6 The Nervous System

Lesson 6.1

Overview of the Nervous System

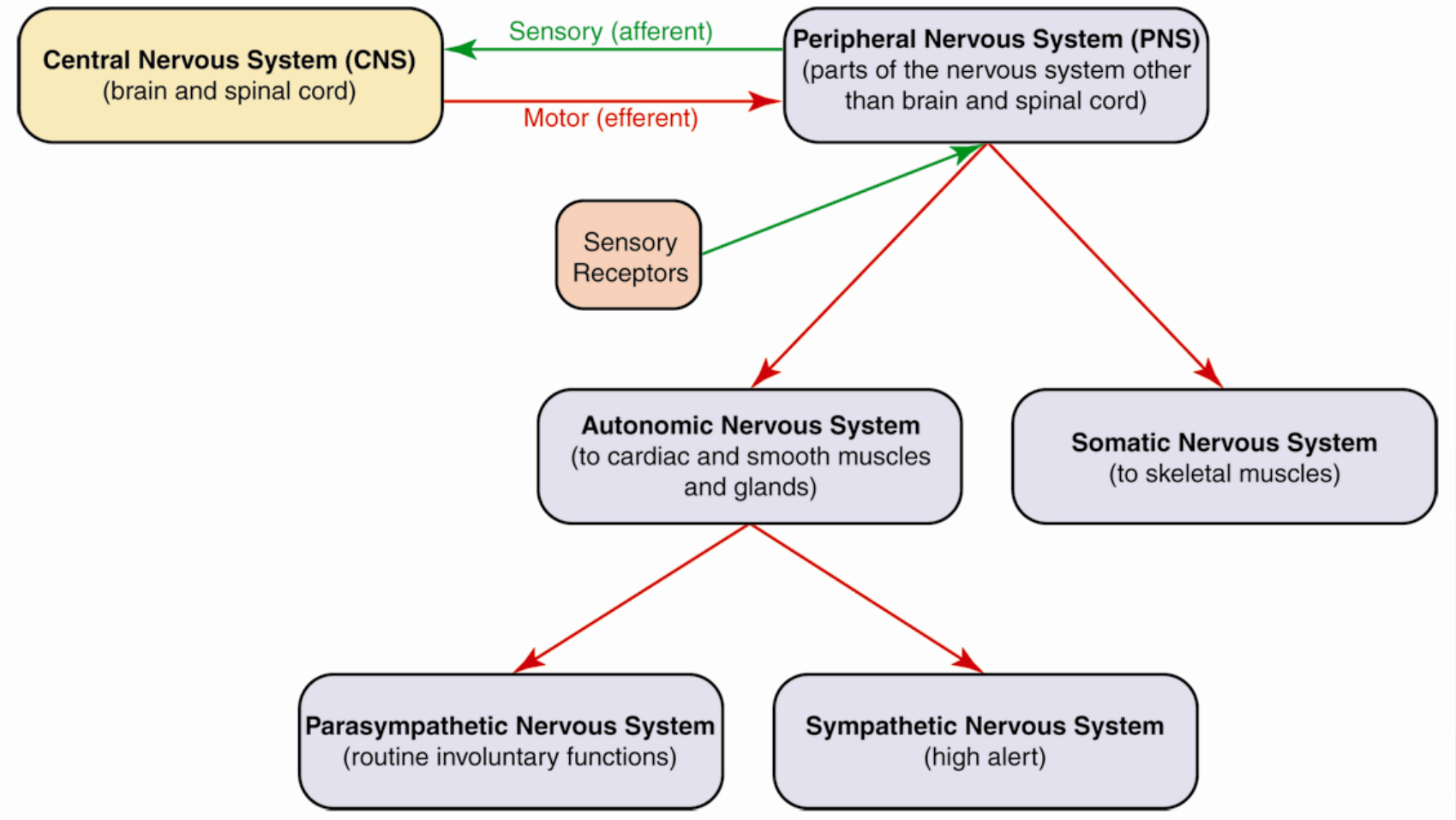
Nervous System Overview

- organization of the nervous system
  - two major divisions
  - the efferent nerves
- nervous tissues
  - neuroglia
  - neurons

Organization of the Nervous System

- two major divisions
  - central nervous system (CNS)
  - peripheral nervous system (PNS)
    - sensory receptors
    - afferent (sensory) nerves
    - efferent (motor) nerves

Two Major Divisions



The Efferent Nerves

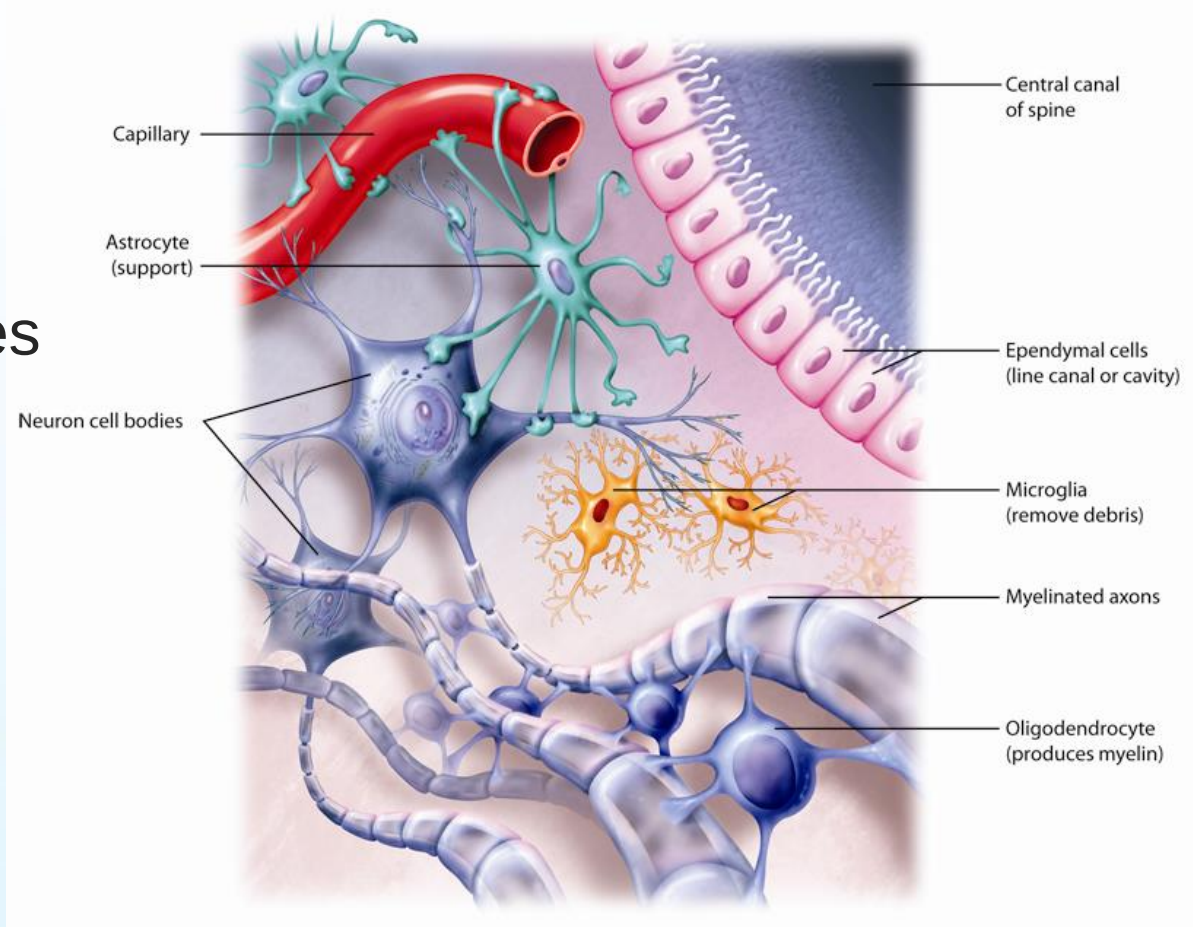
- somatic nervous system
  - voluntary
- autonomic nervous system
  - involuntary
  - sympathetic
  - parasympathetic

