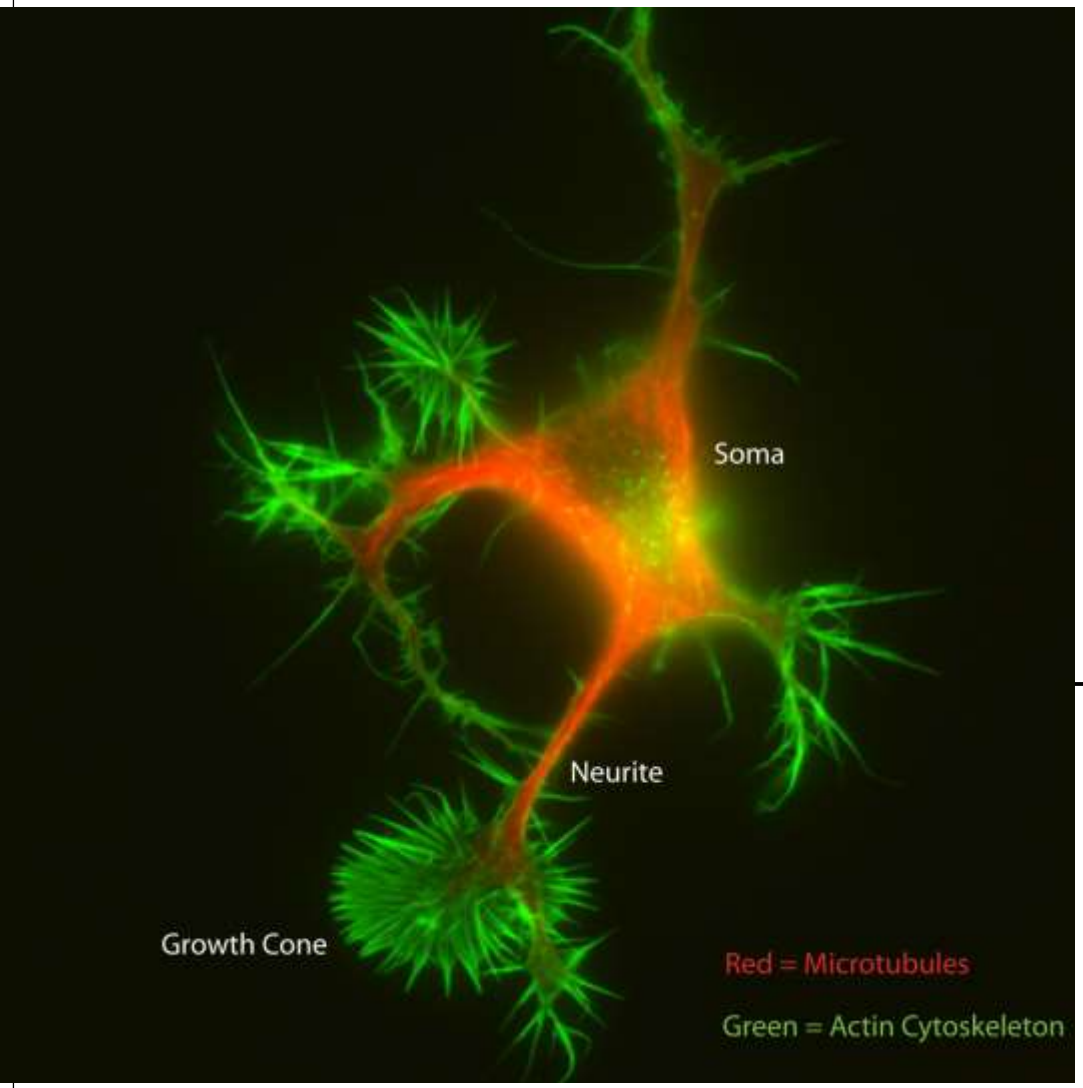


Nervous Tissue

http://ucsdnews.ucsd.edu/newsrel/health/01-08NeuronFunction.asp

Structures of the Nervous System

- Brain – 100 billion neurons
- Cranial nerves - #I through XII
- Spinal cord and spinal nerves
- Ganglia

