons

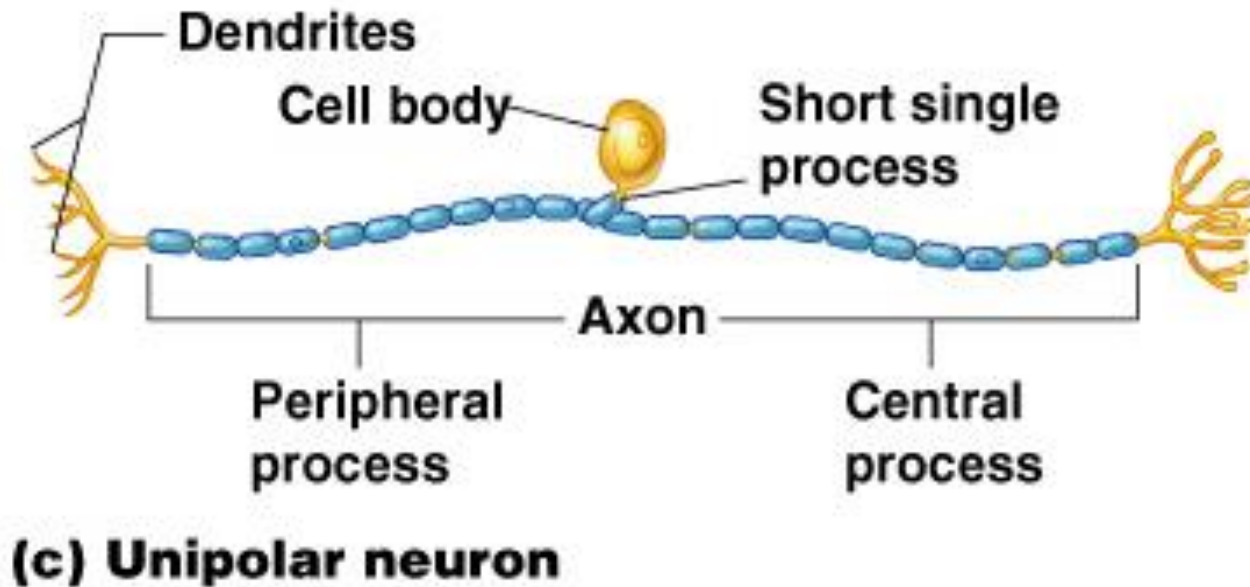


Figure 7.8c

# Function of Neurons

1. Irritability – ability to respond to stimuli
2. Conductivity – ability to transmit an impulse

# Starting a Nerve Impulse

- Polarized – neuron at rest
- Depolarization – a stimulus depolarizes the neuron's membrane
- A depolarized membrane allows sodium ( $\text{Na}^+$ ) to flow inside the membrane
- The exchange of ions initiates an action potential in the neuron

