# Brain Stem Overview: Midbrain, Pons & Medulla

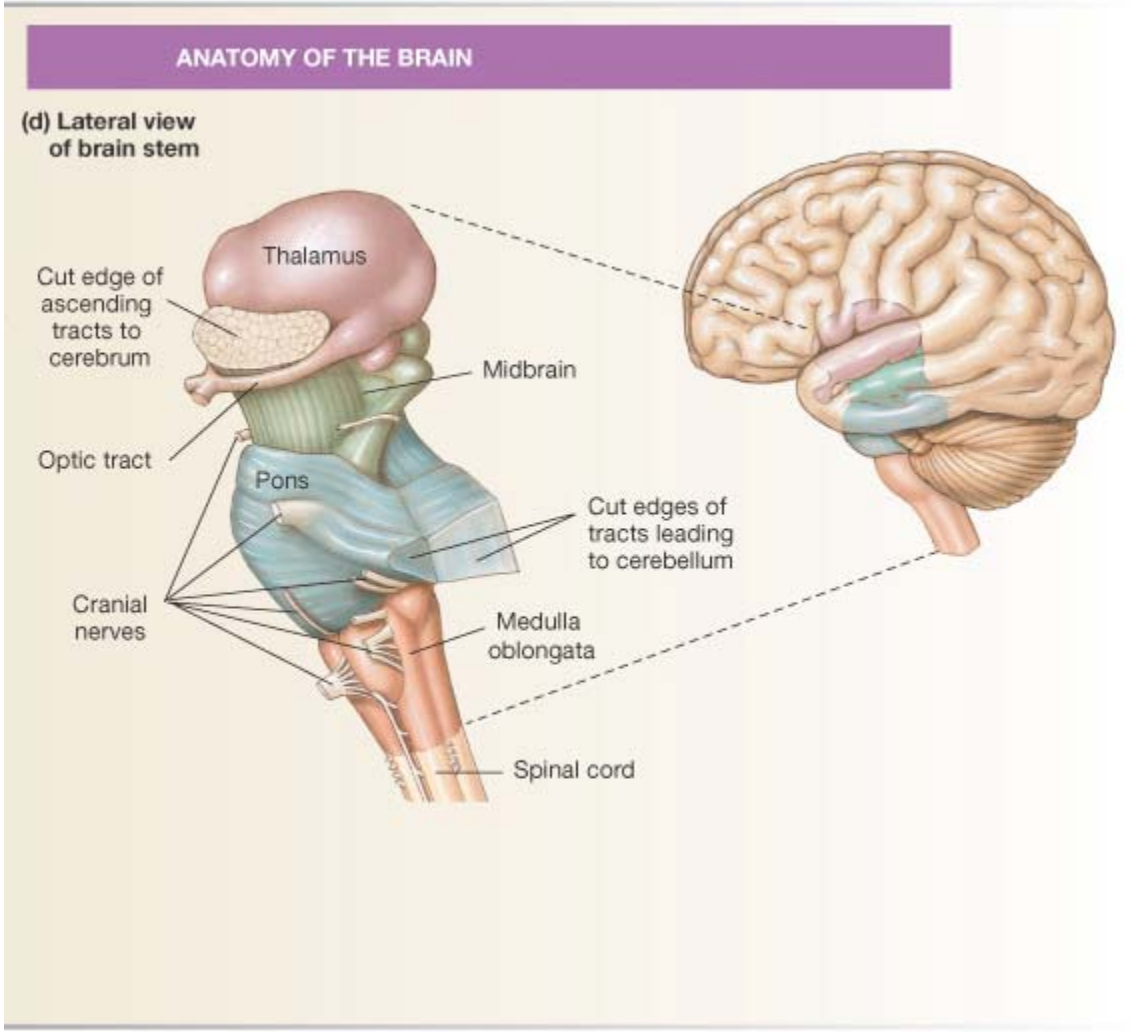



Figure 9-9d: ANATOMY SUMMARY: The Brain

# Brain Stem Overview: Midbrain, Pons & Medulla

- Many cranial nerves enter
- Pyramids – nerve tracts crossover
- Midbrain – eye movement control
- Pons – breathing, signal relay
- Medulla – involuntary functions
  - Examples: Blood pressure, breathing,  vomiting
- Reticular formation:
  - Network in brain stem
  - Arousal, sleep, pain, & muscle tone

# Cranial Nerves

**Table 9-1: The Cranial Nerves**

| NUMBER | NAME | TYPE | FUNCTION |
|---|---|---|---|
| I | Olfactory | Sensory | Olfactory (smell) information from nose |
| II | Optic | Sensory | Visual information from eyes |
| III | Oculomotor | Motor | Eye movement, pupil constriction, lens shape |
| IV | Trochlear | Motor | Eye movement |
| V | Trigeminal | Mixed | Sensory information from face, mouth; motor signals for chewing |
| VI | Abducens | Motor | Eye movement |
| VII | Facial | Mixed | Sensory for taste; efferent signals for tear and salivary glands, facial expression |
| VIII | Vestibulocochlear | Sensory | Hearing and equilibrium |
| IX | Glossopharyngeal | Mixed | Sensory from oral cavity, baro- and chemoreceptors in blood vessels; efferent for swallowing, parotid salivary gland secretion |
| X | Vagus | Mixed | Sensory and efferents to many internal organs, muscles, and glands |
| XI | Spinal accessory | Motor | Muscles of oral cavity, some muscles in neck and shoulder |
| XII | Hypoglossal | Motor | Tongue muscles |

Table 9-1: The Cranial Nerves

# Spinal Cord Regions

- Cervical
- Thoracic
- Lumbar
- Sacral

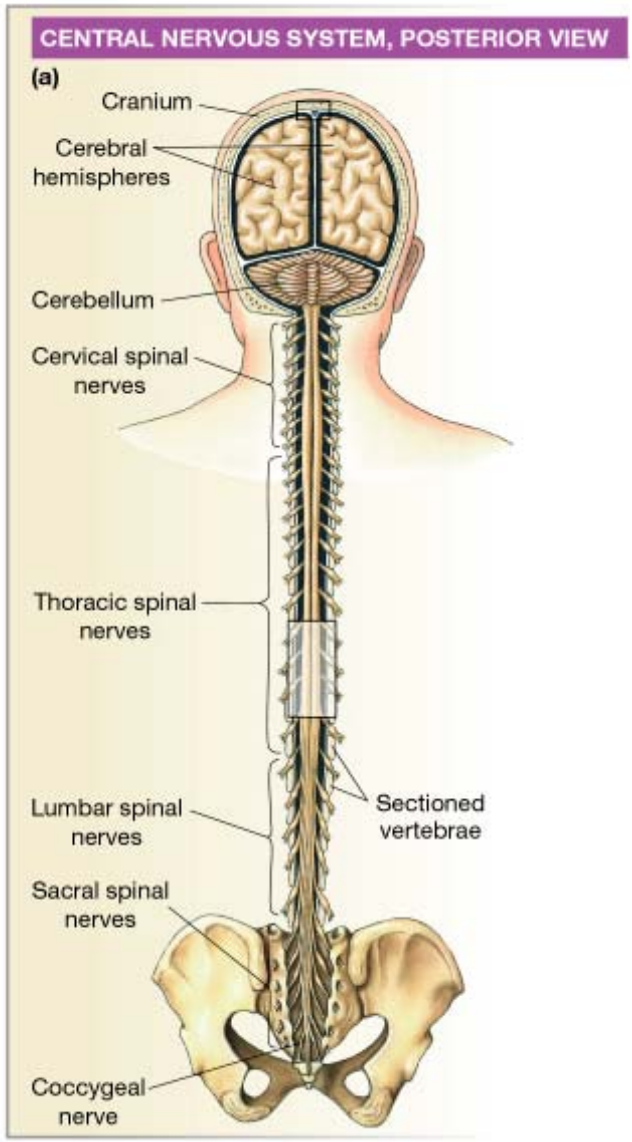



Figure 9-4a: ANATOMY SUMMARY: The Central Nervous System

# Cross-Sectional Anatomy of the Spinal Cord

- Anterior median fissure – separates anterior funiculi
- Posterior median sulcus – divides posterior funiculi