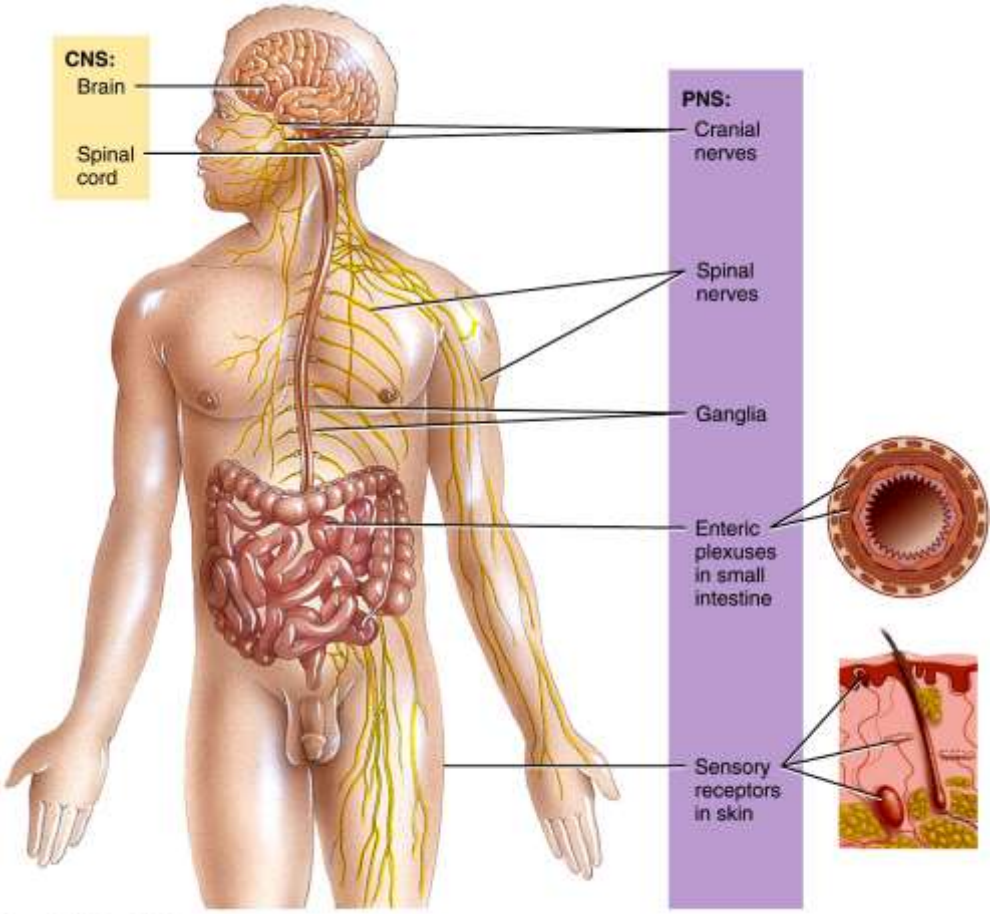
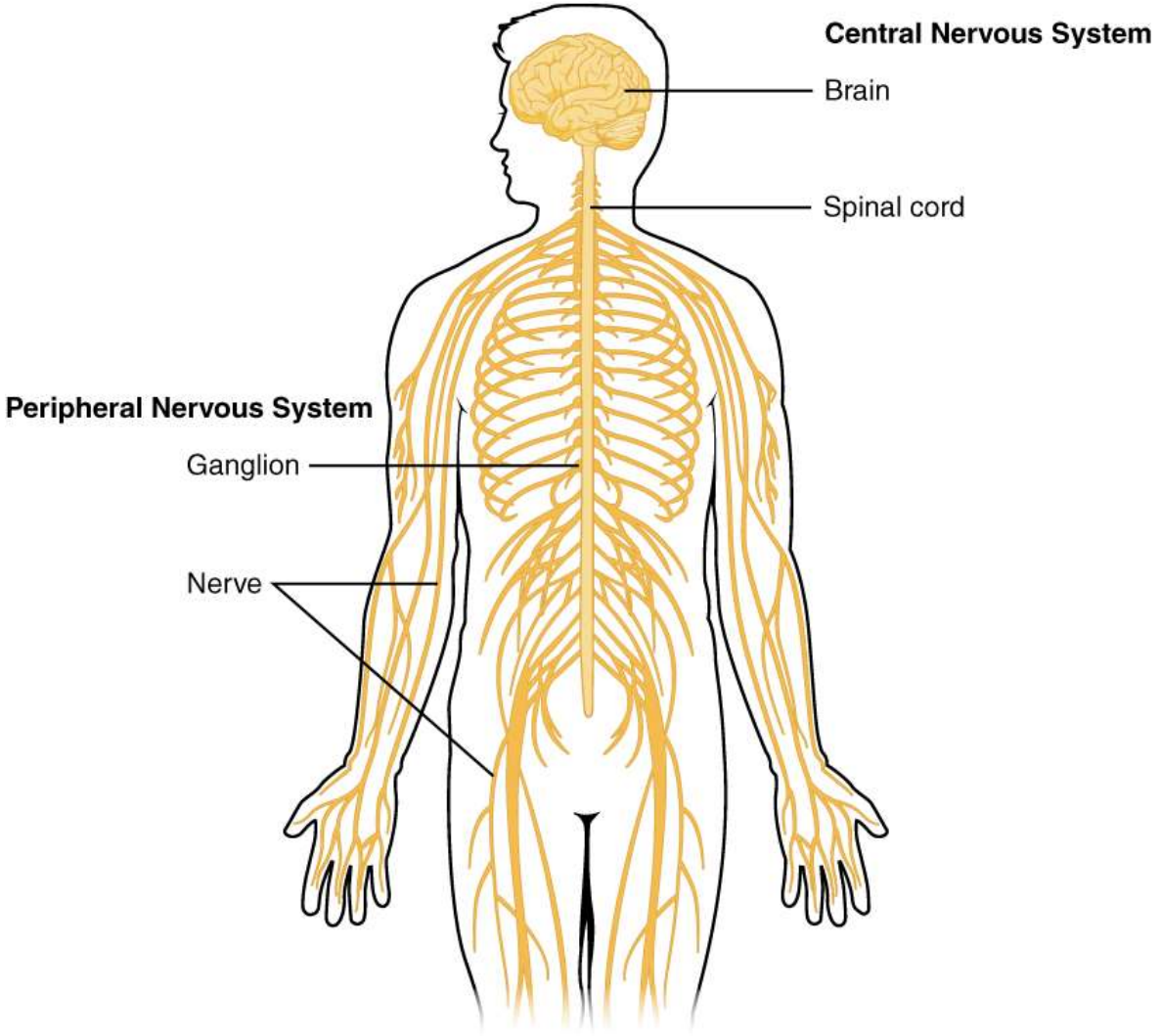


Figure 12.01 Tortora - PAP 12/e

Nervous system Divisions



What Is A Neuron?

Parts of a Neuron – Cell Body

1. Cell Body (perikaryon or soma)
   a. All the usual suspects plus Nissl bodies
      - Nissl bodies – free ribosomes and clusters of RER
      - Function of ribosomes?
   b. Neurofibrils – shape and support
   c. Microtubules