Nervous Tissues

- neuroglia
  - also known as *glial cells*
  - support the neurons
  - protect the neurons
- neurons
  - transmit nerve impulses

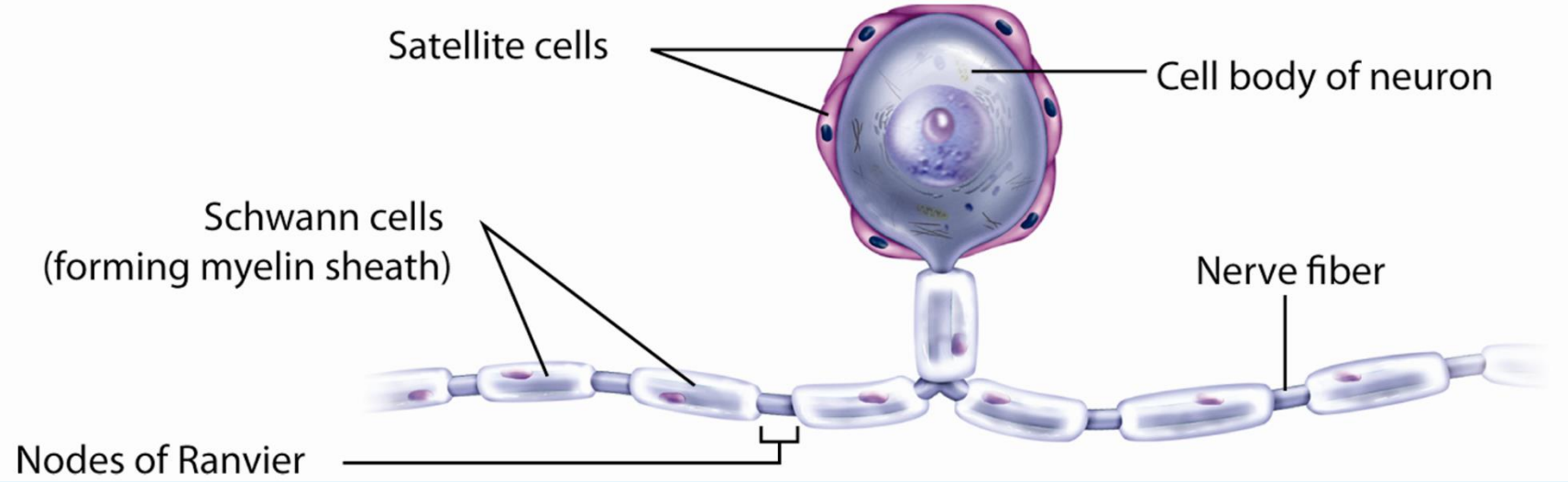
Neuroglia

- central nervous system
  - astrocytes
  - microglia
  - ependymal
  - oligodendrocytes



Neuroglia

- peripheral nervous system
  - Schwann cells
  - satellite cells



Neurons

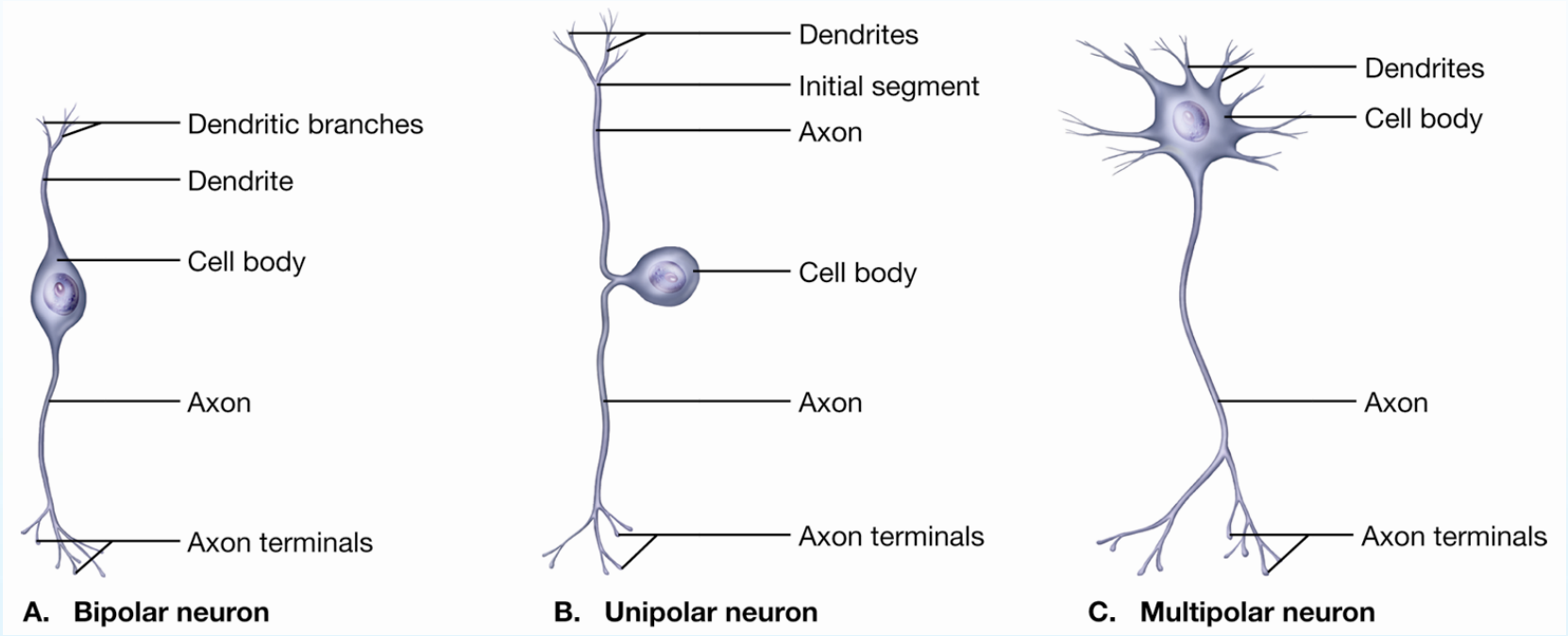
- dendrites
  - send information to cell body
- cell bodies
- axons
  - send information away from cell body

Neuron Types by Function

- sensory neurons
  - send impulses toward CNS
- motor neurons
  - send impulses away from CNS
- interneurons
  - bridges between neurons

Neuron Structures

- bipolar
  - one axon and one dendrite
- unipolar
  - one axon
- multipolar
  - one axon and many dendrites



Review and Assessment

Match these words with 1–4 below: sympathetic nervous system, myelin, synapse, axon.