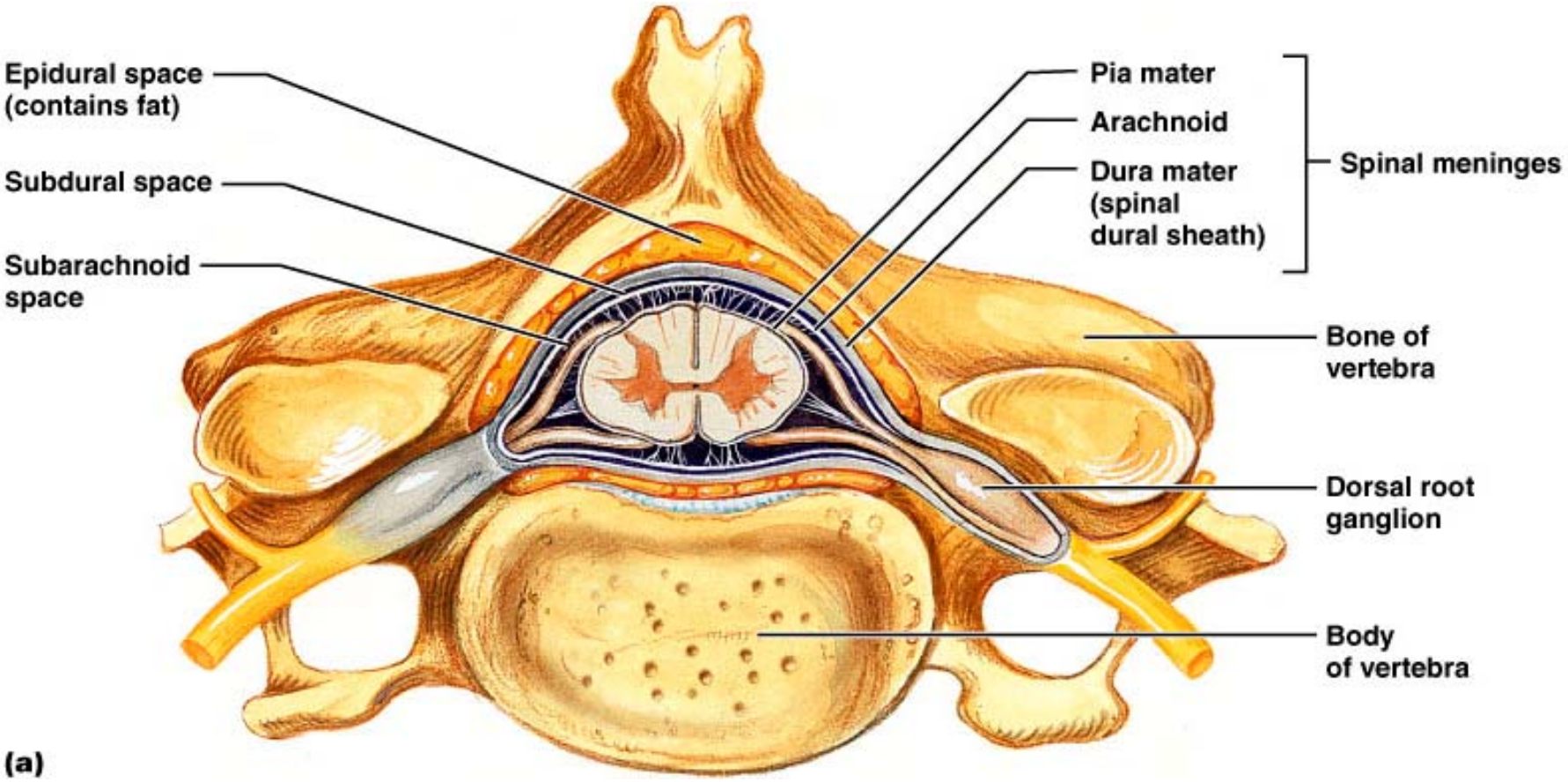



Figure 12.30a

# Dermatomes

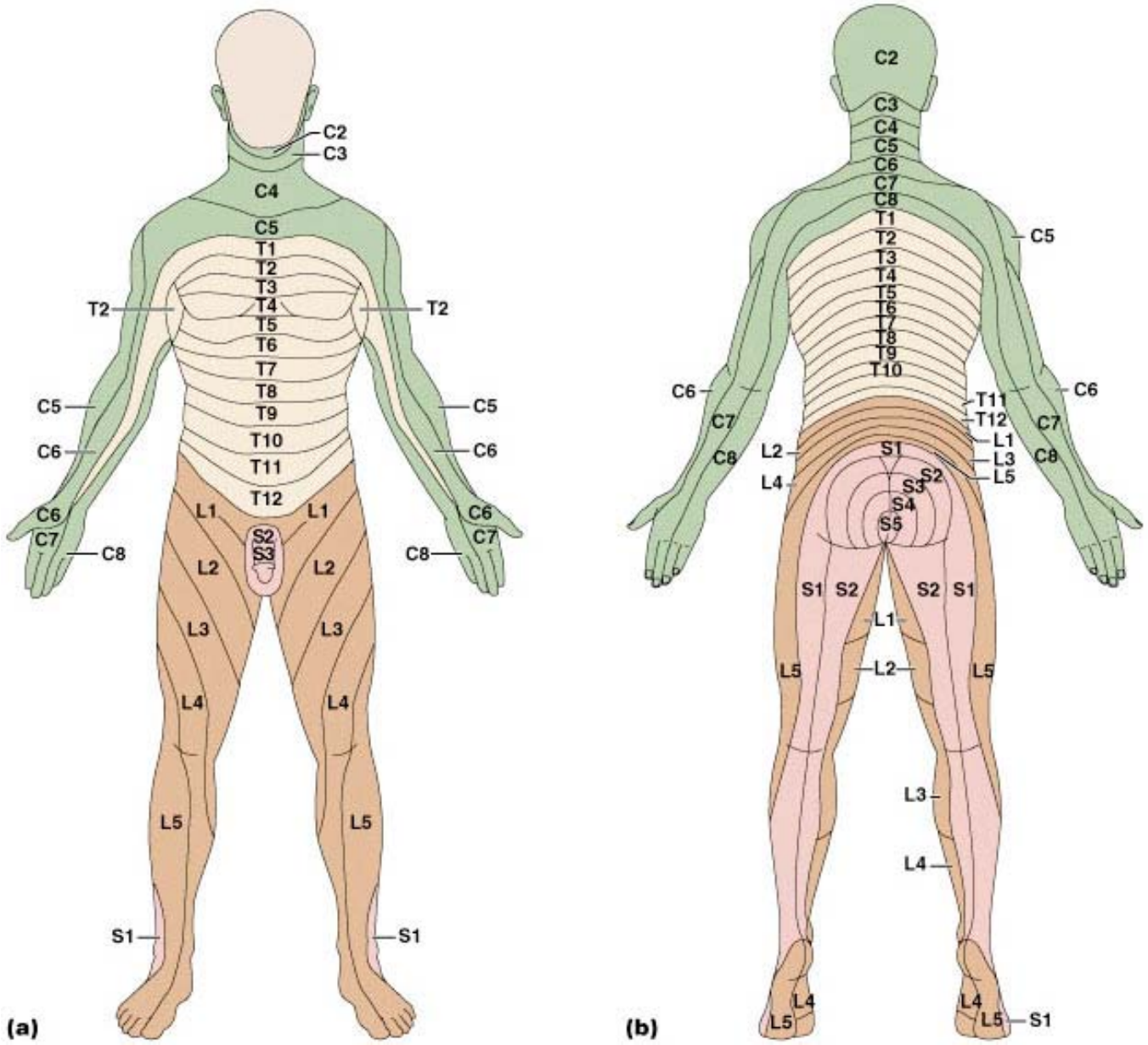



Figure 13.12

# Gray Matter: Organization

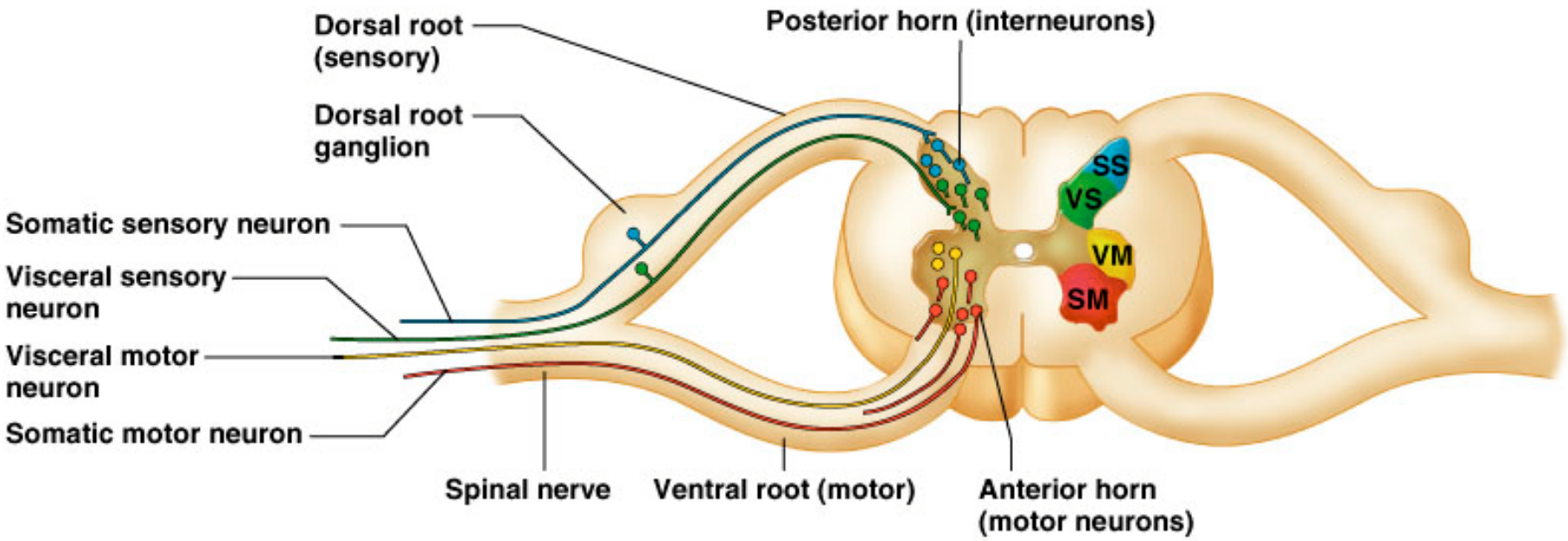



Figure 12.31

# Spinal Cord Organization

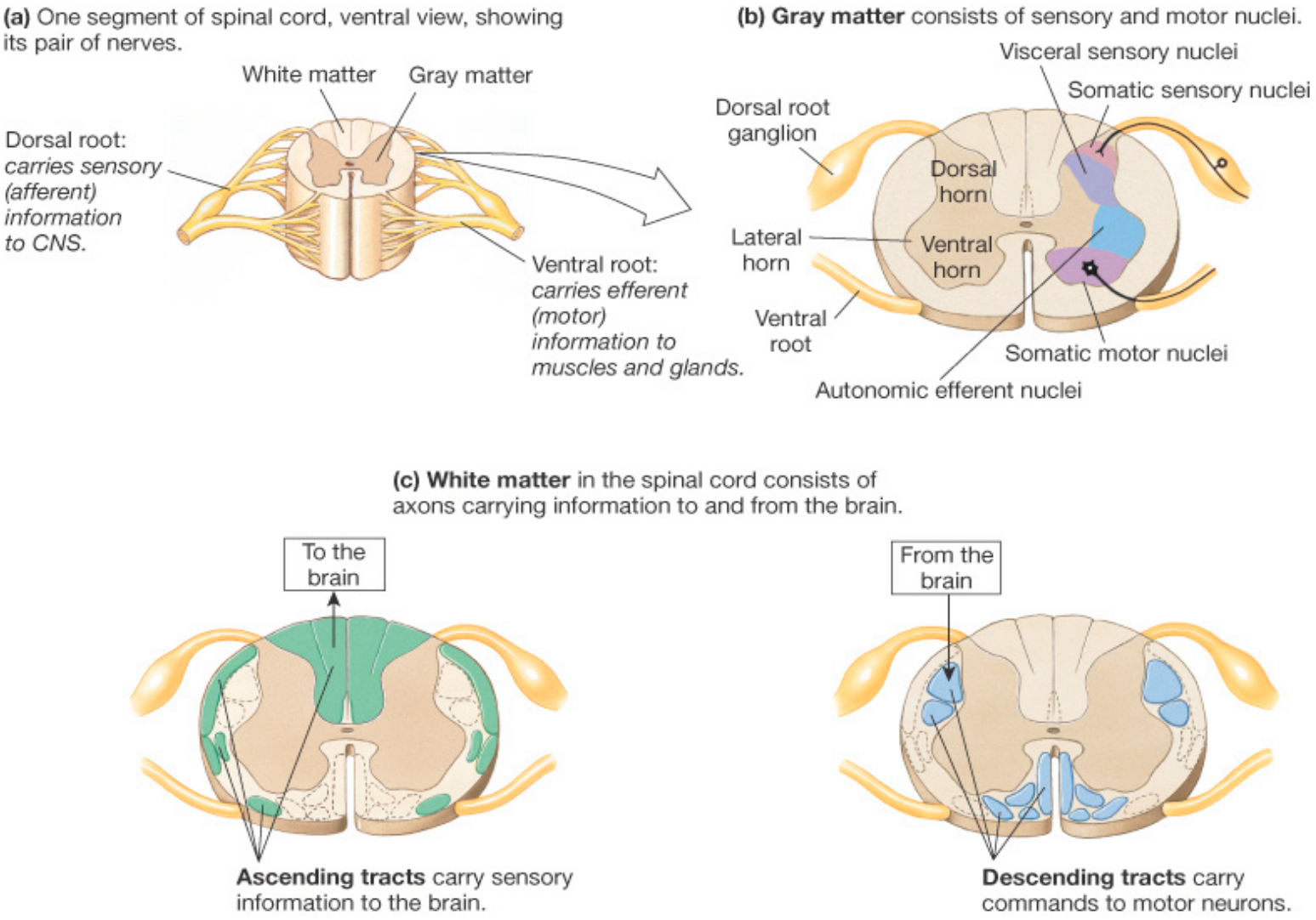