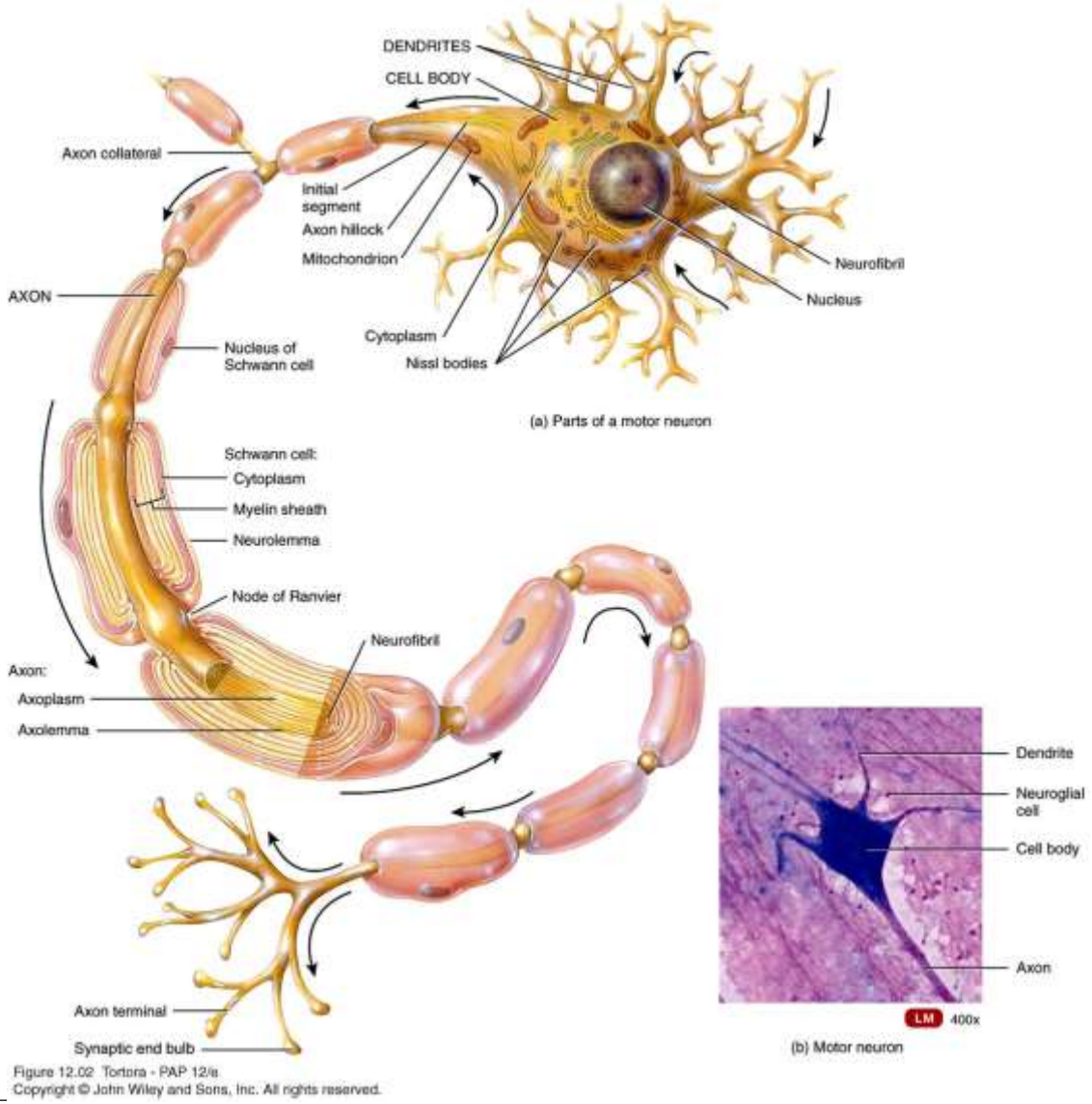
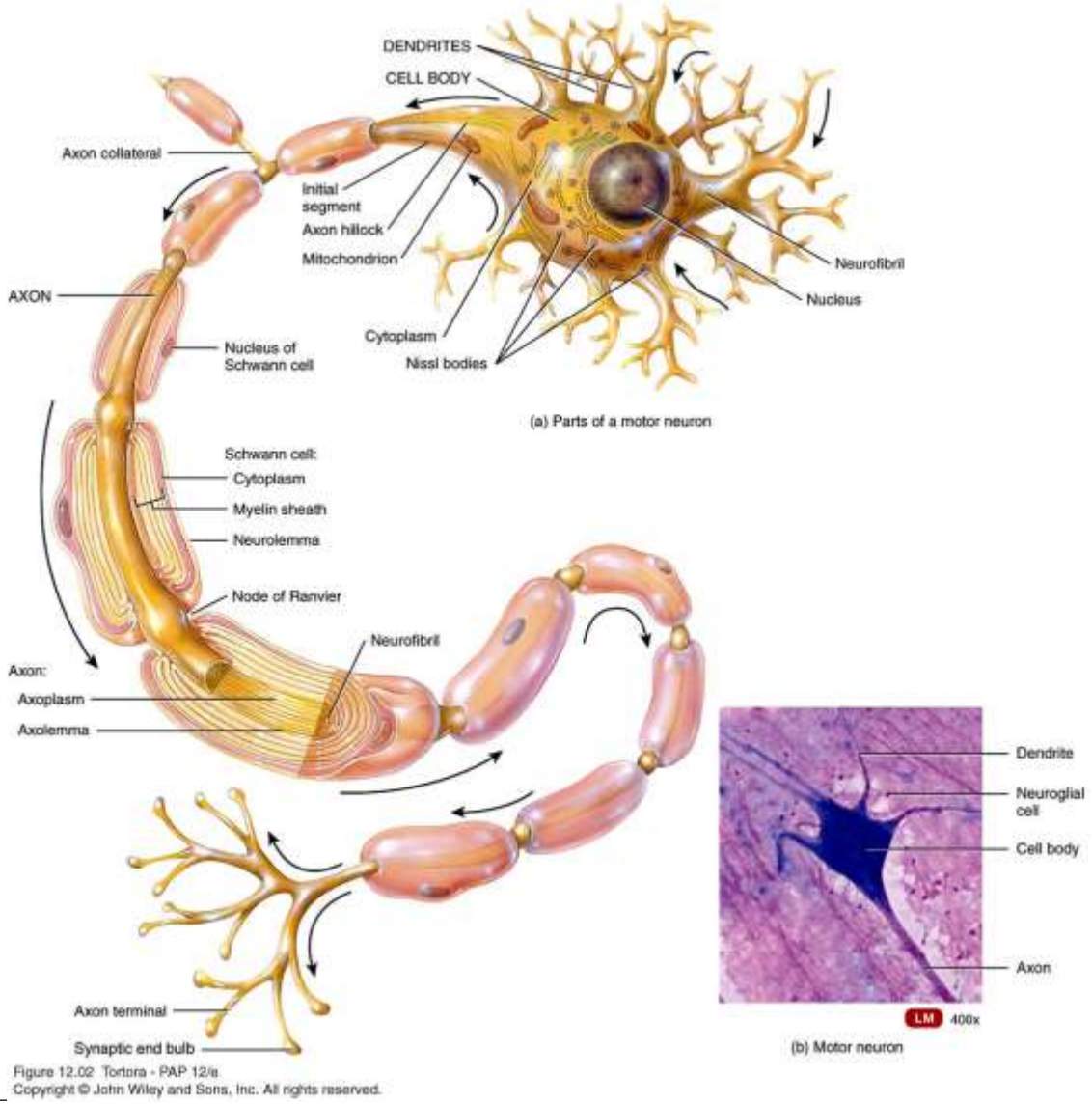