1. high alert
2. transmits impulses away from cell body
3. fatty insulating material
4. gap between neurons

Lesson 6.2

Transmission of Nerve Impulses

Transmission of Nerve Impulses

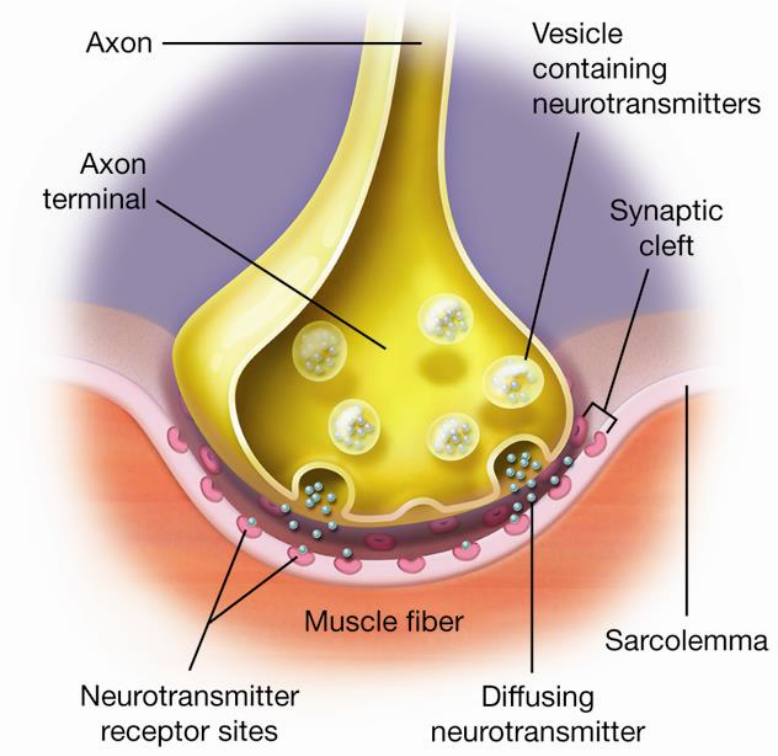
- action potentials
  - change in cell membrane charge
- impulse transmission
  - charge change travels along axon
- reflexes
  - involuntary response to stimulus

Action Potentials

- polarized
- depolarized
- repolarized
- refractory period

Impulse Transmission

- saltatory conduction
- transmission at synapses
  - gap junctions
  - neurotransmitter
  - excitatory effect
  - inhibitory effect



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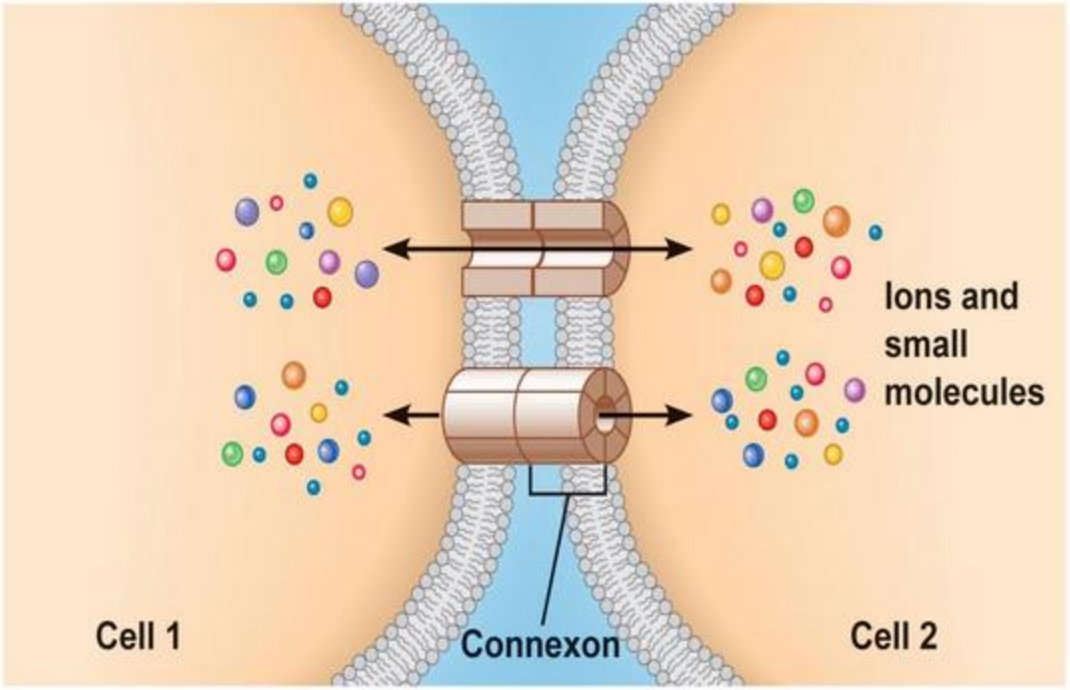


(a) Direct communication through gap junctions

Reflexes

- somatic
  - stimulate skeletal muscles
- autonomic
  - stimulate involuntary muscles

Review and Assessment

Fill in the blanks with: reflexes, saltatory conduction, neurotransmitter, or action potential.

1. A(n) _____ is an all or none response.
2. _____ occurs only in myelinated axons.
3. _____ are rapid, involuntary responses.
4. The axon terminal has tiny vesicles filled with _____.