Figure 9-7: Specialization in the spinal cord

# White Matter: Pathway Generalizations

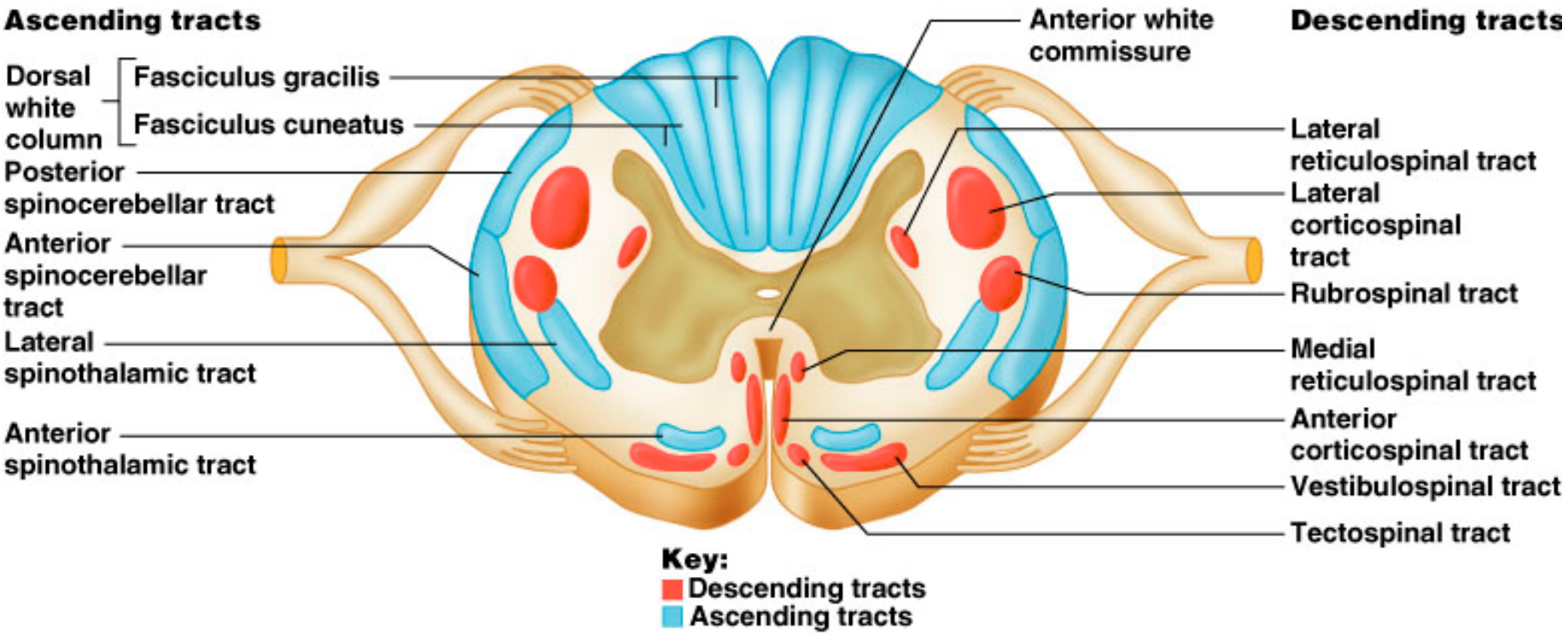



Figure 12.32

# Nonspecific Ascending Pathway

- Nonspecific pathway for pain, temperature, and crude touch within the lateral spinothalamic tract

