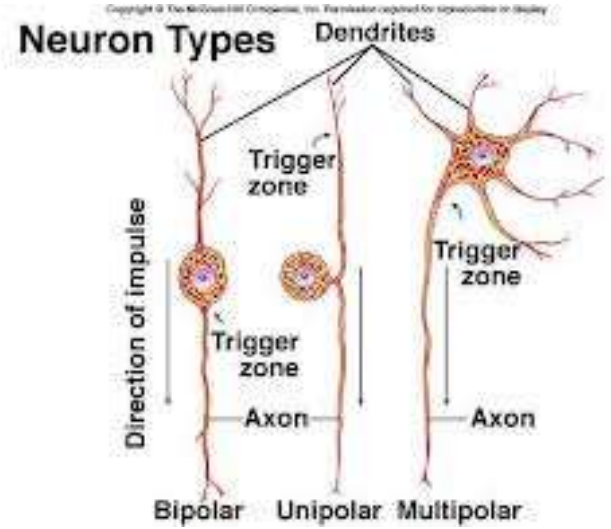
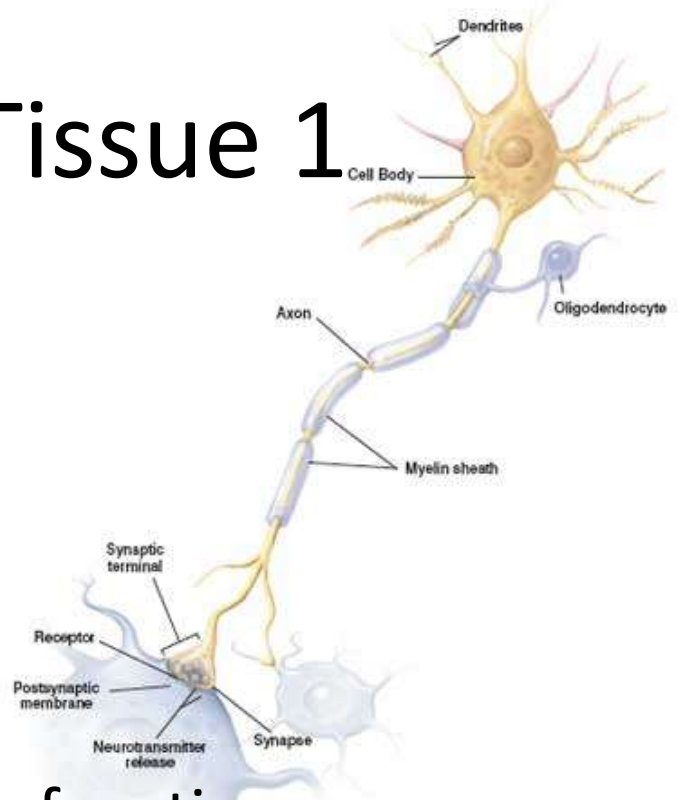
Nervous Tissue 1