Lesson 6.3

Functional Anatomy of the Central Nervous System

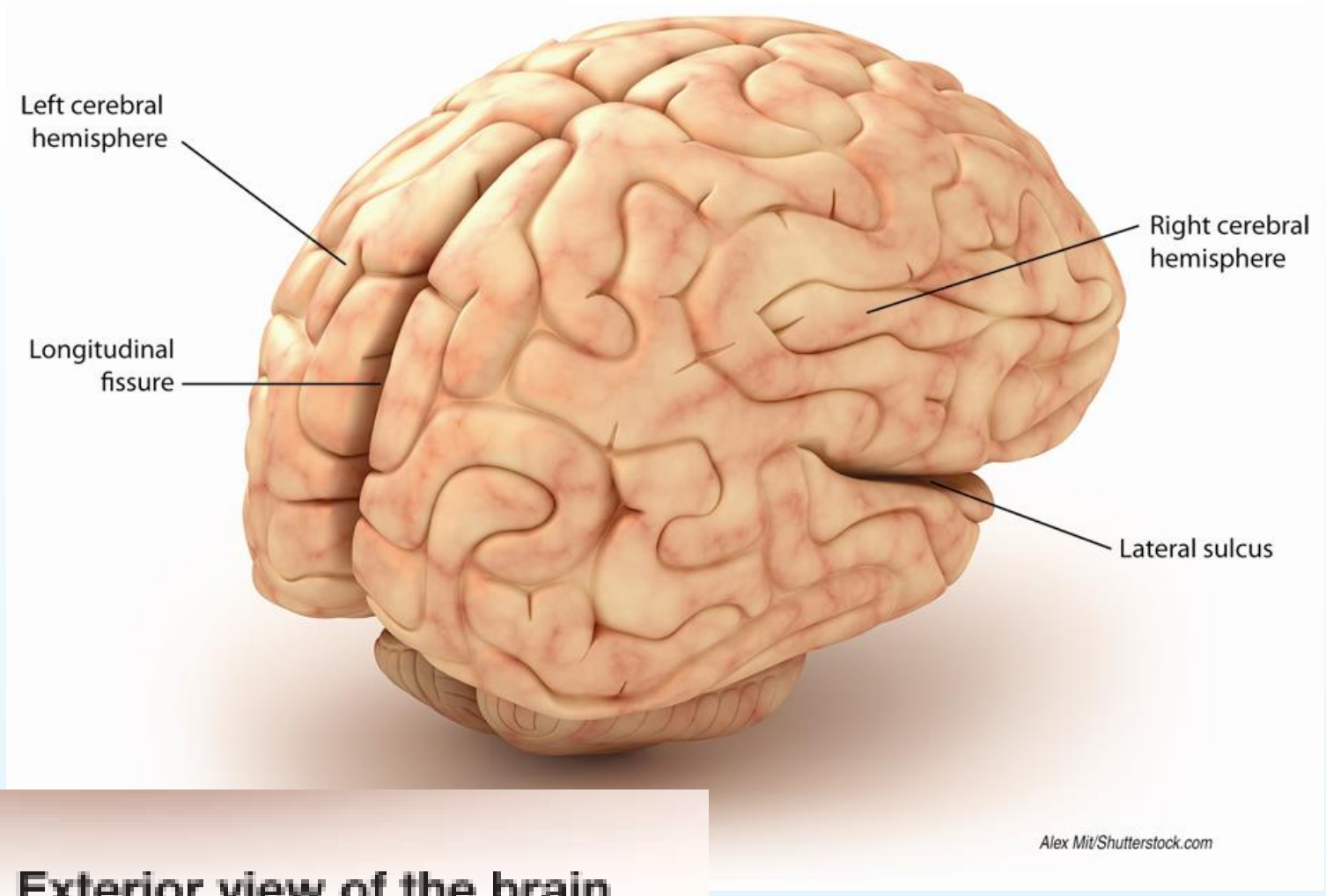
The Brain

- cerebrum
- diencephalon
- brain stem
- cerebellum
- meninges
- blood-brain barrier

Cerebrum

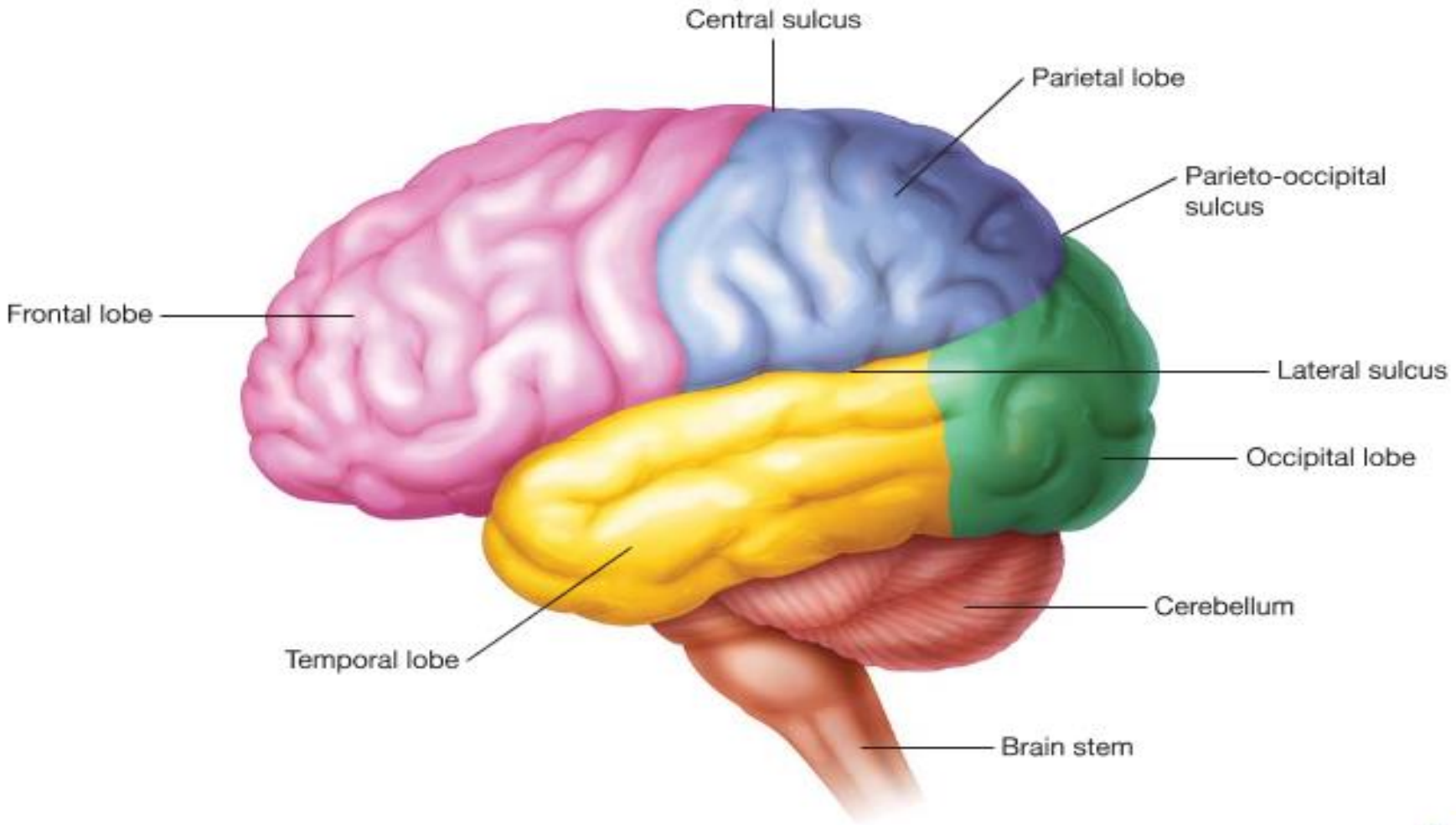
- cerebral cortex
  - gyrus
  - sulcus
  - fissure
- lobes
  - frontal
  - parietal
  - occipital
  - temporal
- primary motor cortex
- primary somatic sensory cortex