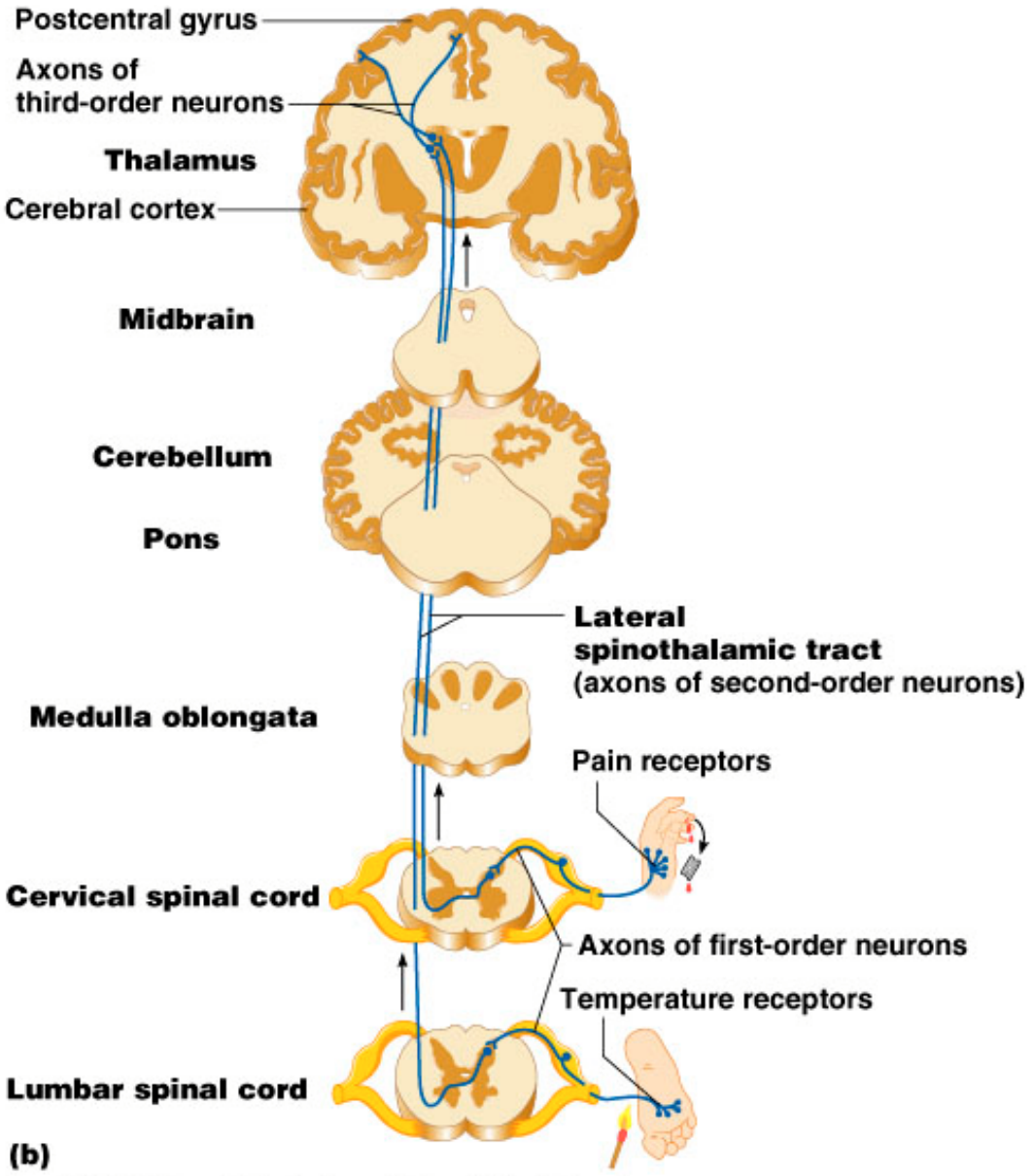
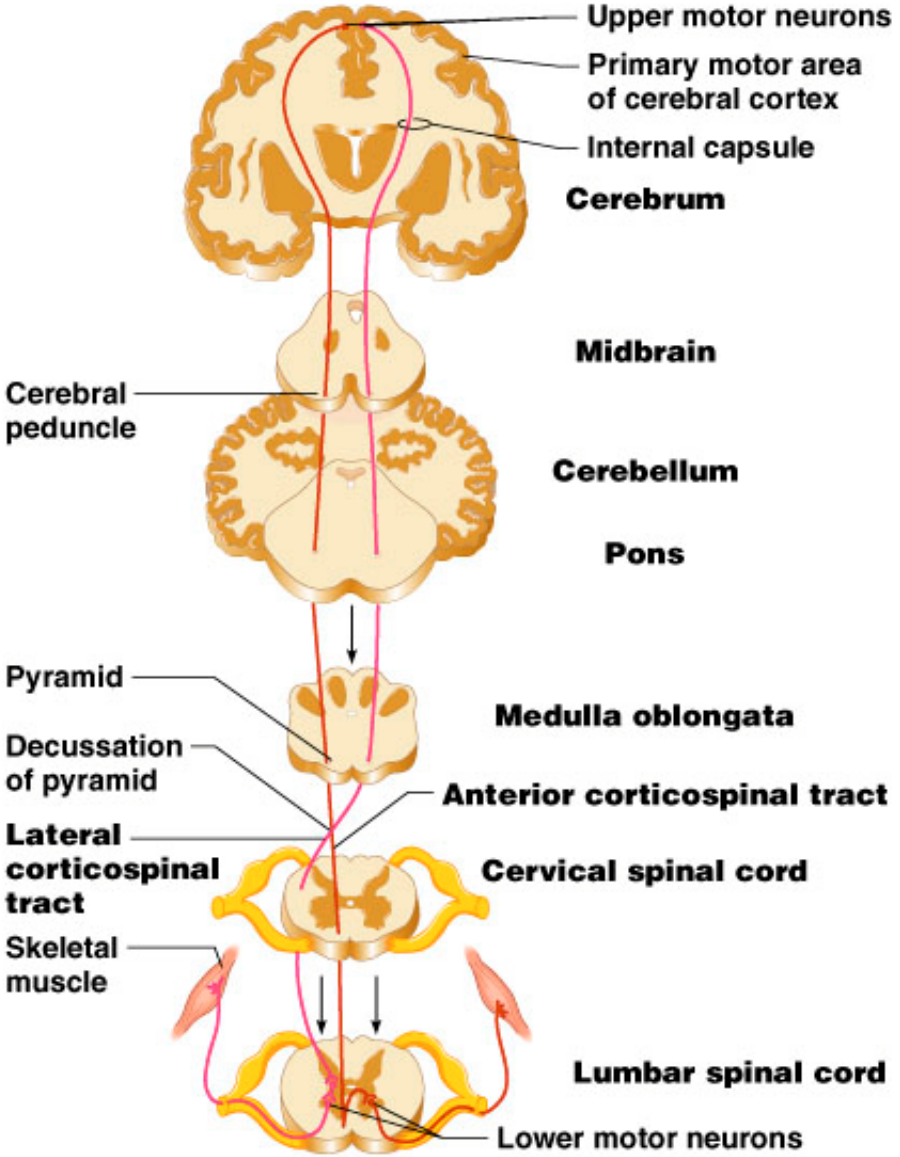



Figure 12.33b

# The Direct (Pyramidal) System




(a) Pyramidal (lateral and anterior corticospinal) tracts

Figure 12.34a

# Spinal Cord Trauma: Transection

- Cross sectioning of the spinal cord at any level results in total motor and sensory loss in regions inferior to the cut
- Paraplegia – transection between $T_1$ and $L_1$
- Quadriplegia – transection in the cervical region

# Reflexes

- A reflex is a rapid, predictable motor response to a stimulus
- Reflexes may:
  - Be inborn (intrinsic) or learned (acquired)
  - Involve only peripheral nerves and the spinal cord
  - Involve higher brain centers as well