Figure 12.02 Tortora - PAP 12/e

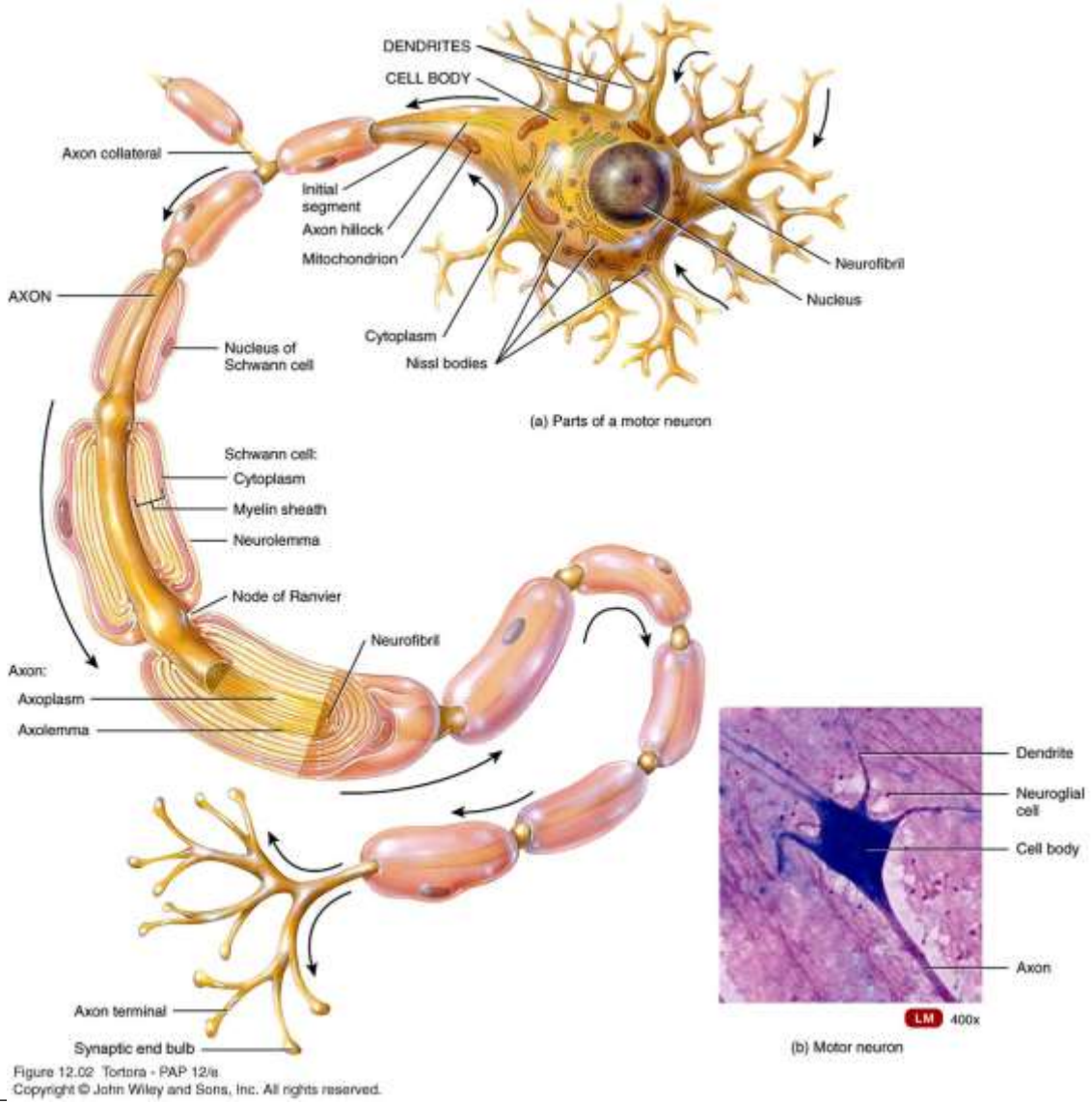
Parts of a Neuron - Dendrites

2. Dendrite



Parts of a Neuron

3. Axon



Classification of Neurons

1. Structural Classification
   a) Multipolar – brain/spinal cord
   b) Bipolar – retina/inner ear/olfactory area
   c) Unipolar – sensory neurons