Cerebrum



A. Exterior view of the brain

Cerebrum

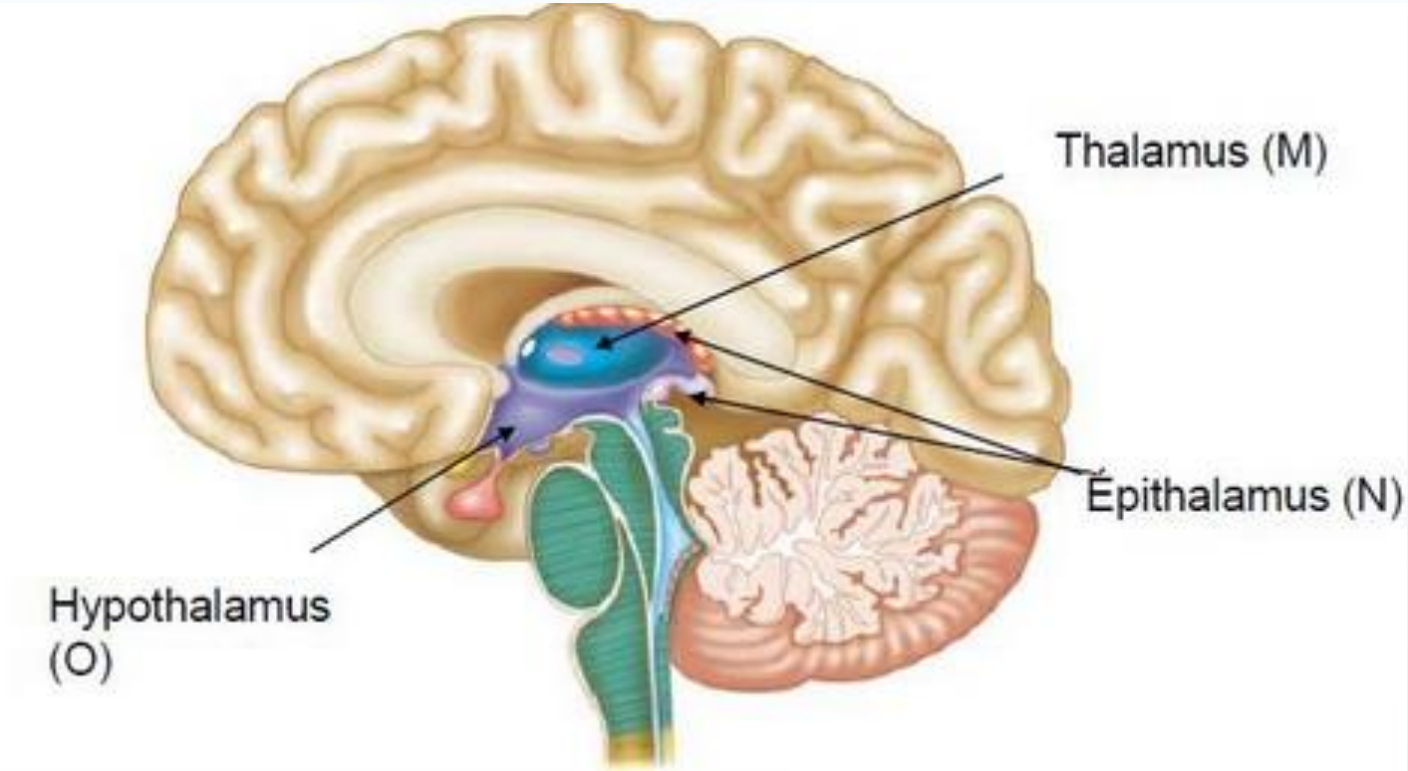


B. Lobes of the brain

Cerebrum

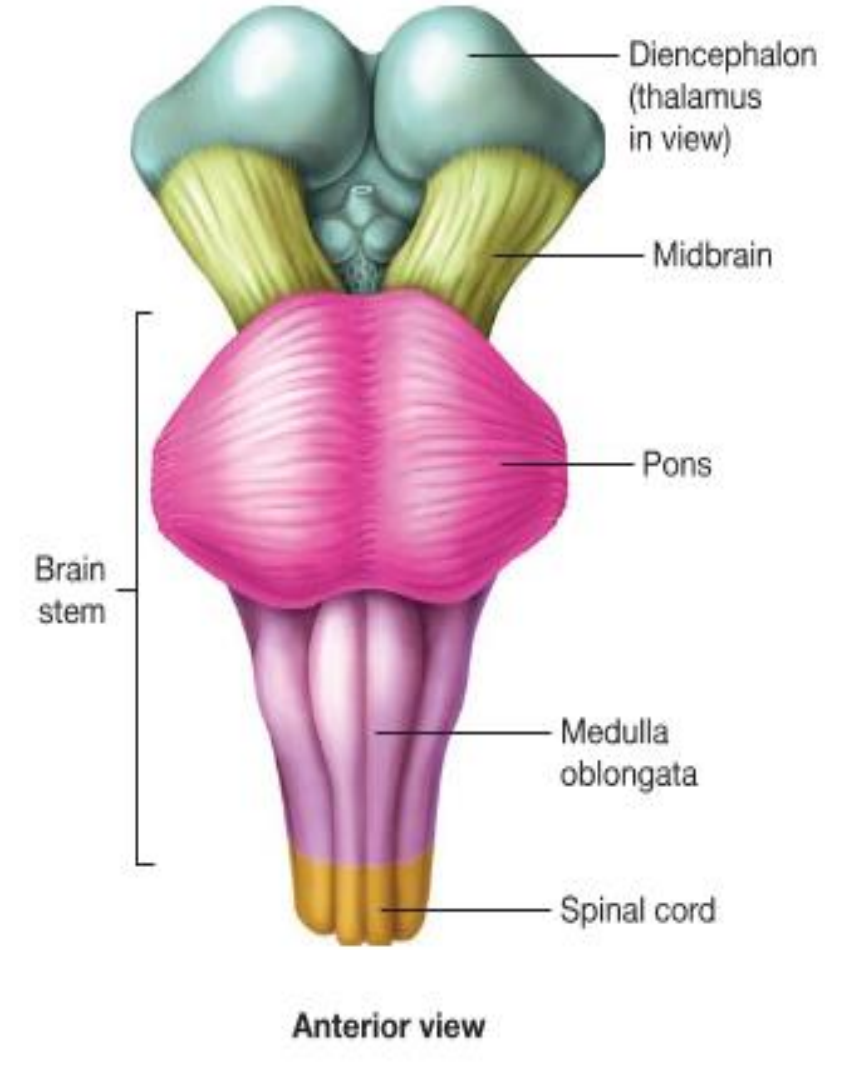
Diencephalon

- thalamus
- hypothalamus
- epithalamus



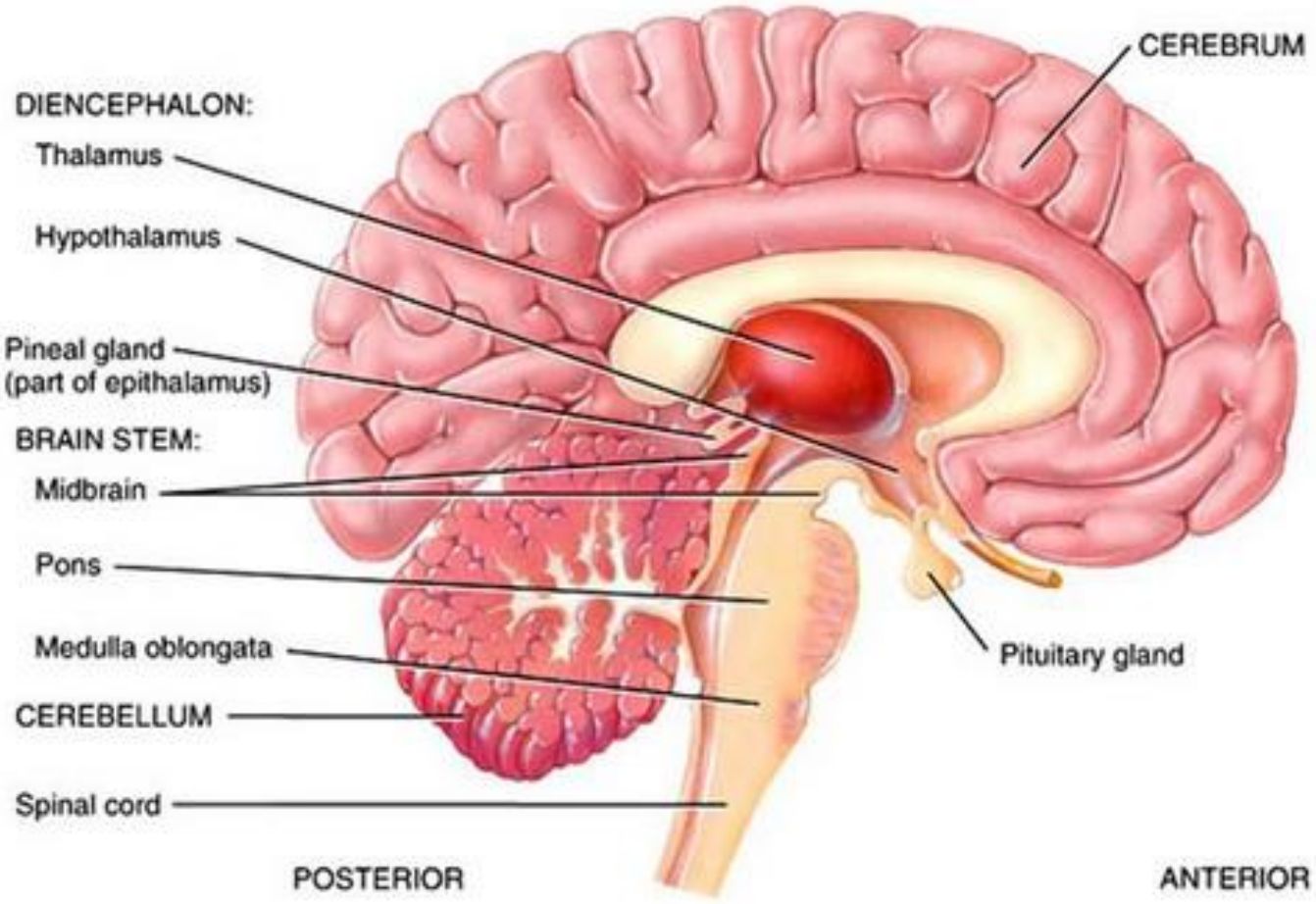
Brain Stem

- midbrain
- pons
- medulla oblongata



The Brain

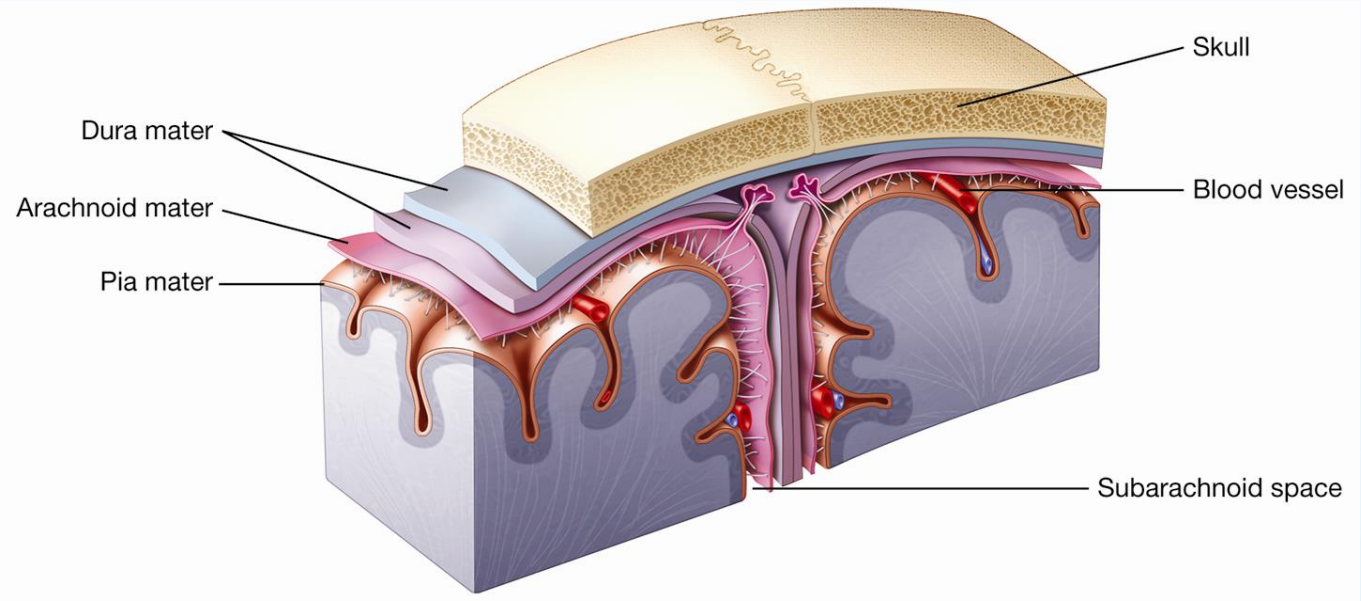
- cerebellum
- blood-brain barrier