Nervous tissue function

Central and Peripheral Nervous System

Nerve cell histology and classification

Nervous system functions

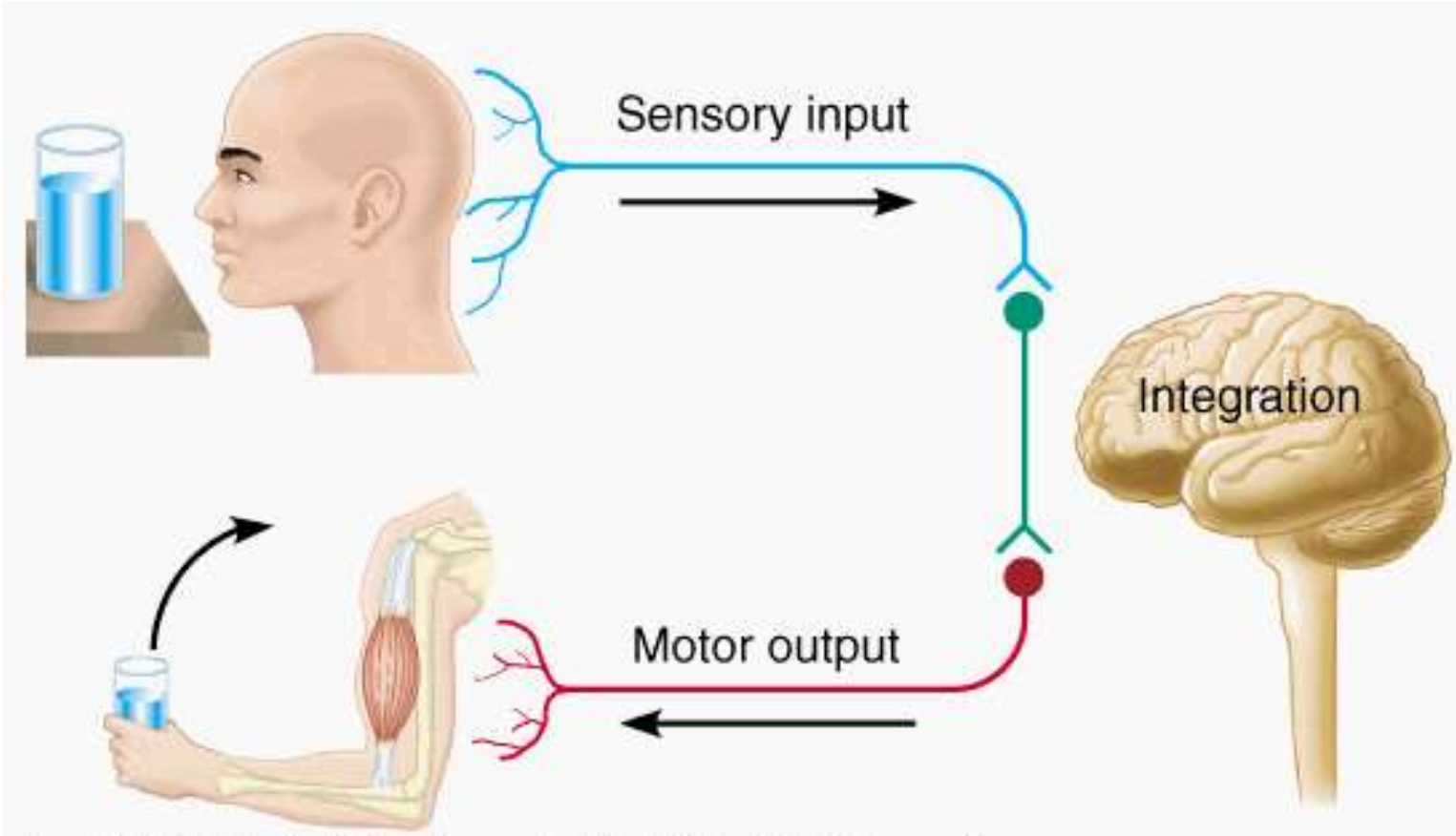
Body's *control center*

Sensation – awareness of change in body and external evironment

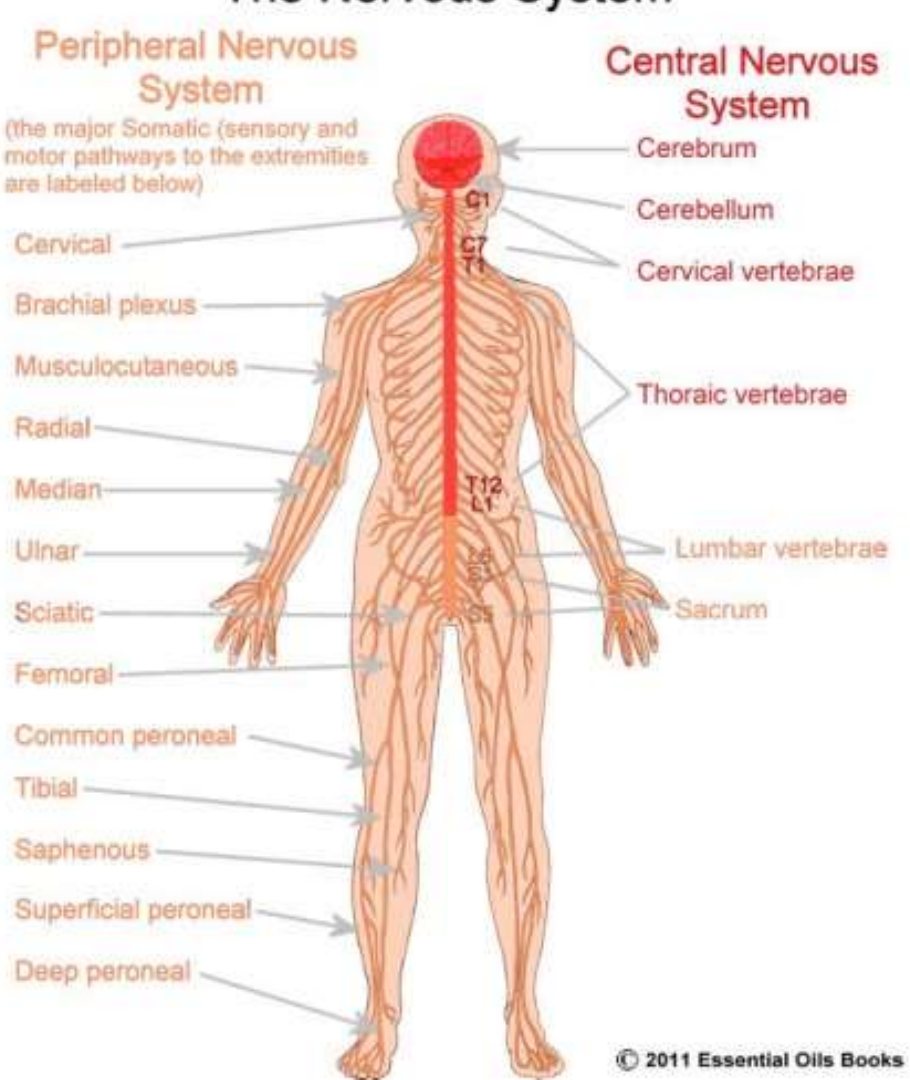
Intregration – interpretation of those changes

Motor – response to change via muscle contraction or glandular secretion

Homeostasis – acts synergistically with endocrine system



Divisions and Functional Organization of the Nervous System


The Nervous System
Peripheral Nervous System
(the major Somatic (sensory and motor pathways to the extremities are labeled below)
Cervical
Brachial plexus
Musculocutaneous
Radial
Median
Ulnar
Sciatic
Femoral
Common peroneal
Tibial
Saphenous
Superficial peroneal
Deep peroneal
Central Nervous System
Cerebrum
Cerebellum
Cervical vertebrae
Thoraic vertebrae
Lumbar vertebrae
Sacrum
C1
C7
T1
T12
L1
S5
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Central nervous system (CNS)

Control center
Consists of the brain and spinal cord with *tracts* and *nuclei*
Sensory input sent to CNS for interpretation
Origin of nerve impulses for action

Nucleus = a collection of nerve cell bodies in the CNS.
Tract = bundle of nerve fibers within the CNS

Peripheral Nervous System (PNS)

Connects brain and spinal cord with *effectors*

Consists of ganglia, cranial nerves, spinal nerves and peripheral receptors.

Ganglia = a collection of nerve cell bodies in the PNS

Nerve = bundle of nerve fibers in the PNS

Peripheral Nervous System (PNS)

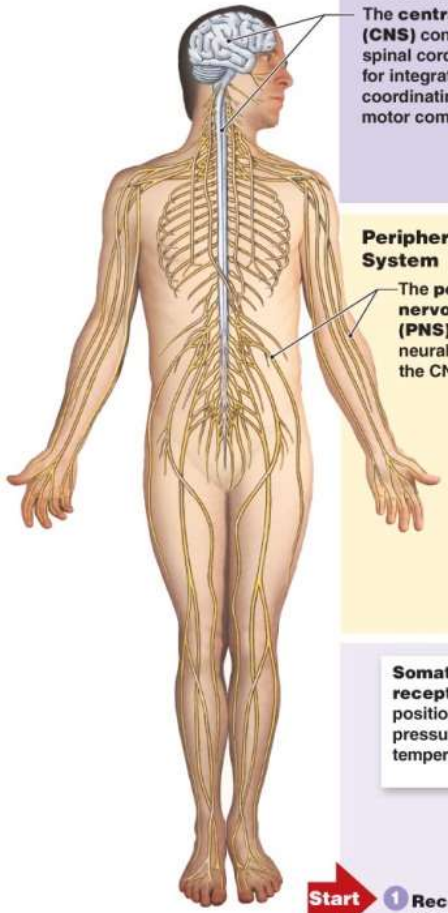
PNS is subdivided into sensory and motor divisions:

somatic nervous system (SNS)

autonomic nervous system (ANS) and the

enteric nervous system (ENS)

The major components and functions of the nervous system



Central Nervous System

The **central nervous system (CNS)** consists of the brain and spinal cord and is responsible for integrating, processing, and coordinating sensory data and motor commands.

Peripheral Nervous System

The **peripheral nervous system (PNS)** includes all the neural tissue outside the CNS.

Start

1 **Receptors** are sensory structures that detect changes in the internal or external environment.

Somatic sensory receptors provide position, touch, pressure, pain, and temperature sensations.

Special sensory receptors provide sensations of smell, taste, vision, balance, and hearing.

Visceral sensory receptors monitor internal organs.

2 The **sensory division** of the PNS brings information to the CNS from receptors in peripheral tissues and organs.

3 **Information processing** includes the integration and distribution of information in the CNS.

4 The **motor division** of the PNS carries motor commands from the CNS to peripheral tissues and systems.

includes

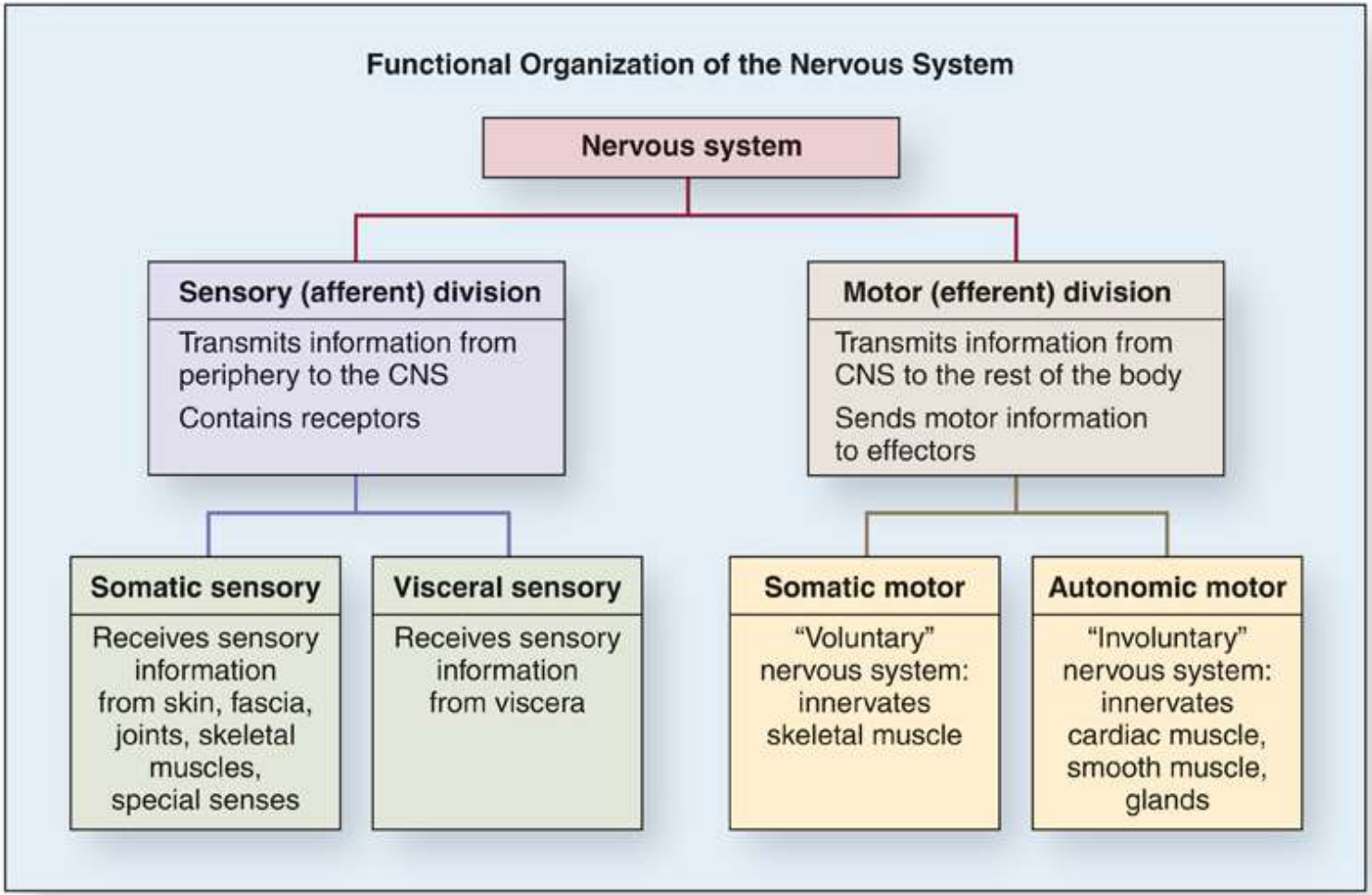
The **somatic nervous system (SNS)** controls skeletal muscle contractions.