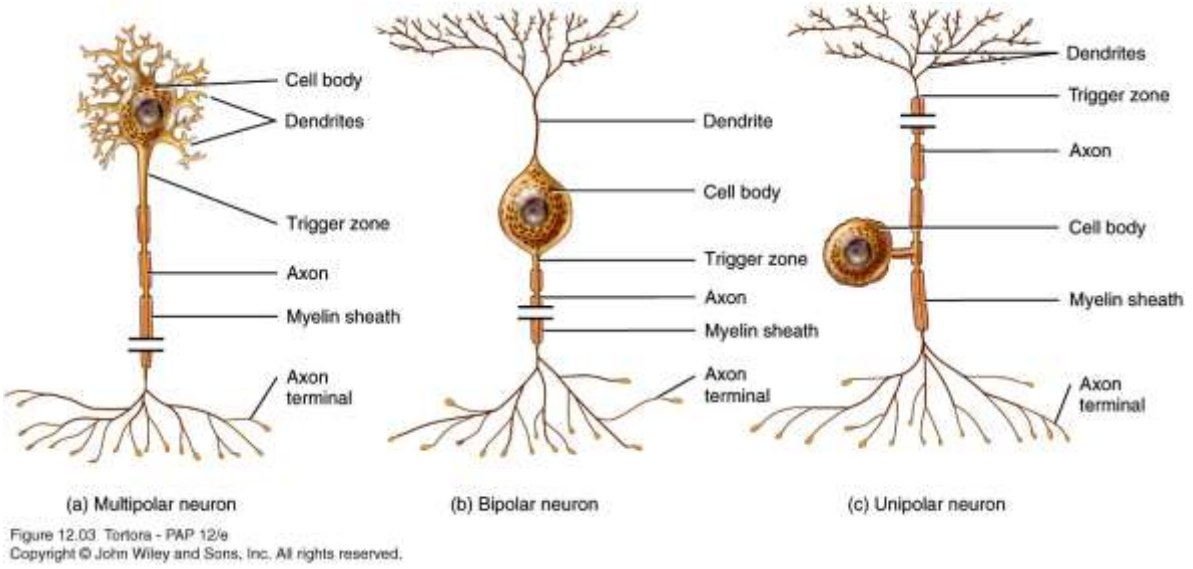
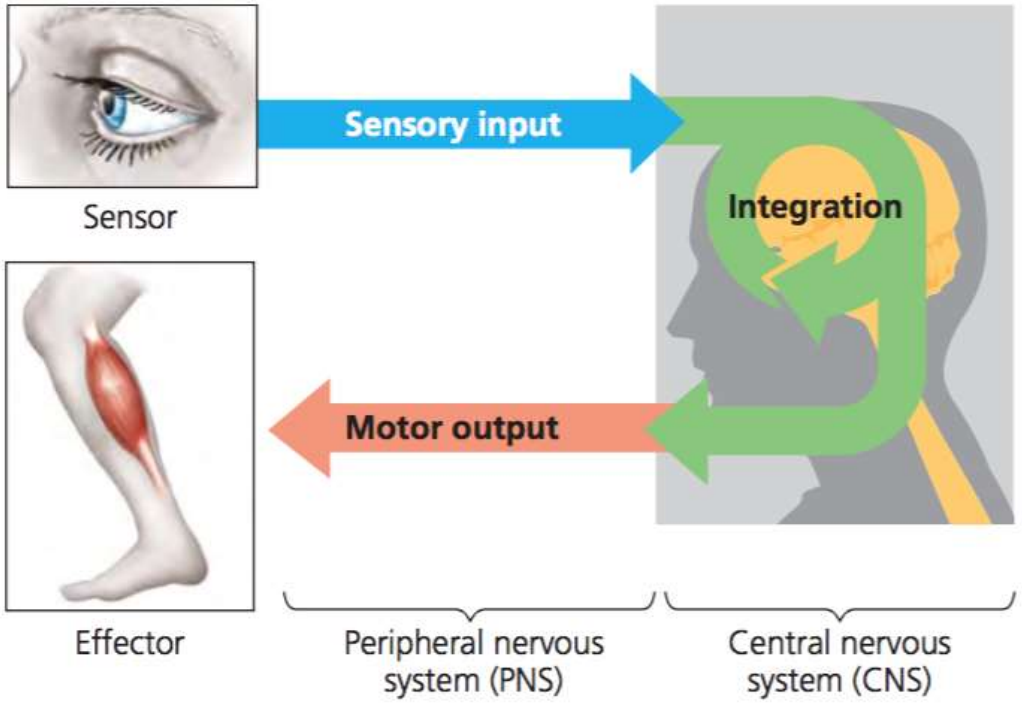