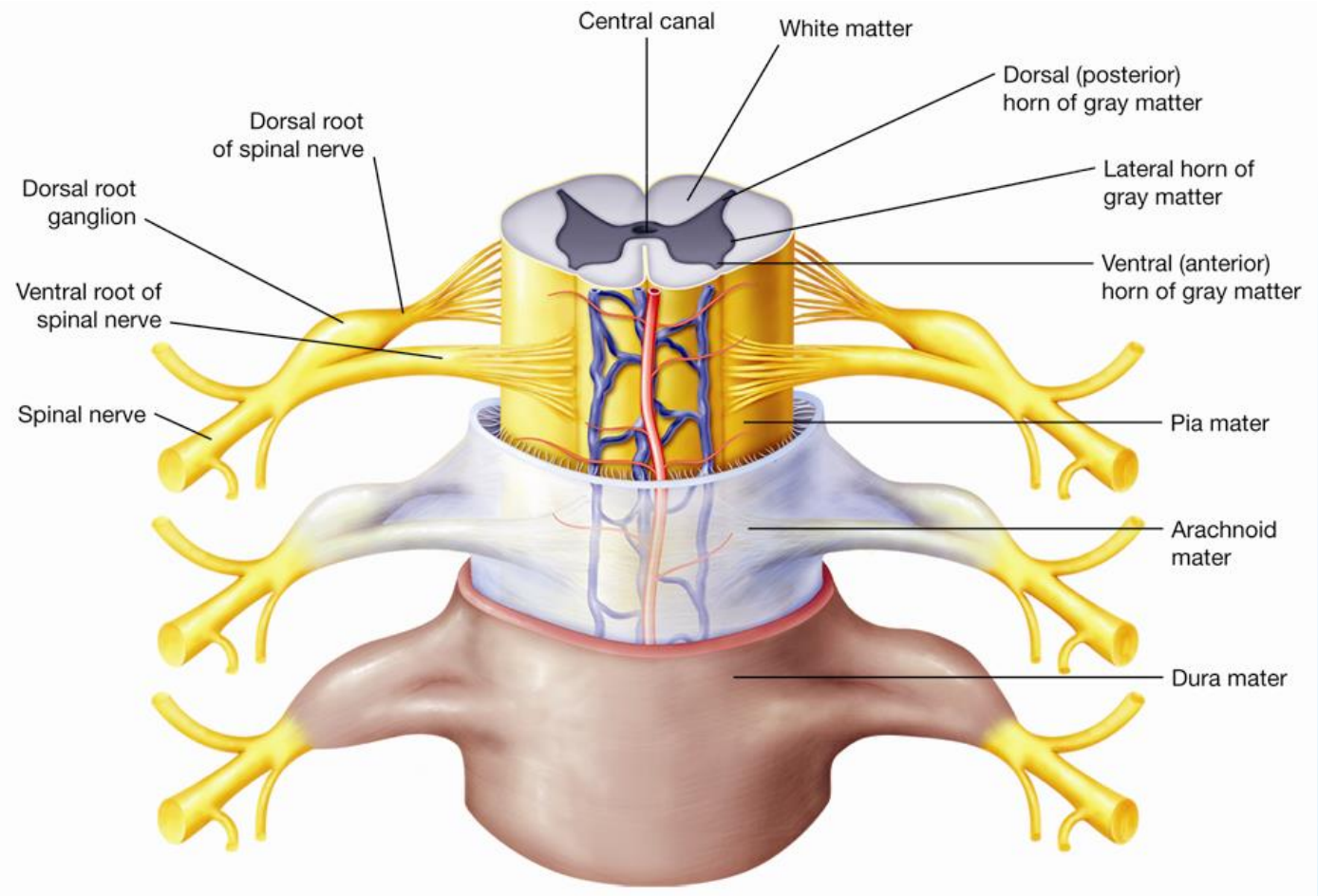
(a) Medial view of sagittal section

The Brain

- cerebellum
- blood-brain barrier
- meninges
  - dura mater
  - arachnoid mater
  - pia mater



Spinal Cord



Review and Assessment

True or False?

1. The gyri divide the brain into 4 regions.
2. The hypothalamus regulates blood pressure.
3. The meninges has 3 layers.
4. The cerebellum coordinates balance.
5. The pons is also called the interbrain.