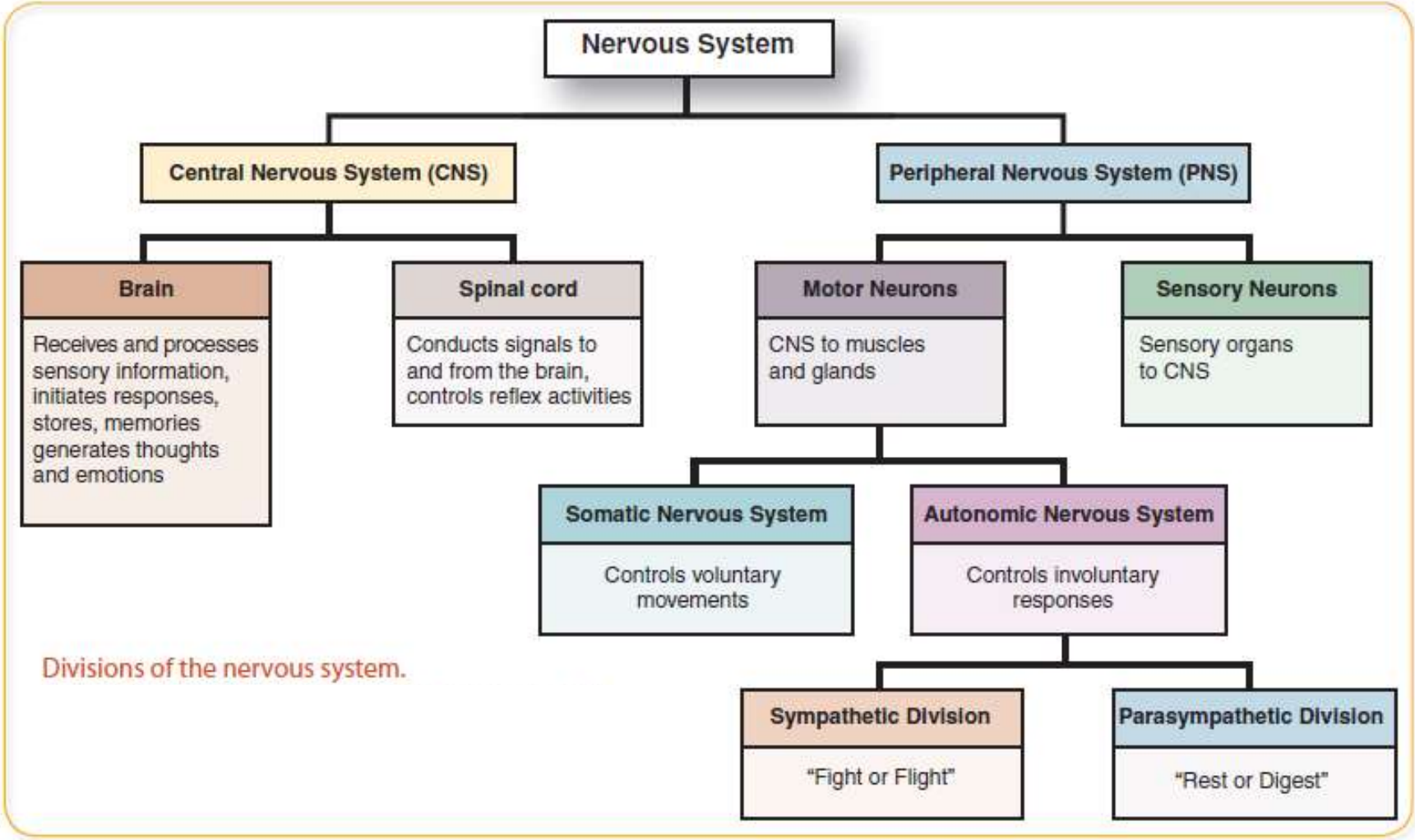
The **autonomic nervous system (ANS)** provides automatic regulation of smooth muscle, cardiac muscle, glands, and adipose tissue.

Skeletal muscle

- Smooth muscle
- Cardiac muscle
- Glands
- Adipose tissue

5 **Effectors** are target organs whose activities change in response to neural commands.





Divisions of the nervous system.

Nerve cell types and histology

Neuroglia
Neurons

Neuroglia (glial) cell functions

Supportive and protective cells
Can go through mitosis
Surround other nerve cells
Line brain and spinal cord nerves
Produce myelin
Phagocytic
Source of brain cancers

Types of neuroglia cells

- Astrocytes
  - Star shaped, multiple processes, surround and support CNS nerves, attach neurons to blood vessels
- Oligodendroglial (oligodendrocyte)
  - Fewer and smaller processes, form tissue between CNS neurons, produce myelin sheath for CNS nerves