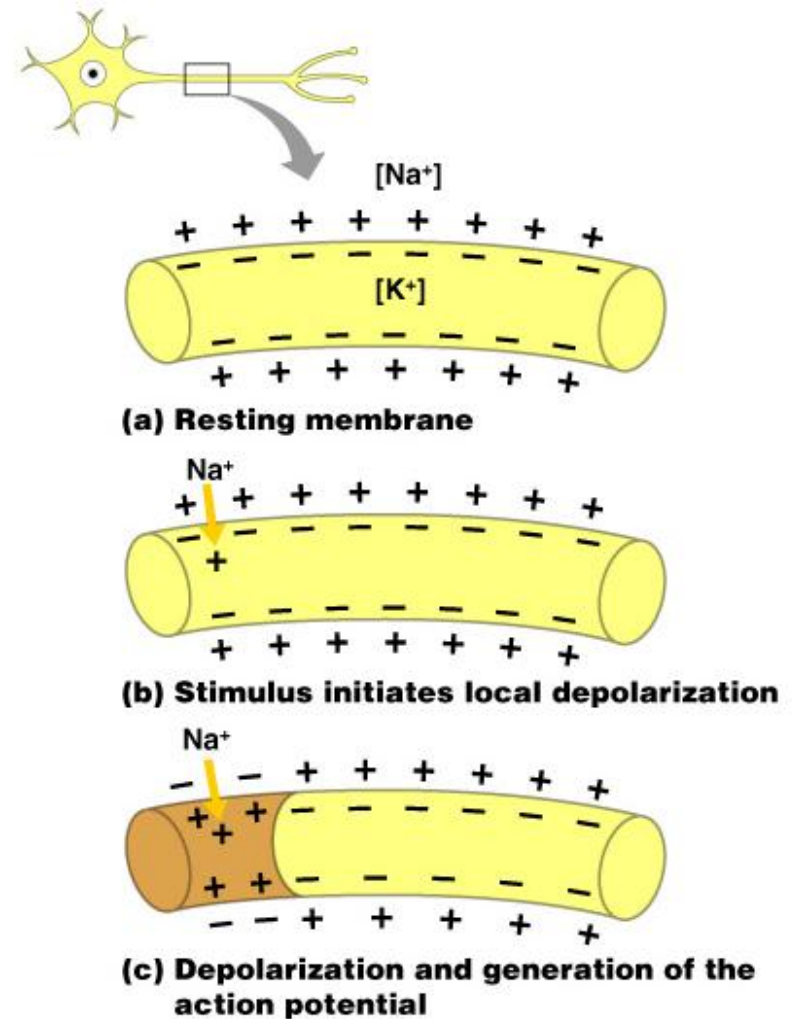


Figure 7.9a–c

# The Action Potential

- If the action potential (nerve impulse) starts, it is propagated over the entire axon
- Potassium ions rush out of the neuron after sodium ions rush in, which repolarizes the membrane
- Repolarization must occur before another impulse is fired

# Nerve Impulse Continued

- The impulse continues to move toward the cell body
- All or none - impulse

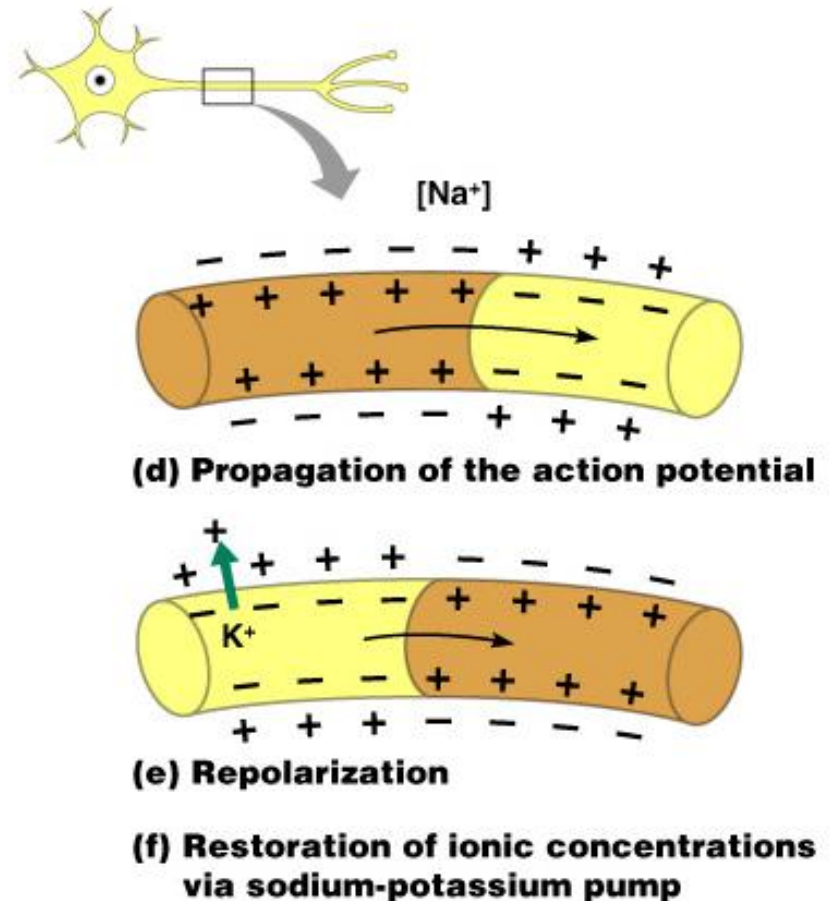


Figure 7.9d-f

# Continuation of the Nerve Impulse between Neurons

- Impulses are able to cross the synapse (space between neurons) to another nerve
  - Neurotransmitter (chemicals) are released from a nerve's axon terminal
  - The dendrite of the next neuron has receptors that are stimulated by the neurotransmitter
  - An action potential is started in the dendrite