Lesson 6.4

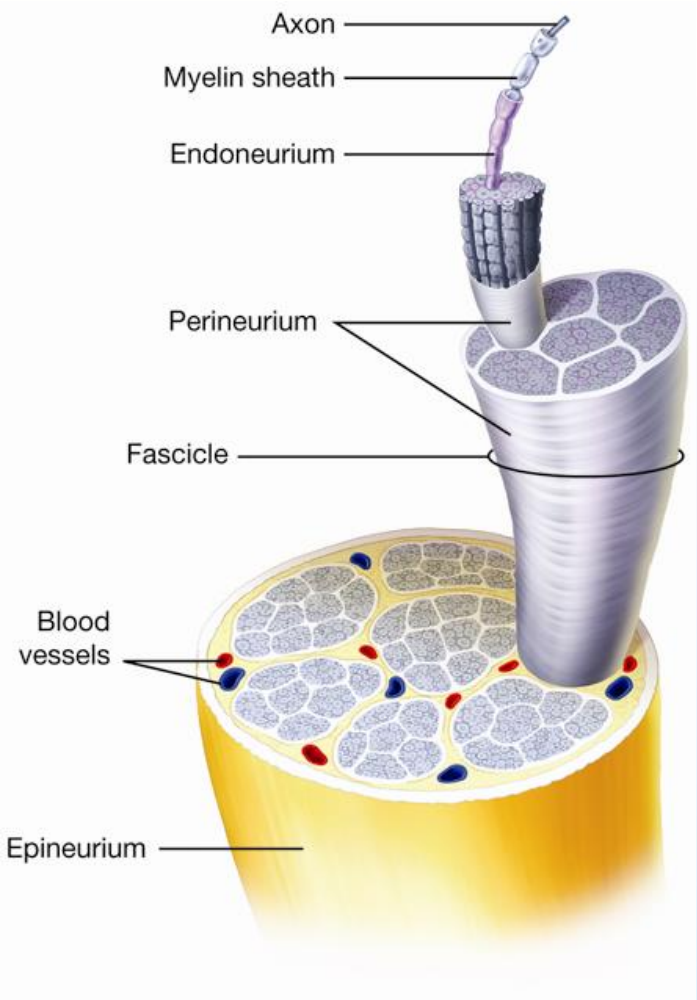
Functional Anatomy of the Peripheral Nervous System

Functional Anatomy of the Peripheral Nervous System

- nerve structure
- cranial nerves
- spinal nerves and nerve plexuses
- autonomic nervous system

Nerve Structure

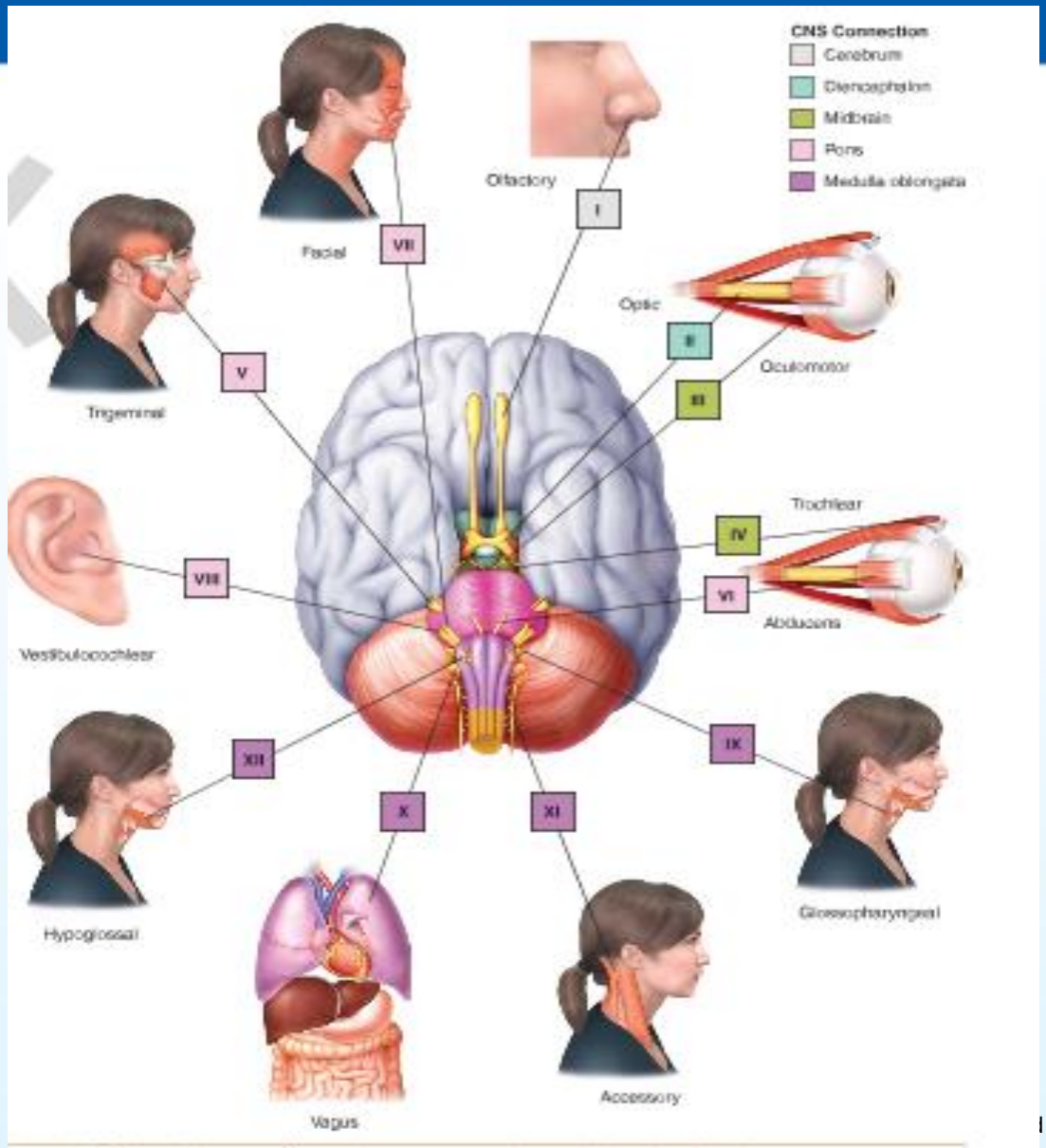
- endoneurium
  - covers axons
- perineurium
  - bundles fascicles
- epineurium
  - wraps nerves