Types of neuroglia cells

Microglia

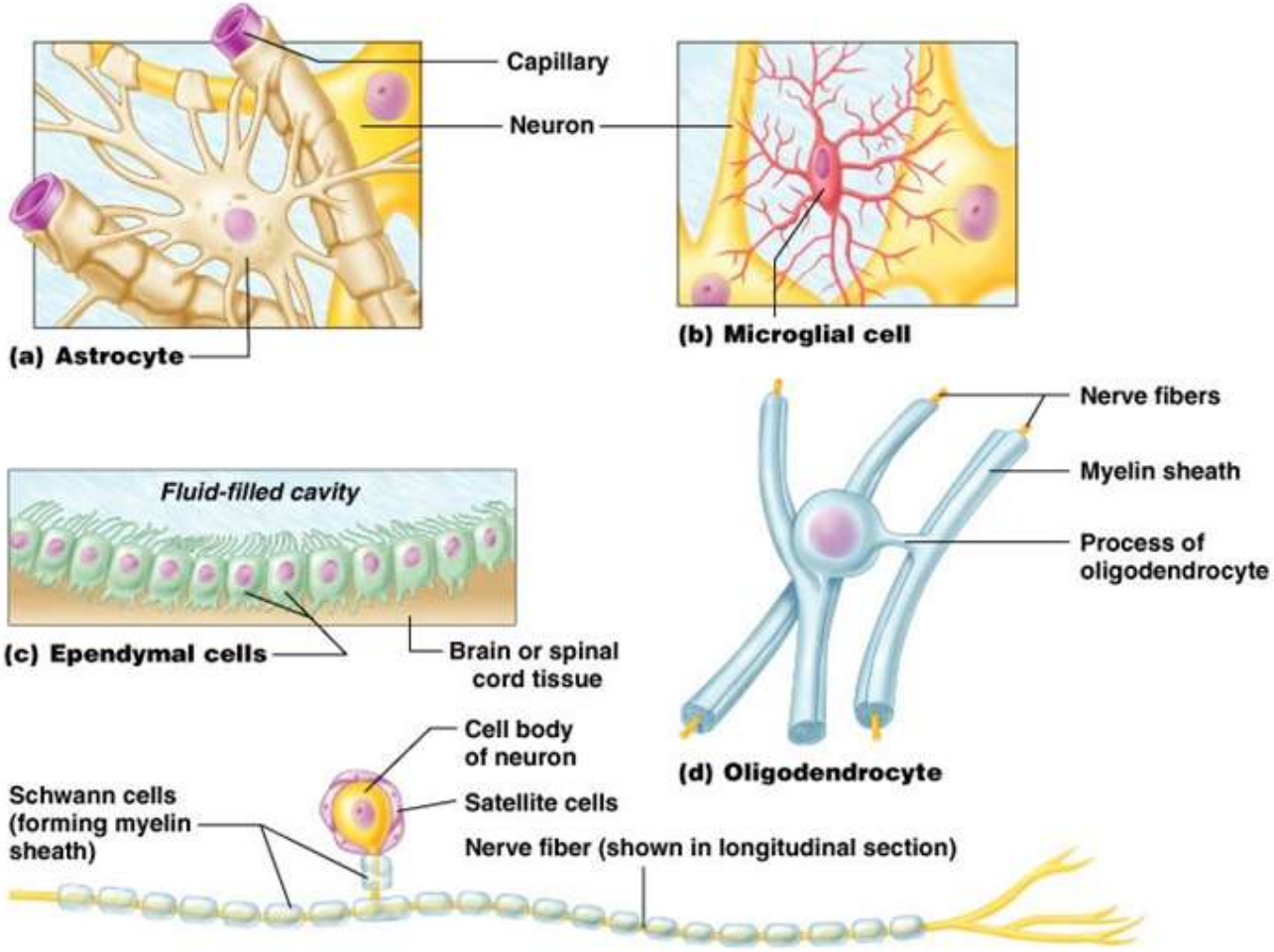
Tiny cells, small number of processes, phagocytize pathogens and cell debris

Ependyma

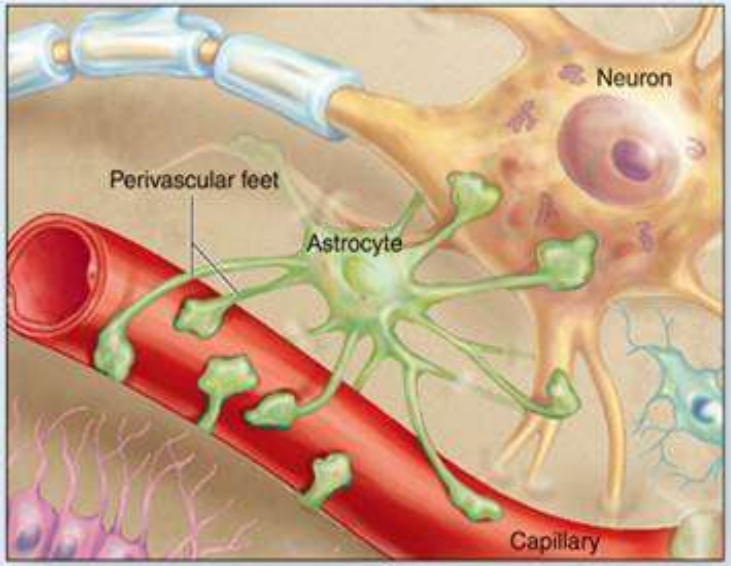
Epithelial, single layer, squamous to columnar, ciliated (cerebro-spinal fluid circulation), line ventricles of brain and spinal cord canal

Schwann

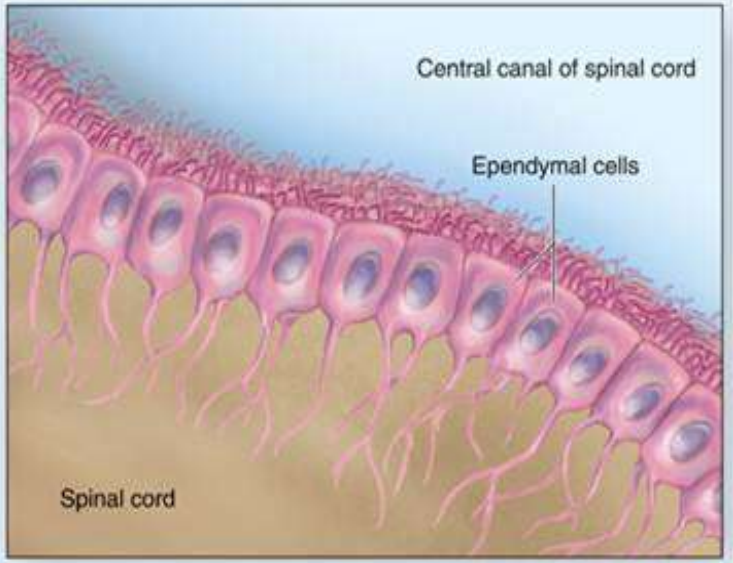
Produces myelin sheath around PNS nerve axons