Figure 12.03 Tortora - PAP 12/e

Classification of Neurons

2. Functional Classification
   a) Sensory (afferent)
   b) Motor (efferent)
   c) Interneurons (association)



Neuroglia of the **Central Nervous System**

Neuroglia of **Central Nervous System**

1. Astrocytes
2. Oligodendrocyte
3. Microglia
4. Ependymal Cells

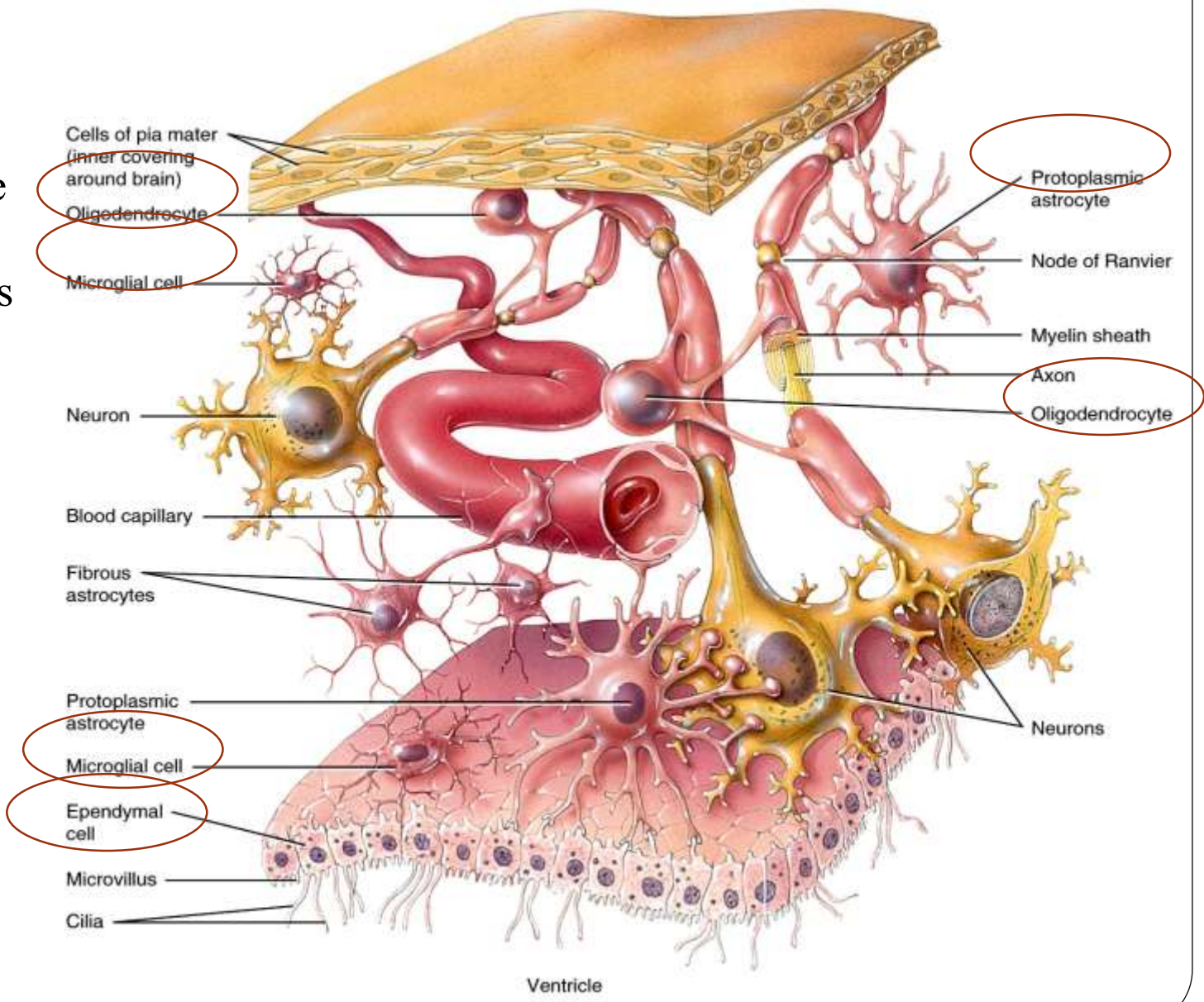
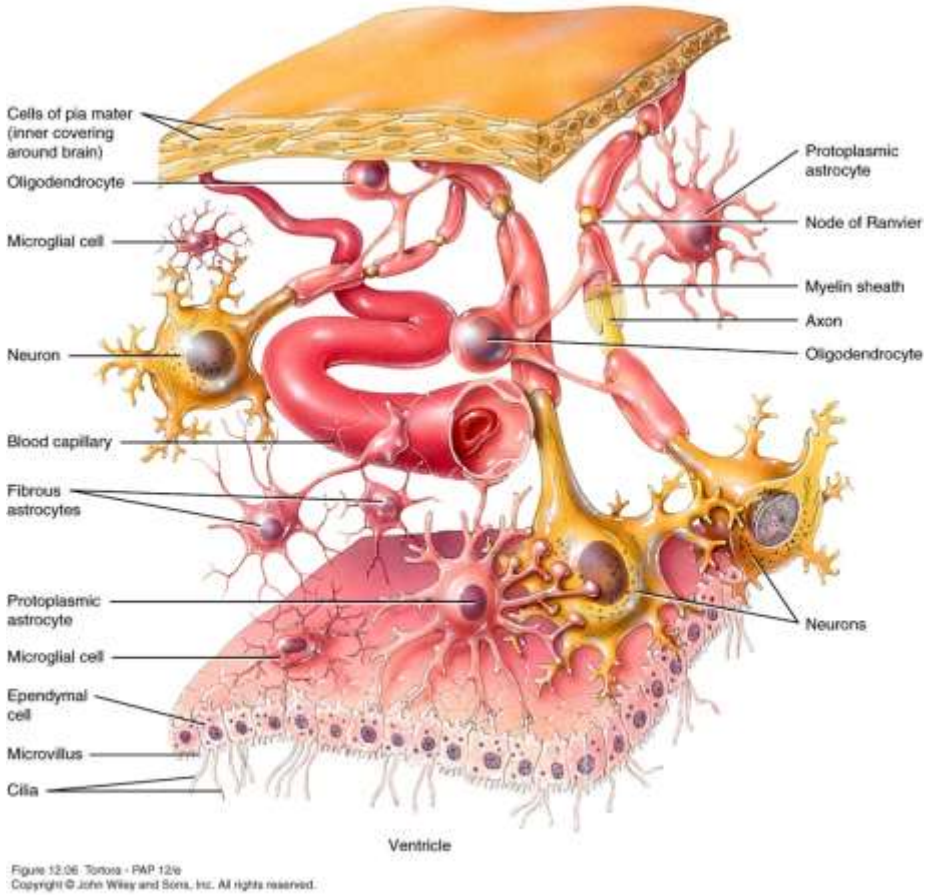


Figure 12.06 Tortora - PAP 12/e

Neuroglia of Central Nervous System
Functions of **Astrocytes**

1. Support neurons
2. Isolate neurons from potentially harmful substances in blood
3. Regulate growth, migration and interconnections of neurons
4. Regulate ion transport
5. Take up excess neurotransmitters
6. Transfer nutrients from capillaries