Cranial Nerves

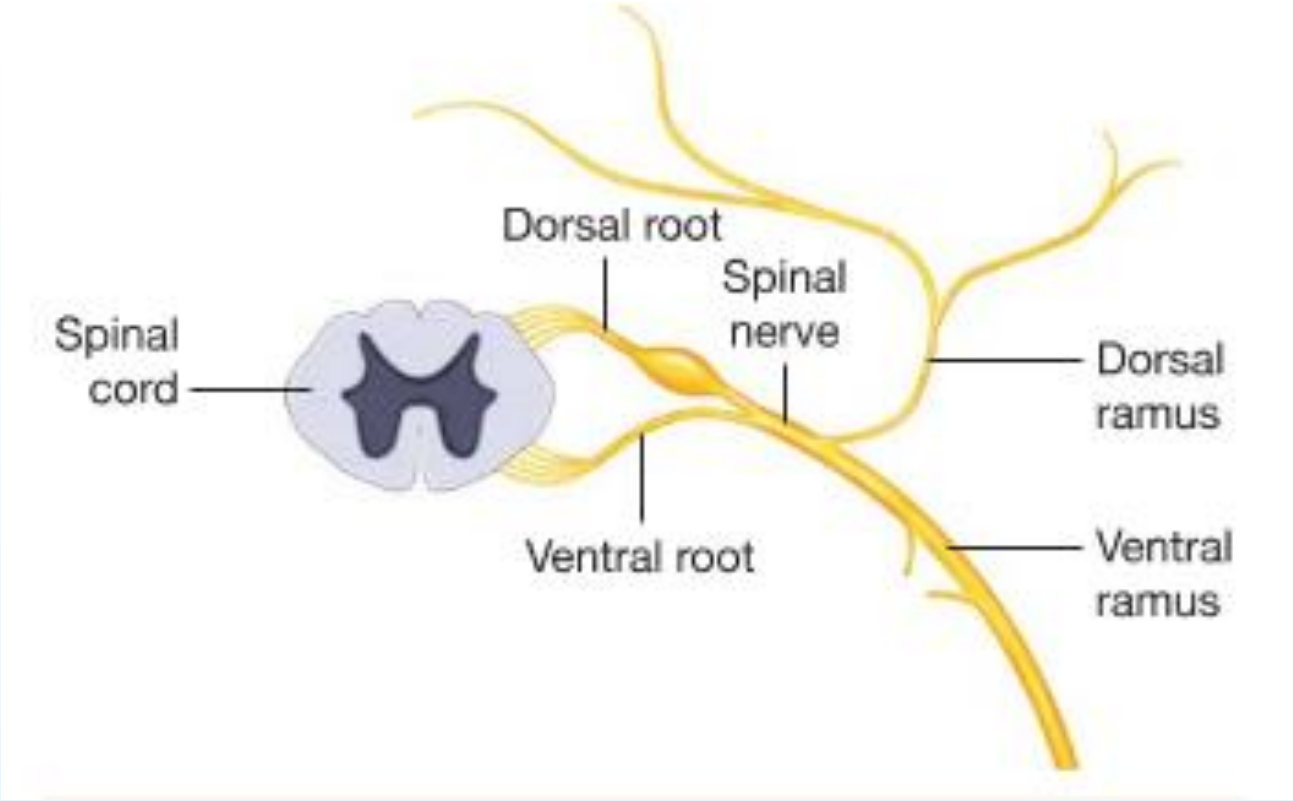
Nerve	#	System	Function
Olfactory	I	sensory	smell
Optic	II	sensory	sight
Oculomotor	III	both	eye movements
Trochlear	IV	both	eye movements
Trigeminal	V	both	facial sensation, jaw motion
Abducens	VI	both	eye movements
Facial	VII	both	facial movements, taste
Vestibulocochlear	VIII	sensory	hearing, balance
Glossopharyngeal	IX	both	throat muscle movements, taste
Vagus	X	both	autonomic control of heart, lungs, digestion, taste, communication between brain and organs
Accessory	XI	mostly motor	trapezius movements, sternocleidomastoid movements
Hypoglossal	XII	both	tongue muscle movements, tongue sensation

Cranial Nerves



Spinal Nerves and Nerve Plexuses

- 31 pairs
- dorsal root
- ventral root
- dorsal ramus
- ventral ramus
- plexuses



Autonomic Nervous System

- preganglionic and postganglionic neurons
- sympathetic nerves
  - fight-or-flight action
- parasympathetic nerves
  - resting or digesting action

Autonomic Nervous System

Review and Assessment

Match these words with 1–4 below: efferent, ganglion, optic, perineurium.

1. wraps fascicles
2. motor
3. a cranial nerve
4. enlarged junction

Lesson 6.5

Injuries and Disorders of the Nervous System

Injuries to the Brain and Spinal Cord

- traumatic brain injury
- cerebral palsy
- spinal cord injury

Traumatic Brain Injury

- violent impact to head
  - mild
  - moderate
  - severe

Cerebral Palsy

- damage to brain
  - before birth
  - during birth
  - during infancy
- motor function impairment

Spinal Cord Injuries

- C1–C3: usually fatal
- C1–C4: quadriplegia
- C5–C7: paralysis of lower extremities
- T1–L5: paraplegia

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Common Diseases and Disorders of the CNS

- meningitis
- multiple sclerosis
- epilepsy
- Parkinson’s disease
- dementia and Alzheimer’s disease

Review and Assessment

Match these words with 1–4 below: quadriplegia, multiple sclerosis, dementia, cerebral palsy.

1. inflammation destroys myelin sheath
2. loss of memory and thinking
3. loss of function below the neck
4. may begin before birth