# How Neurons Communicate at Synapses

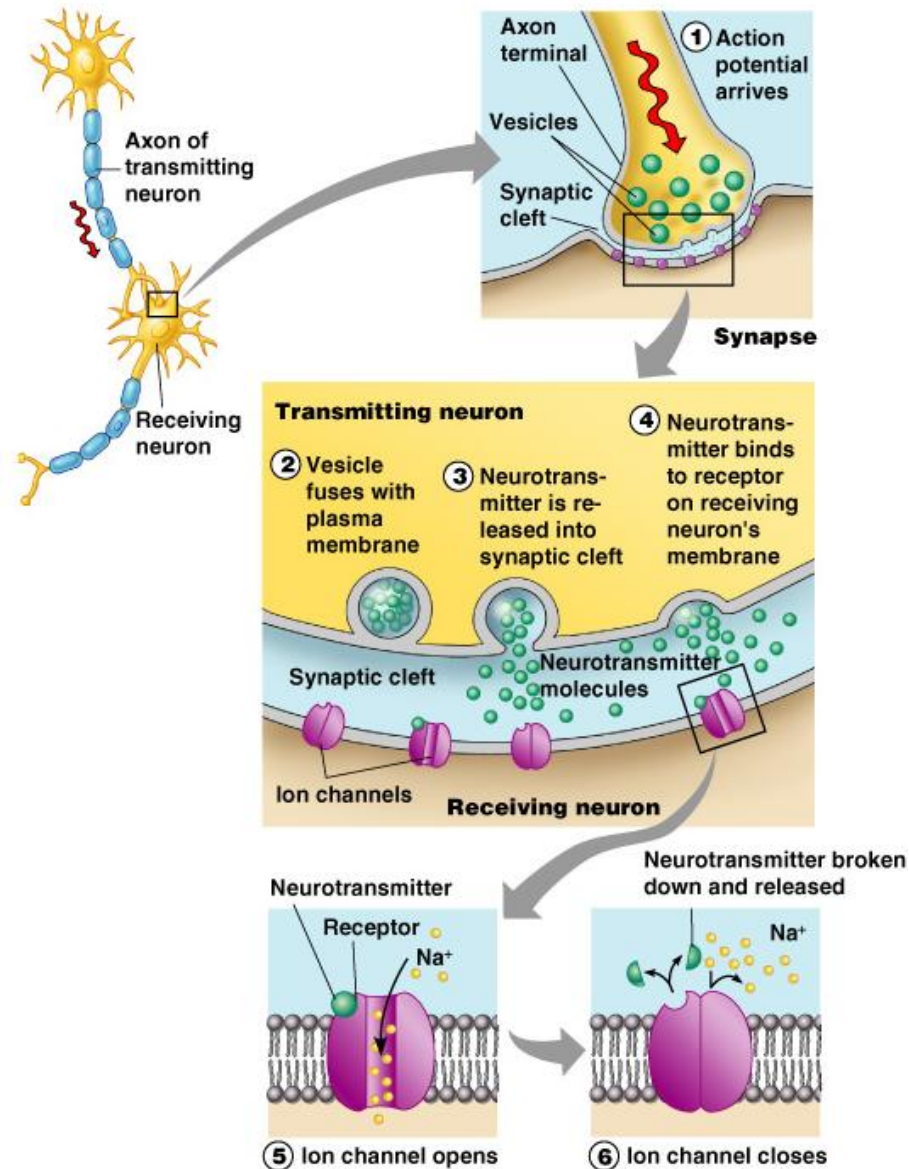


Figure 7.10

# The Reflex Arc

- Reflex – rapid, predictable, and involuntary responses to stimuli
- Reflex arc – direct route from a sensory neuron, to an interneuron, to an effector