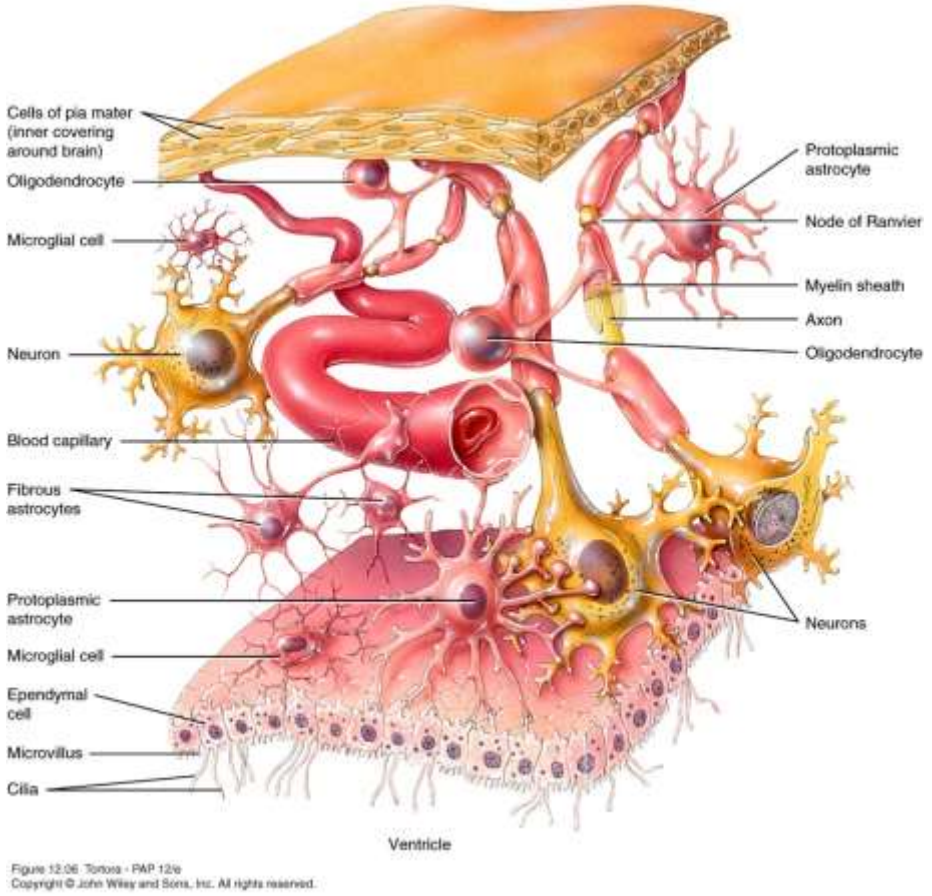


Neuroglia of Central Nervous System
Functions of **Oligodendrocytes**

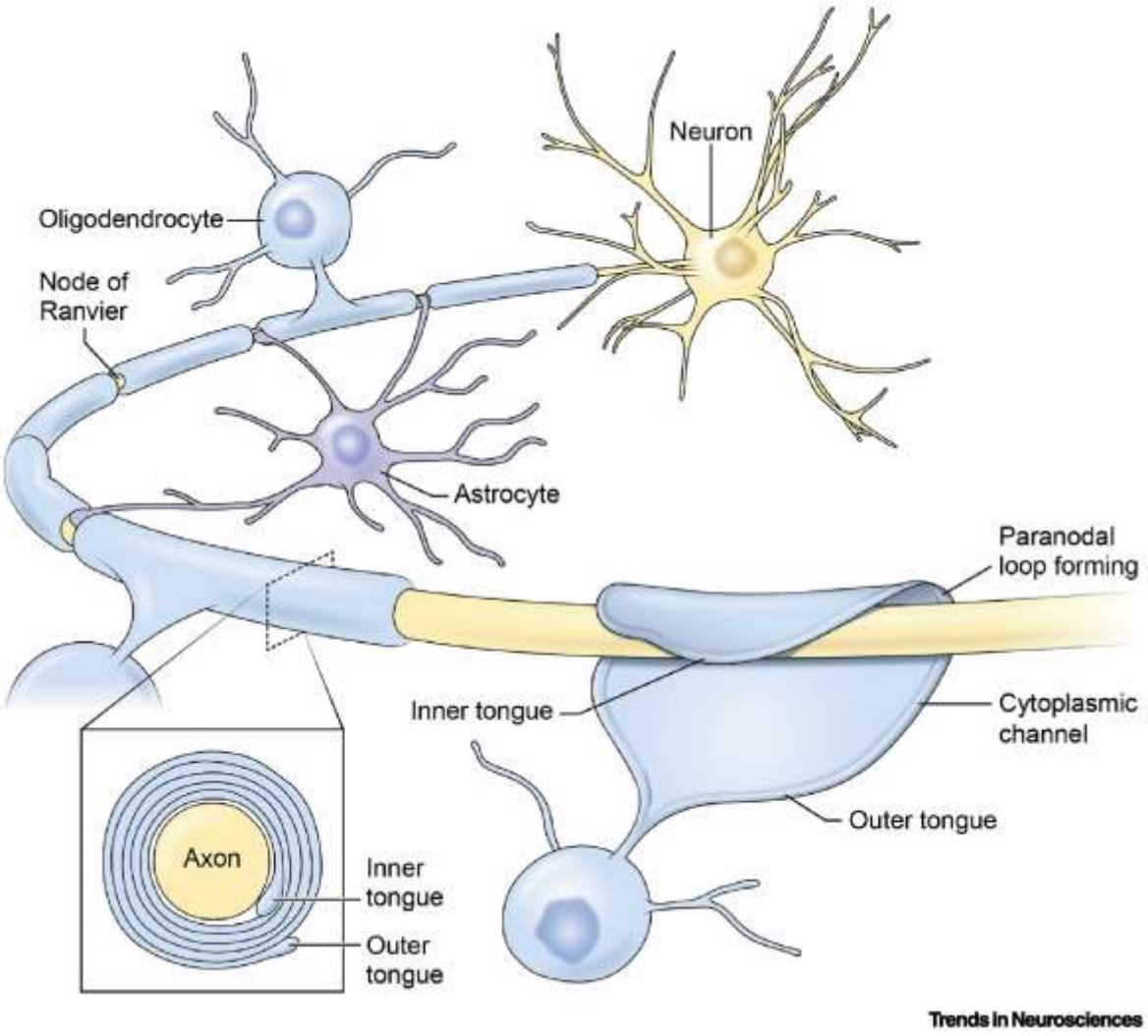
Form and maintain myelin sheath in the central nervous system