# Reflex Arc

- There are five components of a reflex arc
  - Receptor – site of stimulus
  - Sensory neuron – transmits the afferent impulse to the CNS
  - Integration center – either monosynaptic or polysynaptic region within the CNS
  - Motor neuron – conducts efferent impulses from the integration center to an effector
  - Effector – muscle fiber or gland that responds to the efferent impulse

# Reflex Arc

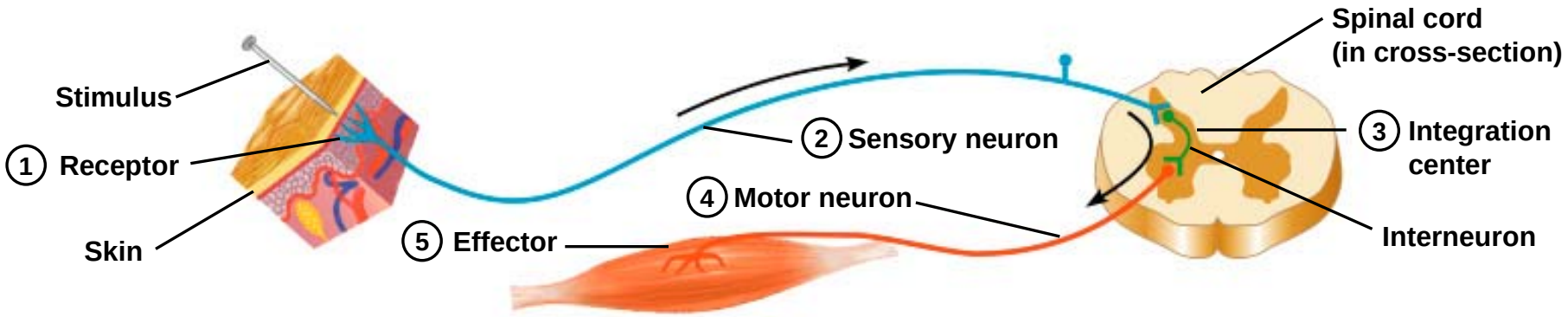



Figure 13.14

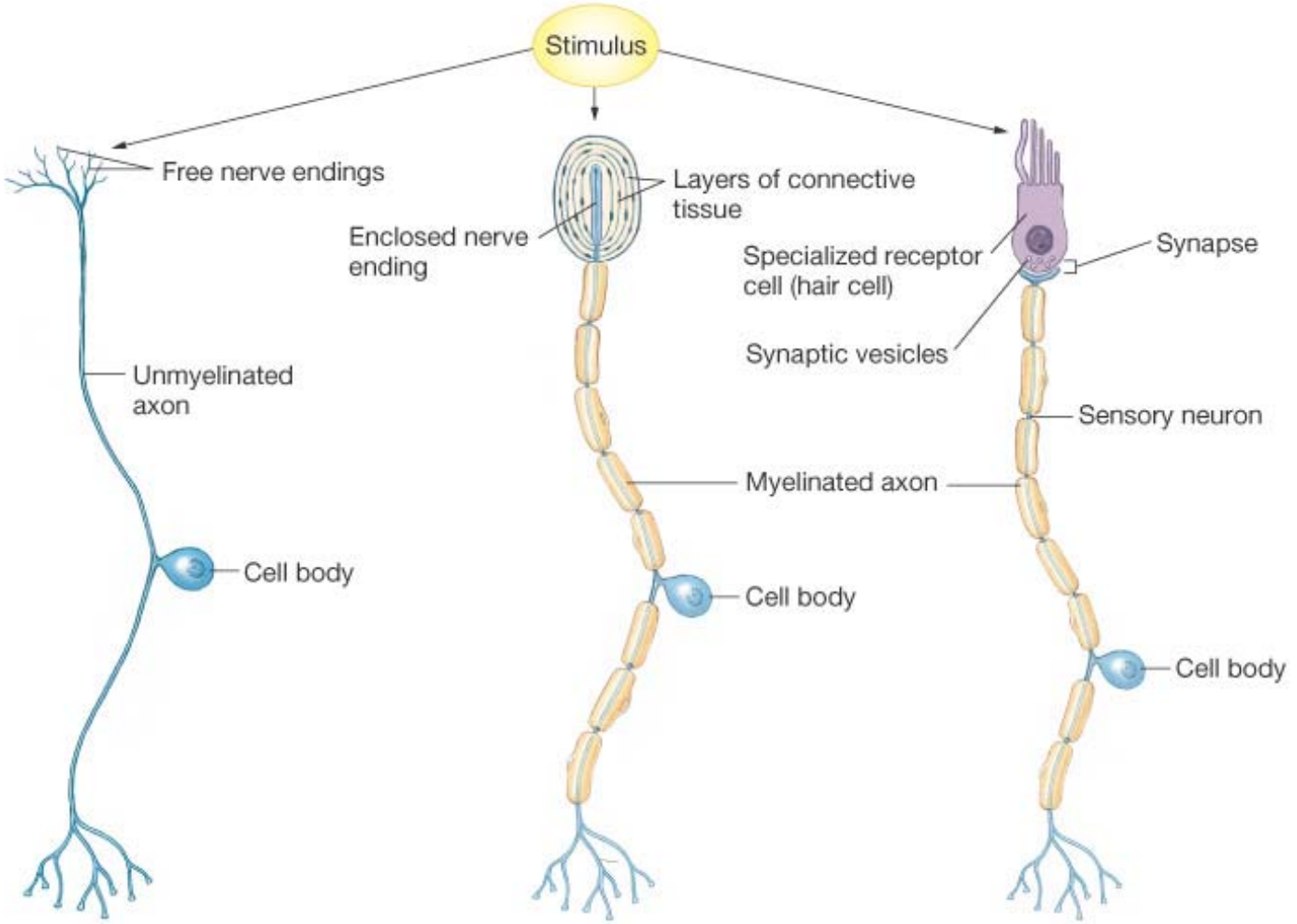
# Special Senses – External Stimuli

- Vision
- Hearing
- Taste
- Smell
- Equilibrium

# Sensory Receptor Types

- Chemoreceptors
- Mechanoreceptors
- Photoreceptors
- Thermoreceptors
- Nociceptors

# Sensory Receptor Types




**(a) Simple receptors** are neurons with free nerve endings.

**(b) Complex neural receptors** have nerve endings enclosed in connective tissue capsules.

**(c)** Most **special senses receptors** are cells that release neurotransmitter onto sensory neurons, initiating an action potential.