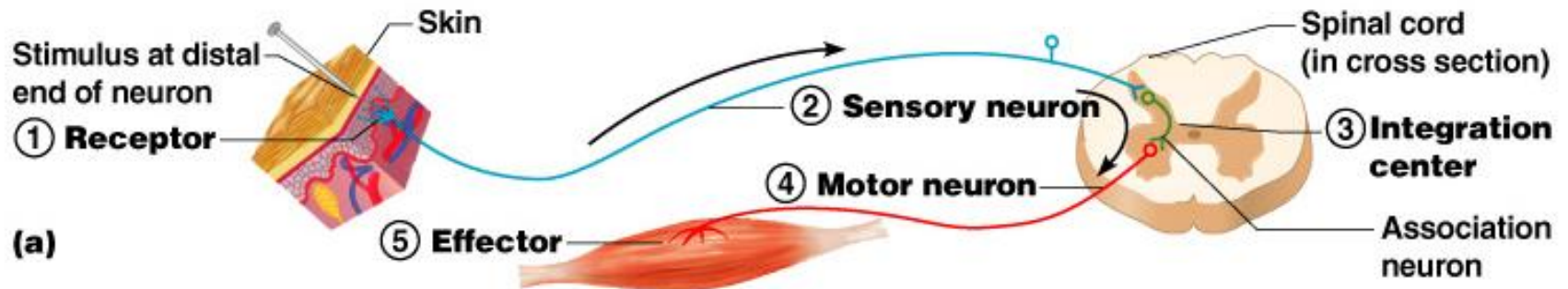


Figure 7.11a

# Simple Reflex Arc

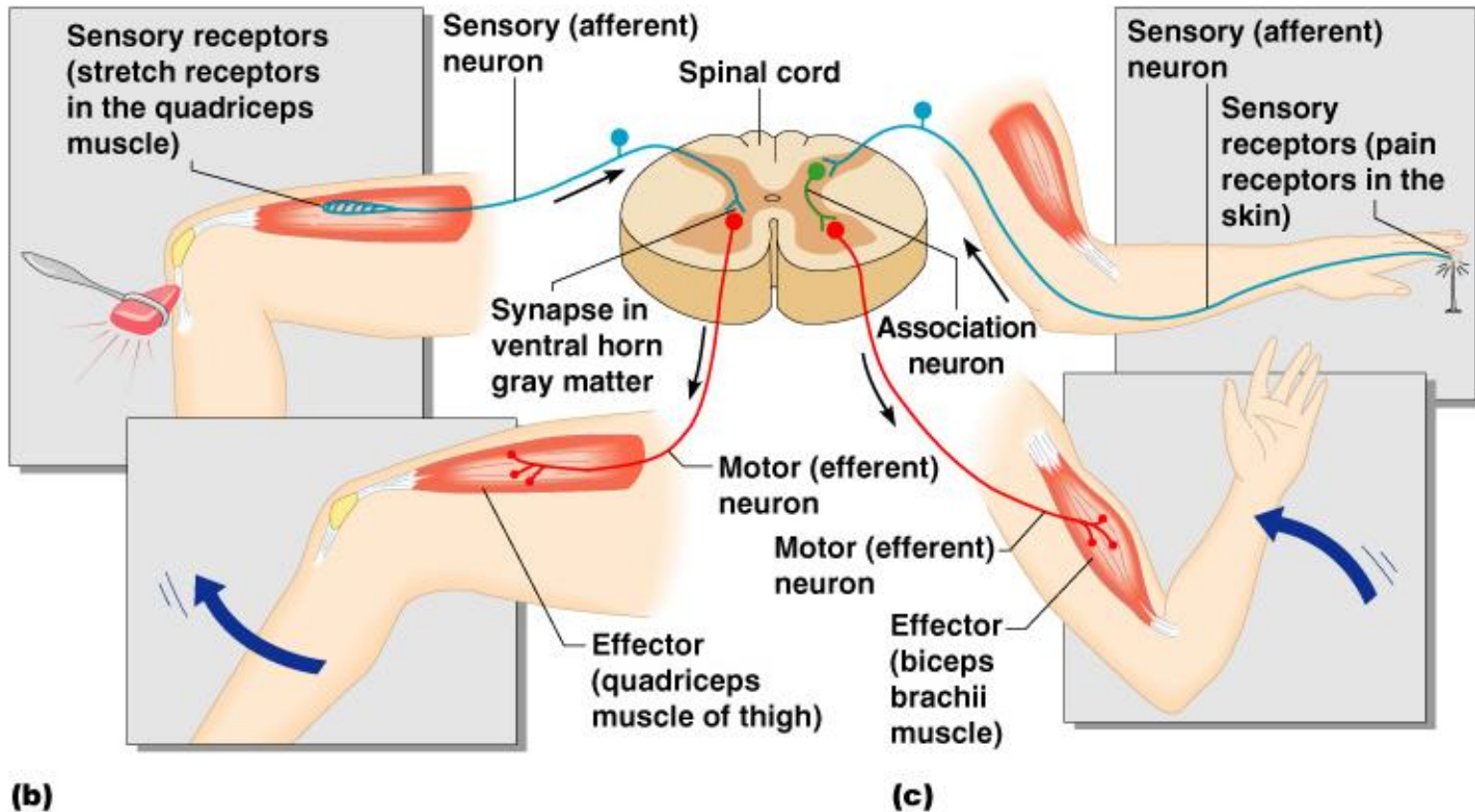


Figure 7.11b–c

# Types of Reflexes and Regulation

## 1. Autonomic reflexes

- Smooth muscle regulation
- Heart and blood pressure regulation
- Regulation of glands
- Digestive system regulation

## 2. Somatic reflexes

- Activation of skeletal muscles