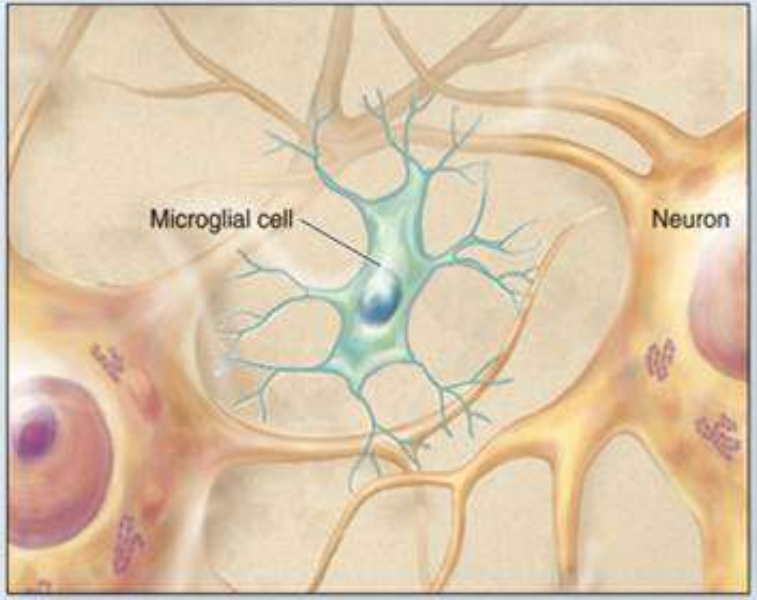
CNS Glial Cells



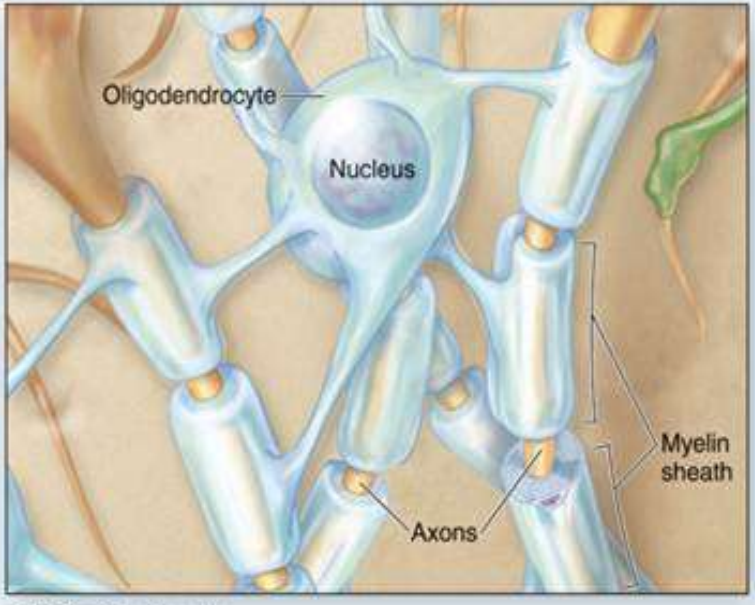
(a) Astrocyte



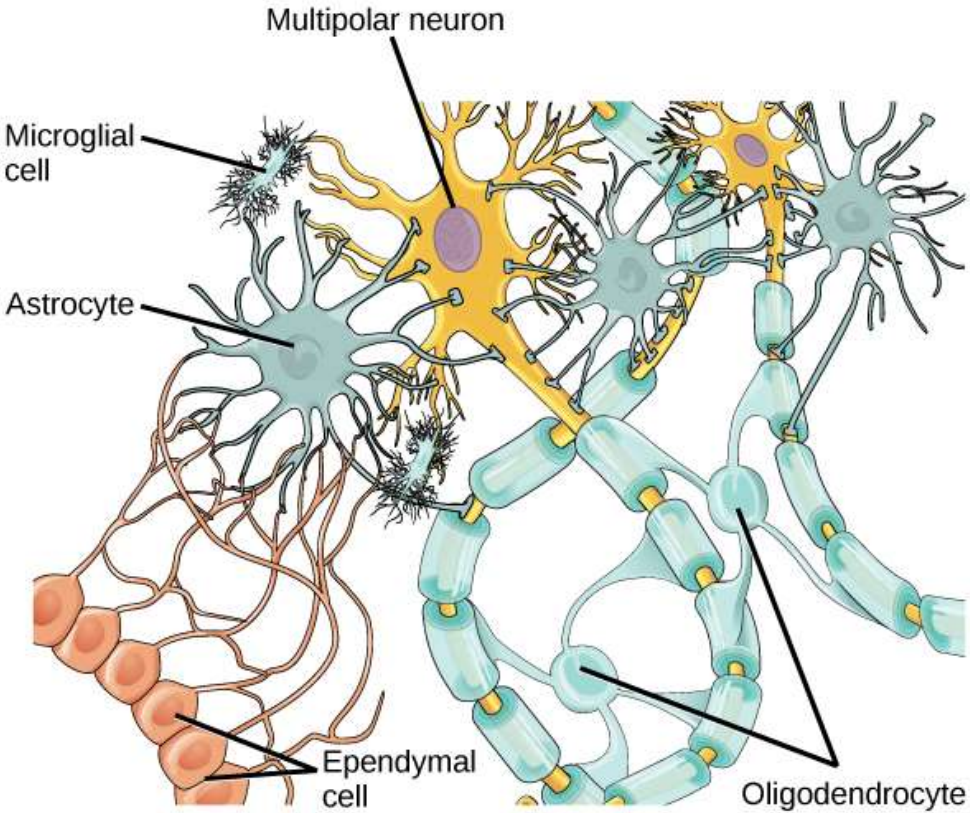
(b) Ependymal cells



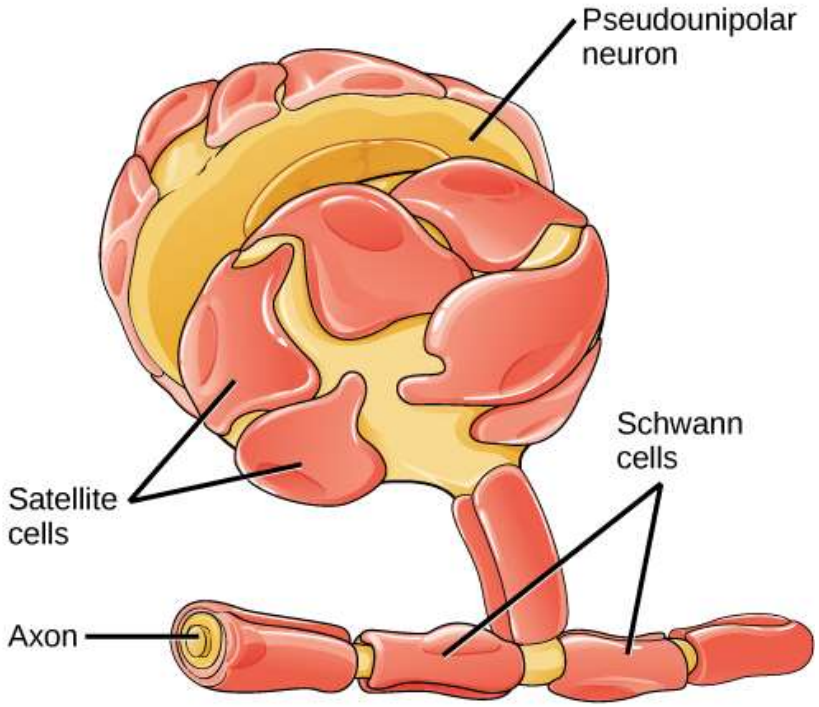
(c) Microglia



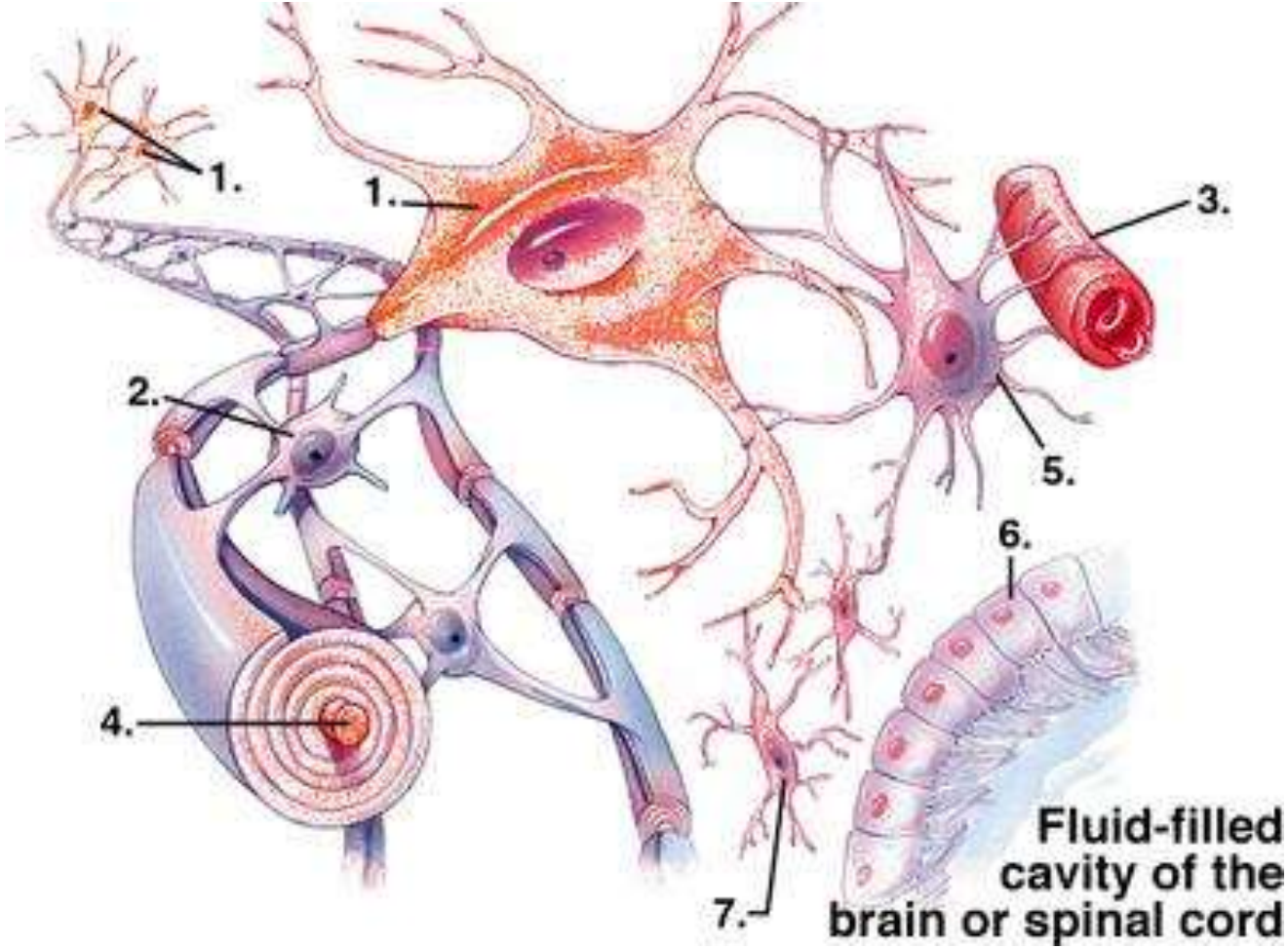
(d) Oligodendrocyte