Figure 10-1: Sensory receptors

# General Properties of Sensory Systems

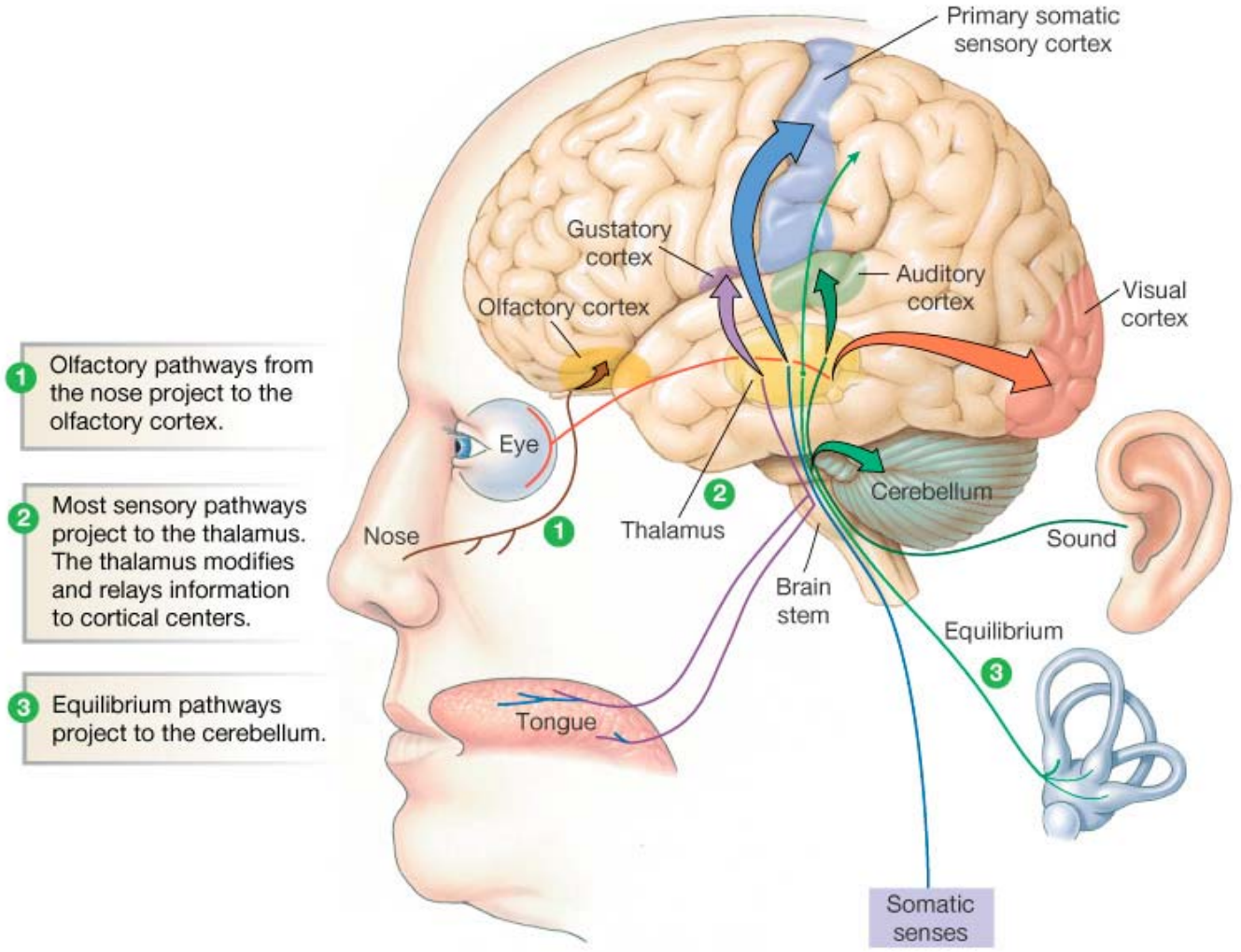



Figure 10-4: Sensory pathways

# Touch (pressure)

- Mechanoreceptors
- Free nerve endings
- Pacinian corpuscles
- Ruffini corpuscles
- Merkel receptors
- Meisaner's corpuscles
- Barroreceptors