(a) Central nervous system



(b) Peripheral nervous system


1.
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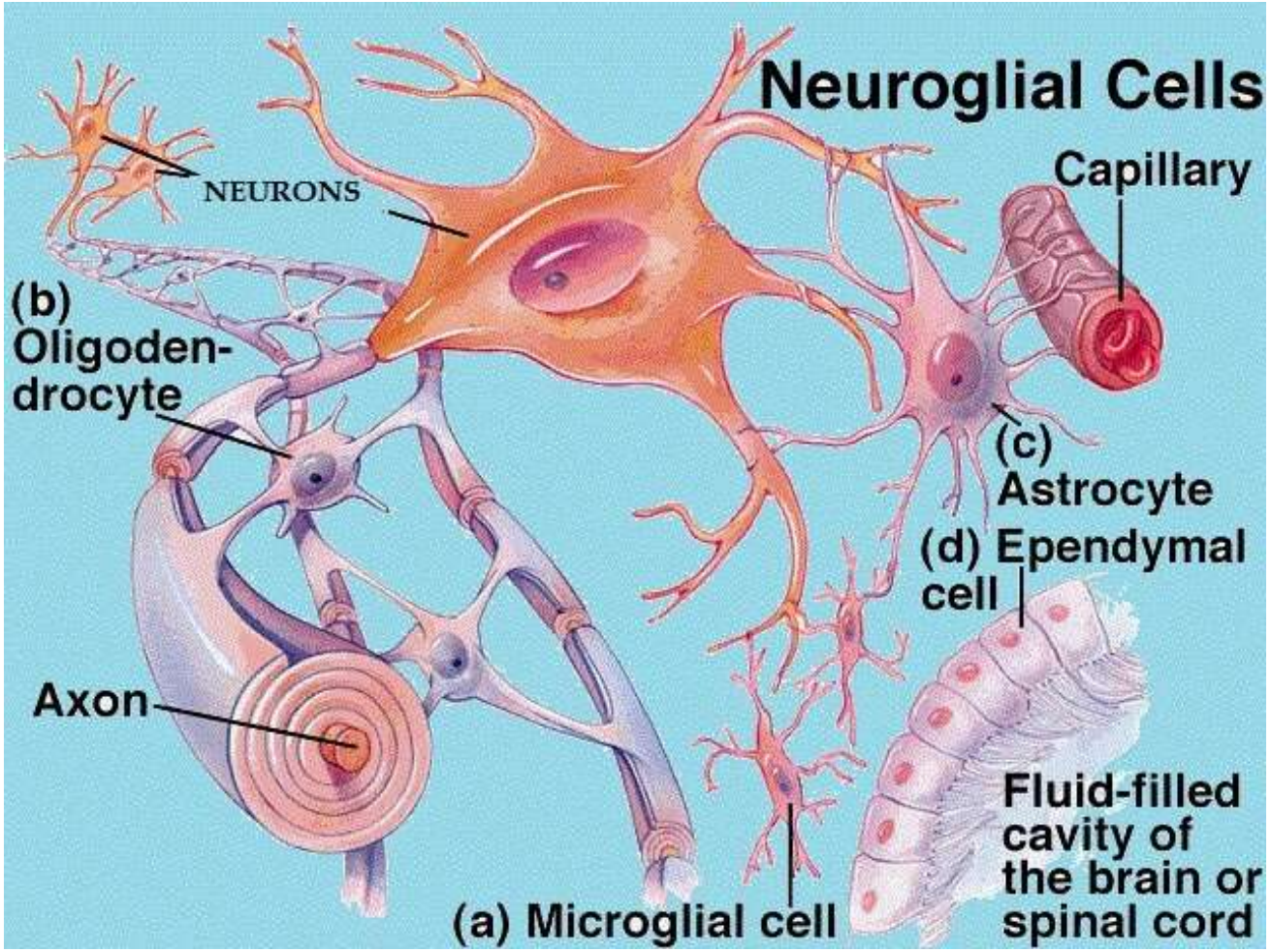
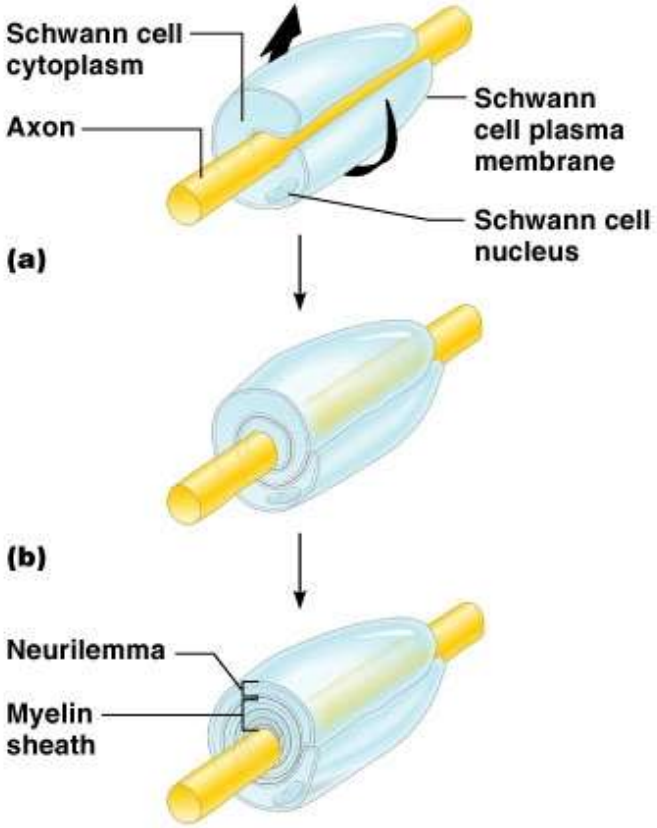
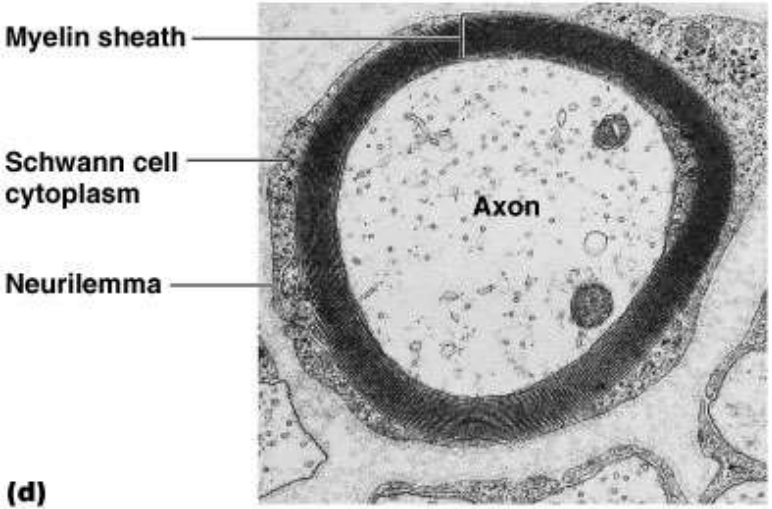
Fluid-filled cavity of the brain or spinal cord