# Touch (pressure)

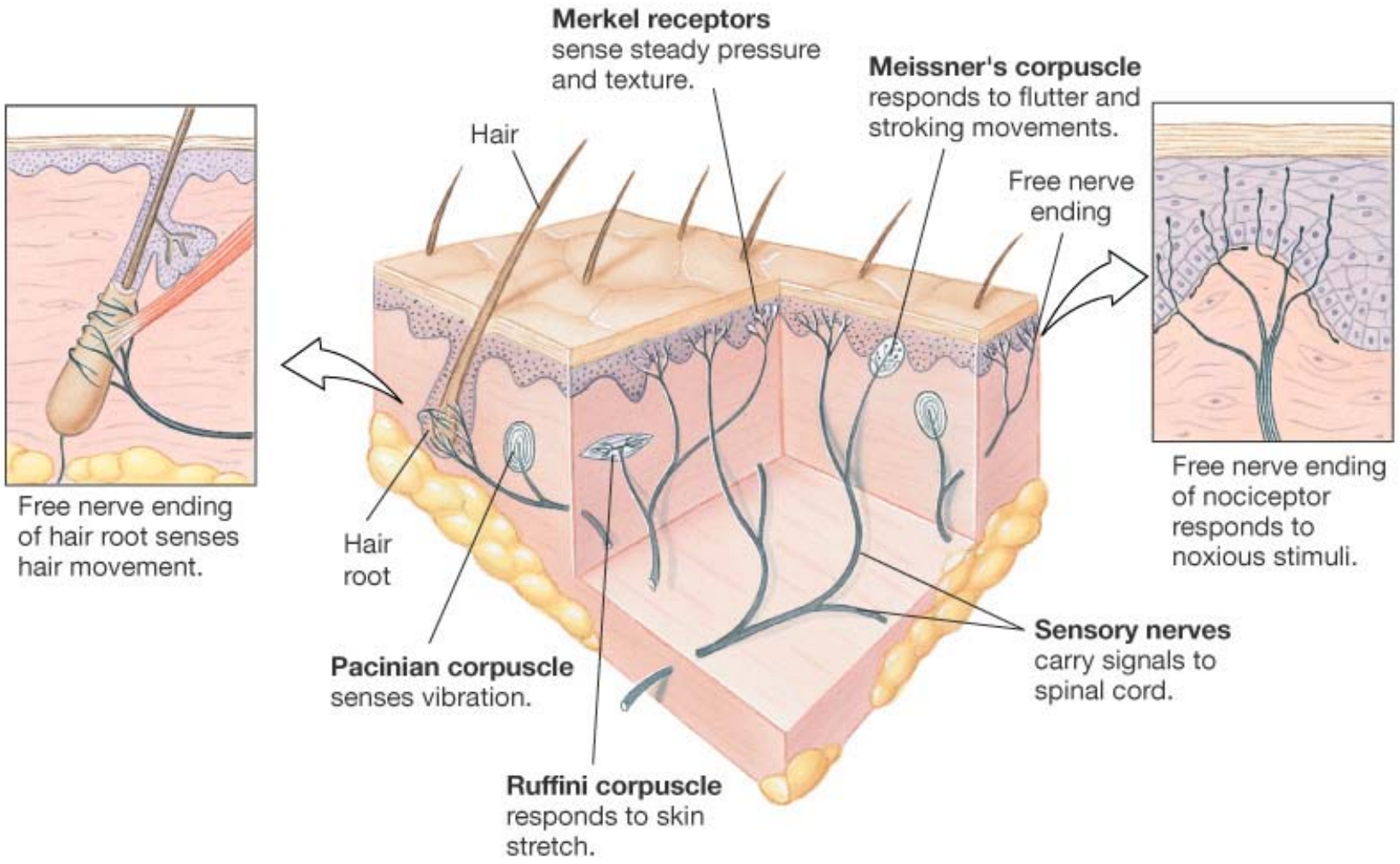



Figure 10-11: Touch-pressure receptors

# Somatic Senses – Internal Stimuli

- Touch
- Temperature
- Pain
- Itch
- Proprioception
- Pathway

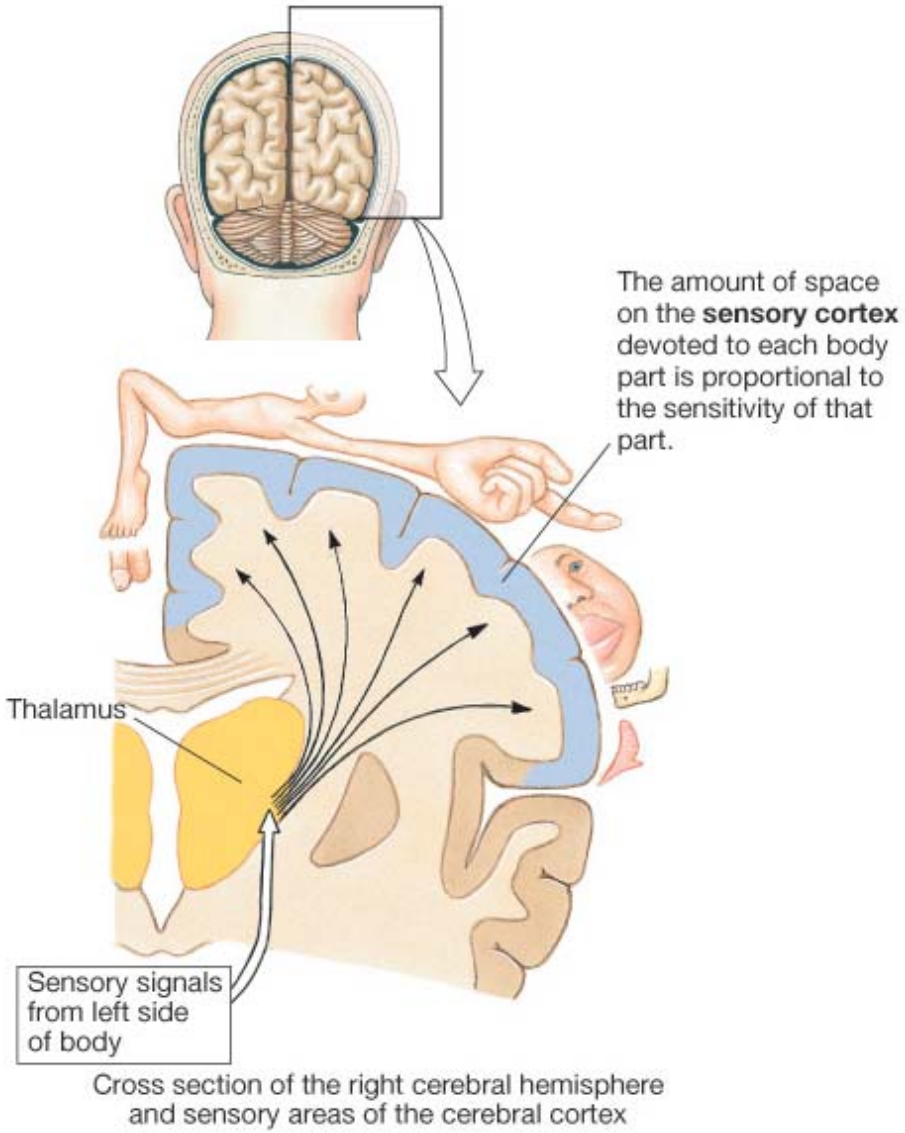



Figure 10-10: The somatosensory cortex

# Somatic Pathways

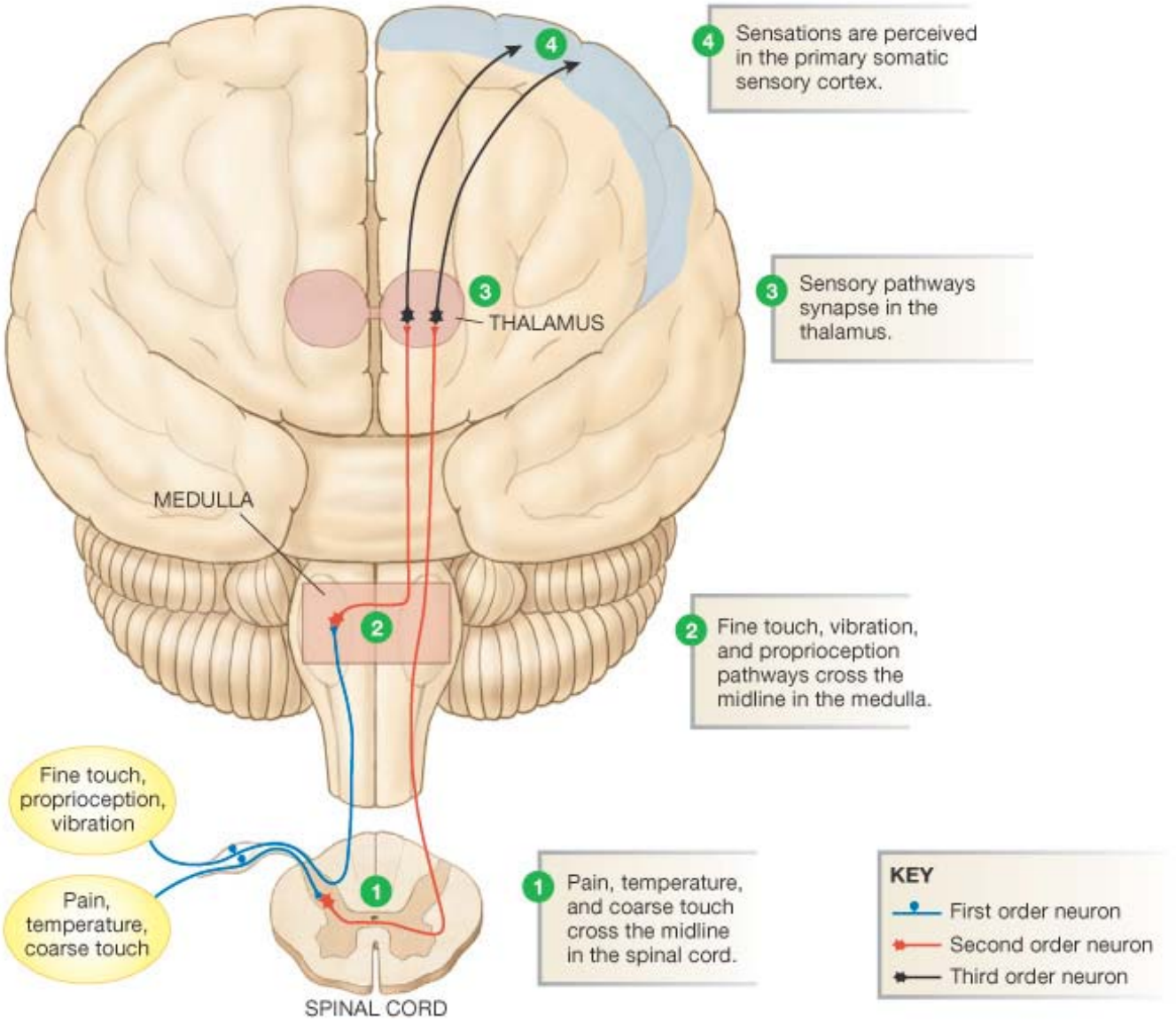



Figure 10-9: Sensory pathways cross the body's midline

# Sensory Modality

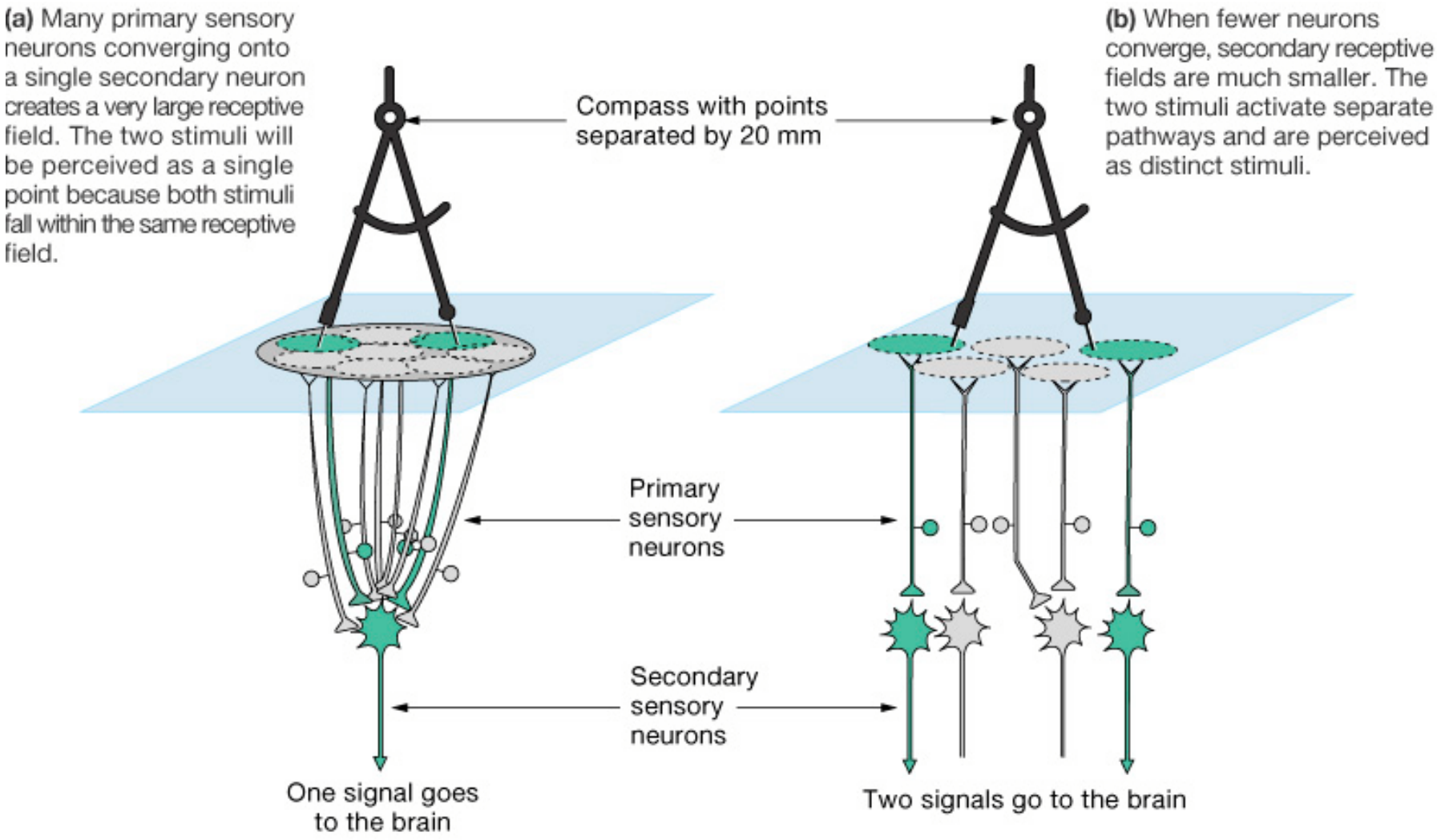



Figure 10-3: Two-point discrimination

# Sensory Modality

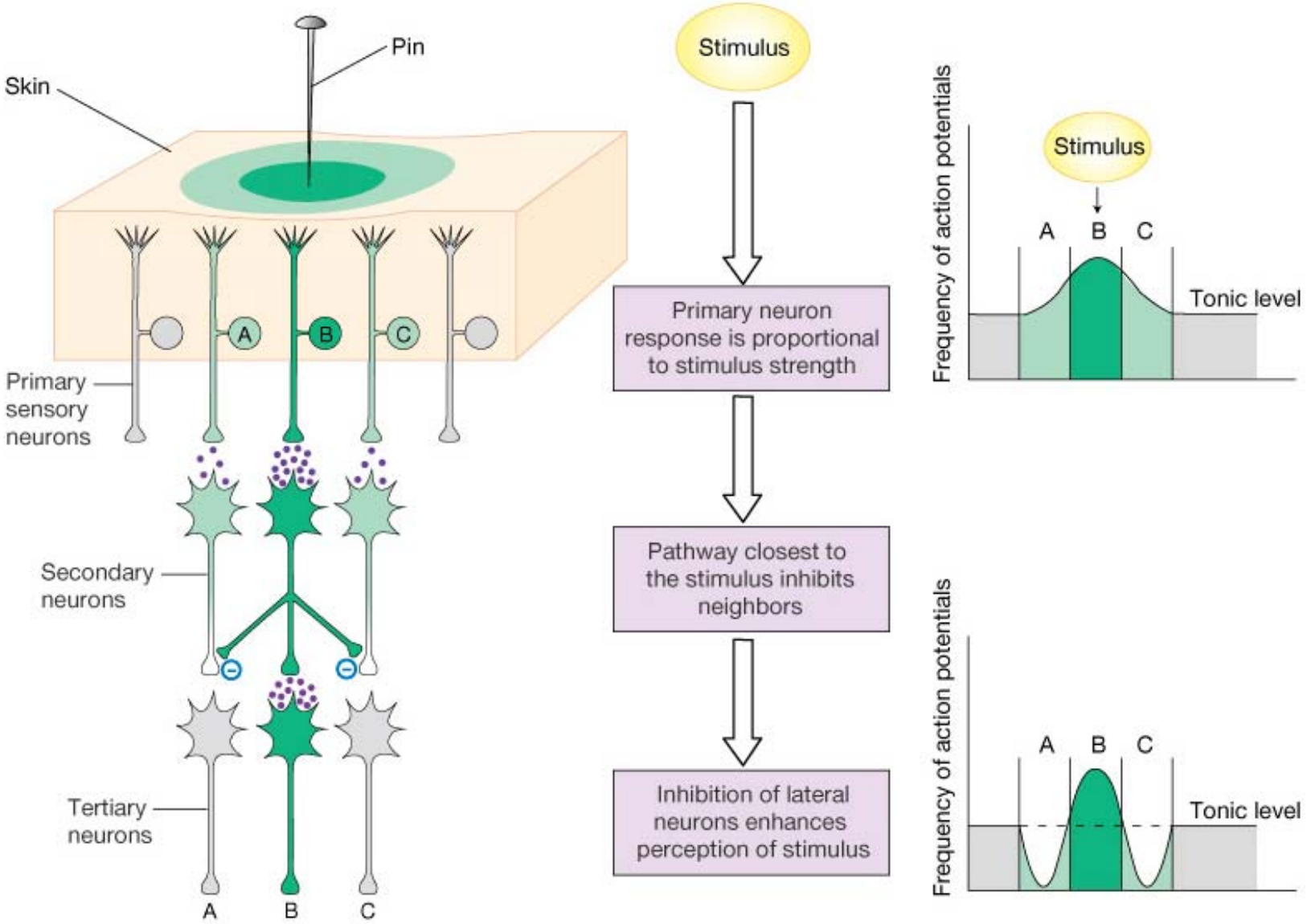