Neuroglial Cells
NEURONS
Capillary
(b)
Oligoden-
drocyte
(c)
Astrocyte
(d) Ependymal
cell
Axon
Fluid-filled
cavity of
the brain or
spinal cord
(a) Microglial cell





Neurons

Very limited ability to regenerate. No Mitotic ability. Injuries to nervous tissue are severe

Conduct impulses from one part of the body to another

Process relies on copious ATP due to prodigious active transport process mechanisms involved

Neurons

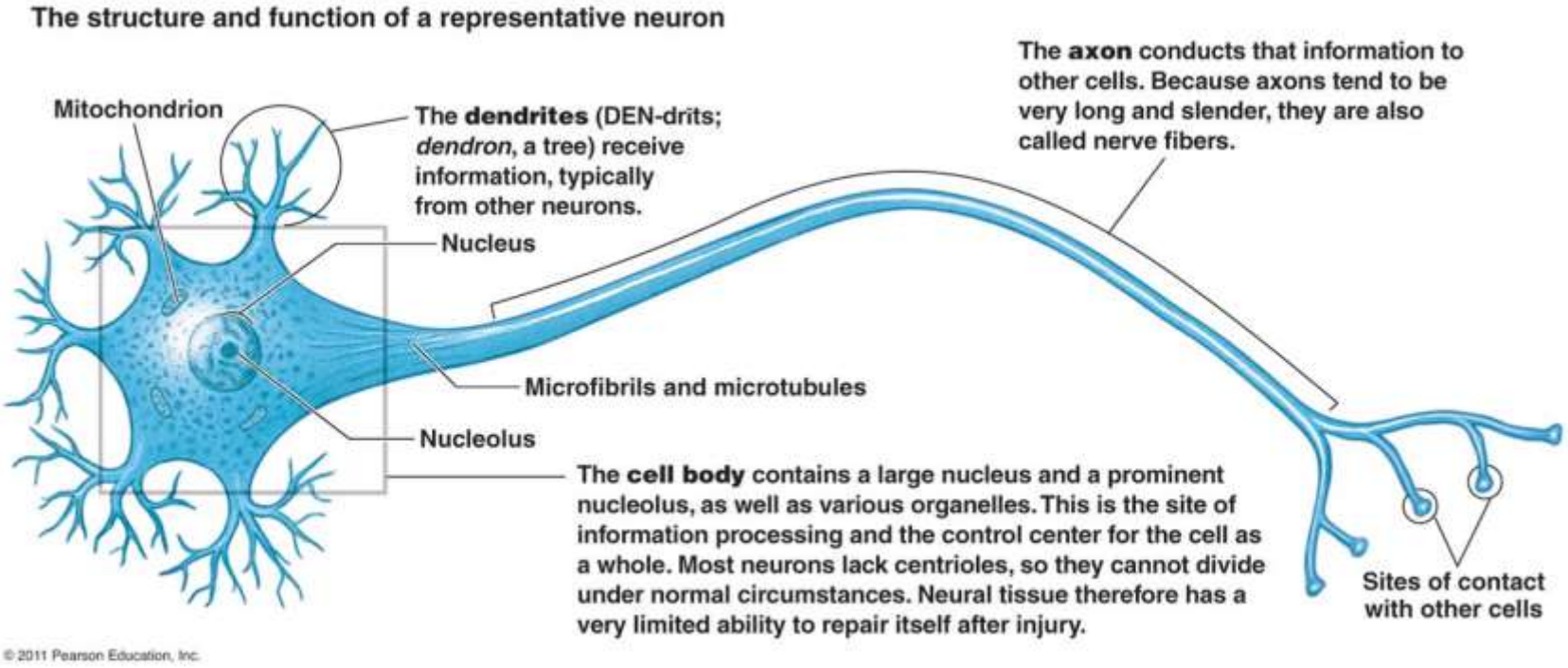
Three structural components:

Cell body: site of nucleus and other organelles

Dendrites: several branches or processes that are extensions of the cell body, conduct impulses toward body

Axon: long thin process, conducts impulses away from cell body

Neurons


The structure and function of a representative neuron
Mitochondrion
The dendrites (DEN-drits; dendron, a tree) receive information, typically from other neurons.
Nucleus
Microfibrils and microtubules
Nucleolus
The cell body contains a large nucleus and a prominent nucleolus, as well as various organelles. This is the site of information processing and the control center for the cell as a whole. Most neurons lack centrioles, so they cannot divide under normal circumstances. Neural tissue therefore has a very limited ability to repair itself after injury.
The axon conducts that information to other cells. Because axons tend to be very long and slender, they are also called nerve fibers.
Sites of contact with other cells
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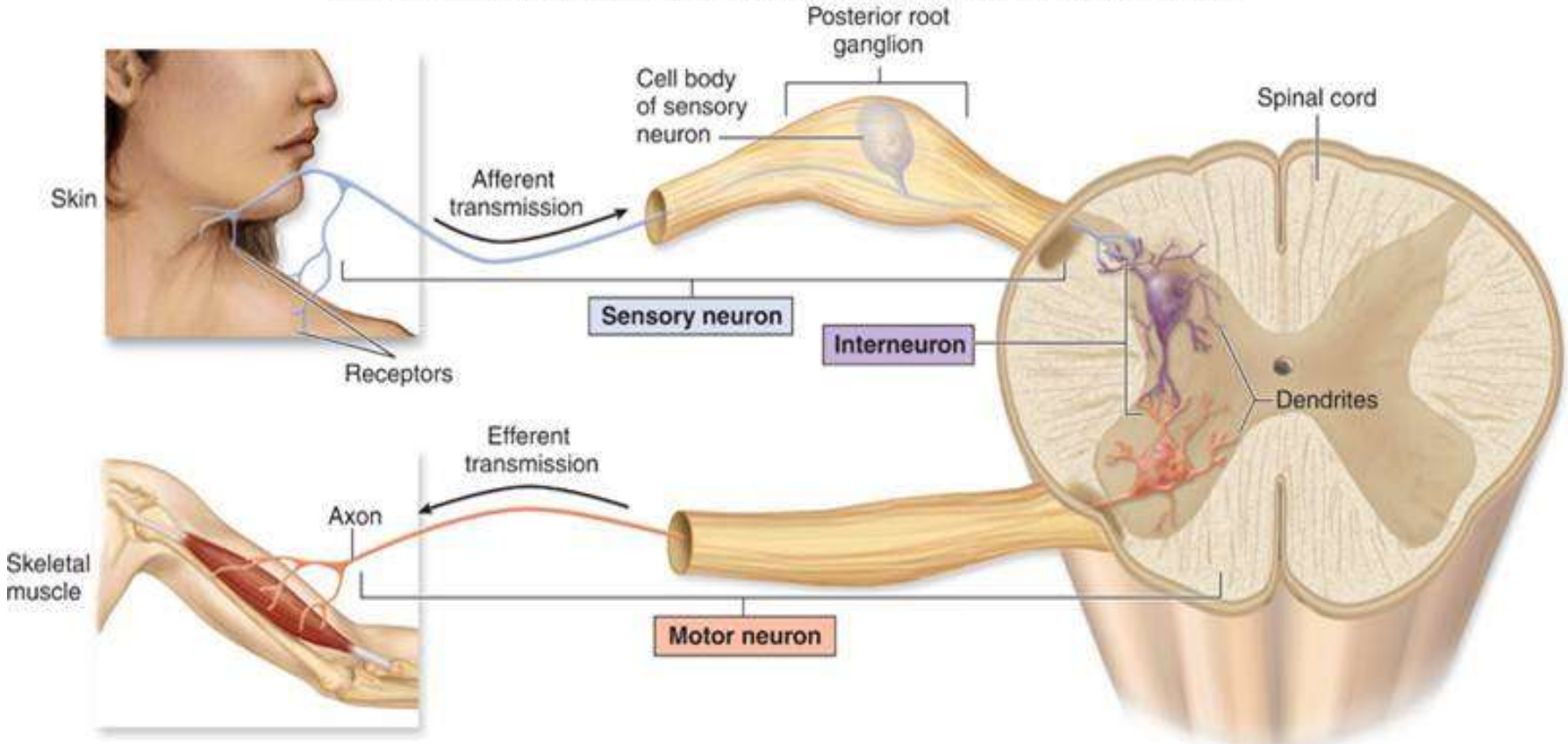
Types of neurons

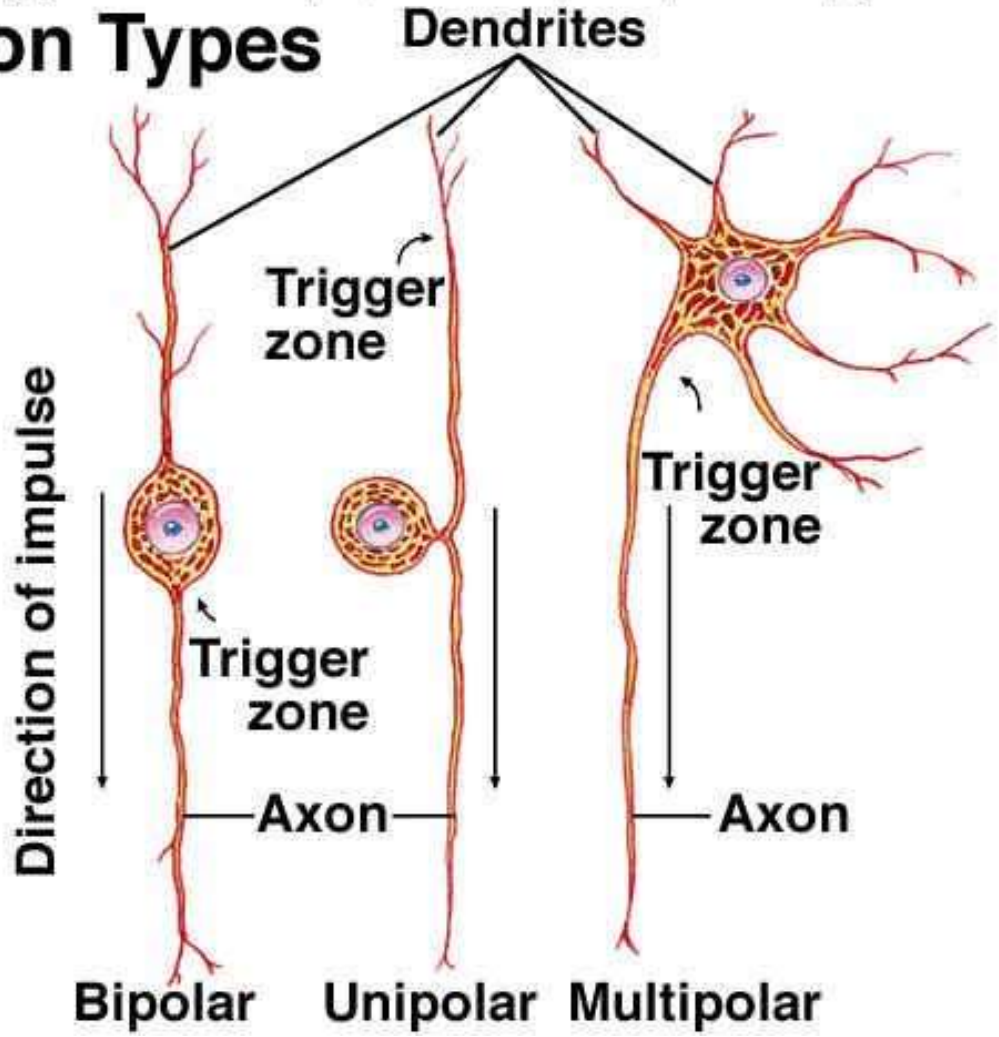
Sensory – afferent

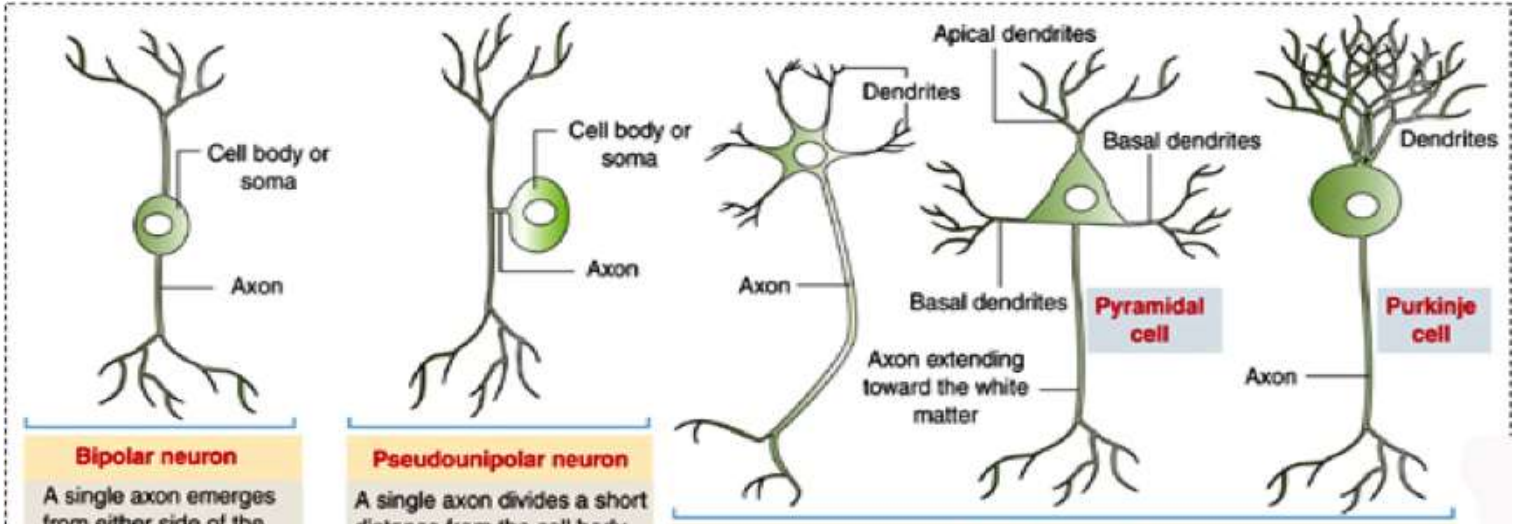
Motor – efferent

Interneurons, conduct sensory signal to motor neurons



Neuron Types





Bipolar neuron

A single axon emerges from either side of the cell body.

Bipolar neurons are found in sensory structures such as the **retina**, the **olfactory epithelium**, and the **vestibular** and **auditory systems**.

Pseudounipolar neuron

A single axon divides a short distance from the cell body.

The short axon of pseudounipolar neurons (or unipolar) divides into two branches: The peripheral branch carries information from the periphery. The central branch ends in the spinal cord.

These cells are found in **sensory ganglia** of **cranial** and **spinal nerves**.

Multipolar neuron

Many dendrites and a single long axon emerge from the cell body.

Examples of multipolar neurons are the **pyramidal cell** of the cerebral cortex and the **Purkinje cell** of the cerebellar cortex.