Figure 10-6: Lateral inhibition

# Stimulus Coding and Processing

- Modality of the stimulus
- location
- Intensity
- Duration
- Tonic receptors
- Phasic receptors
- Adaptation

# Temperature

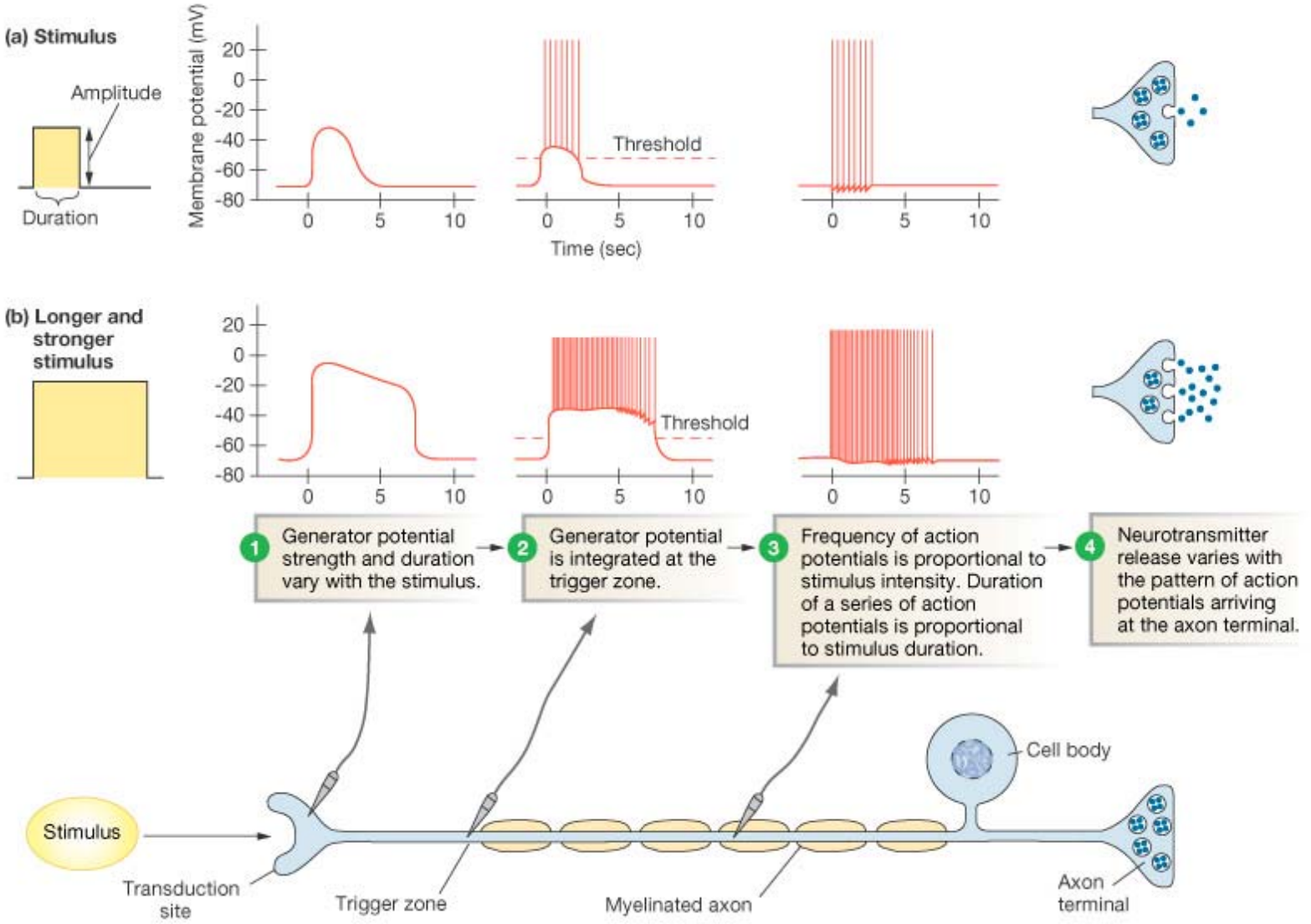



Figure 10-7: Sensory coding for stimulus intensity and duration

# Adaptation of Sensory Receptors

- Receptors responding to pressure, touch, and smell adapt quickly
- Receptors responding slowly include Merkel’s discs, Ruffini’s corpuscles, and interoceptors that respond to chemical levels in the blood
- Pain receptors and proprioceptors do not exhibit adaptation