a) Insulates

b) Increases speed of nerve impulses

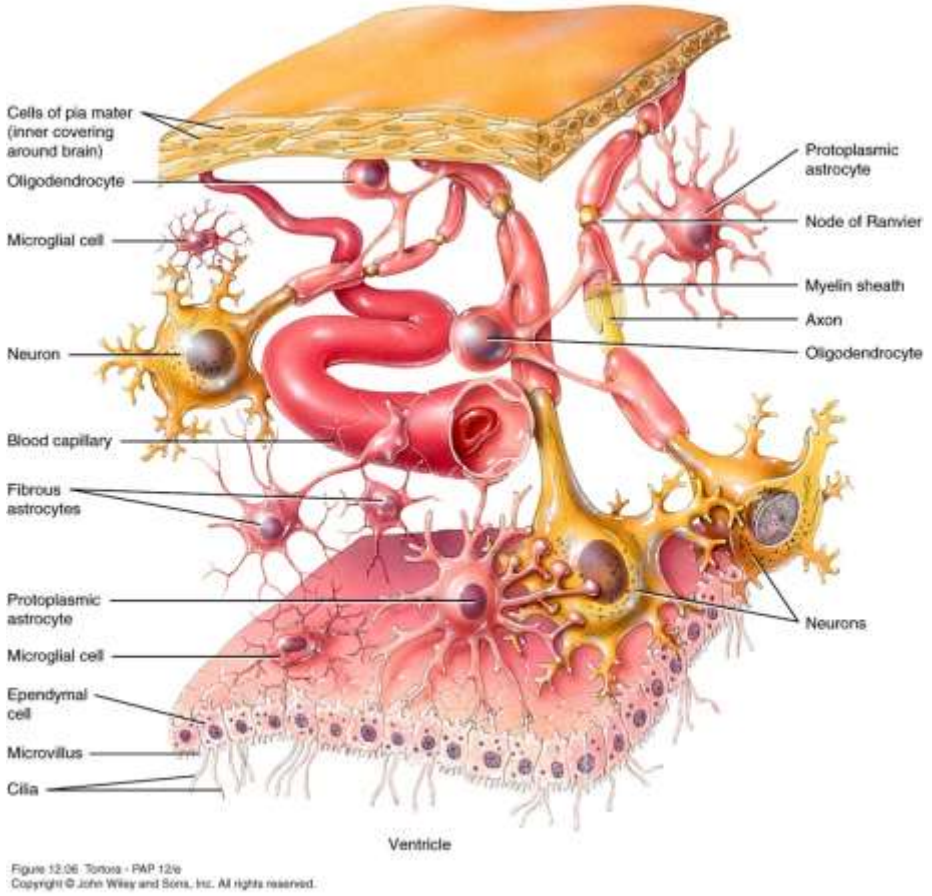


Neuroglia of Central Nervous System
Functions of Oligodendrocytes



Neuroglia of Central Nervous System
Functions of **Microglia**

1. Phagocytes
   a) Remove damaged tissue
   b) Remove microbes

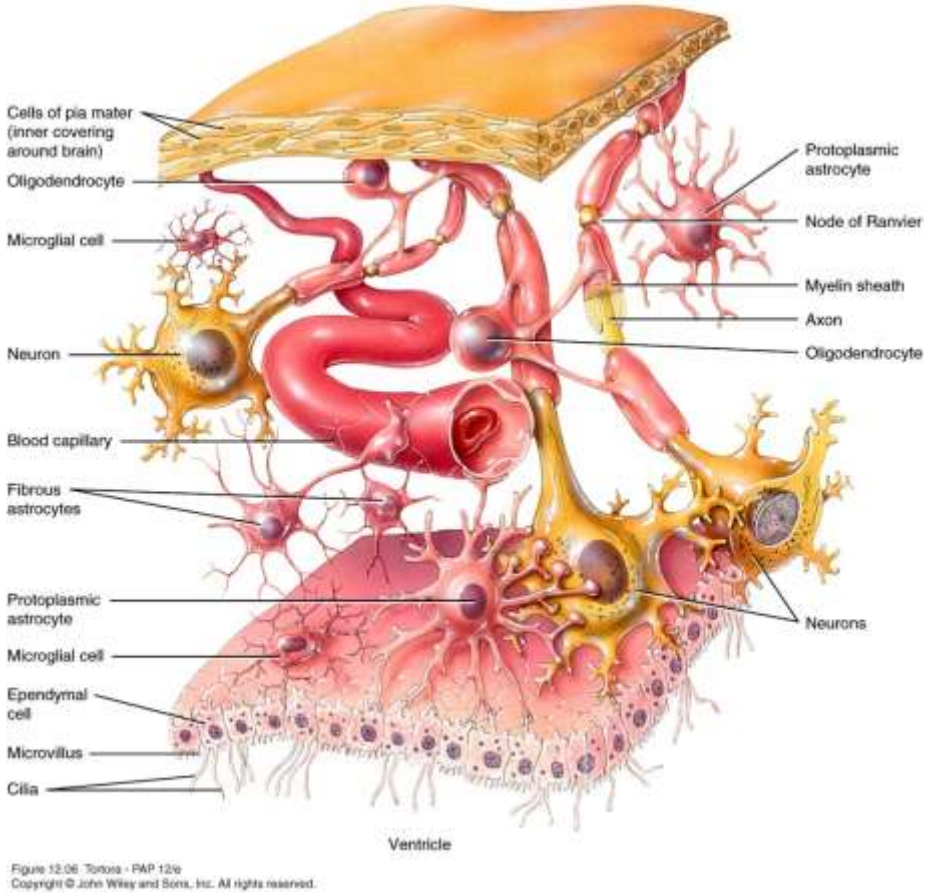


Neuroglia of Central Nervous System
Functions of Ependymal Cells

1. Contribute to the barrier between the blood and brain by forming the blood-cerebrospinal fluid barrier

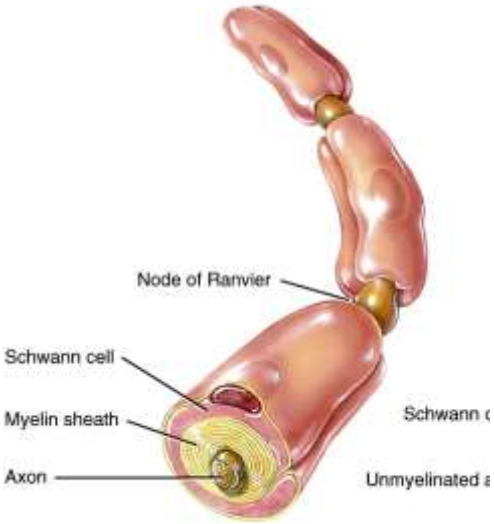
2. Produce cerebrospinal fluid – choroid plexus

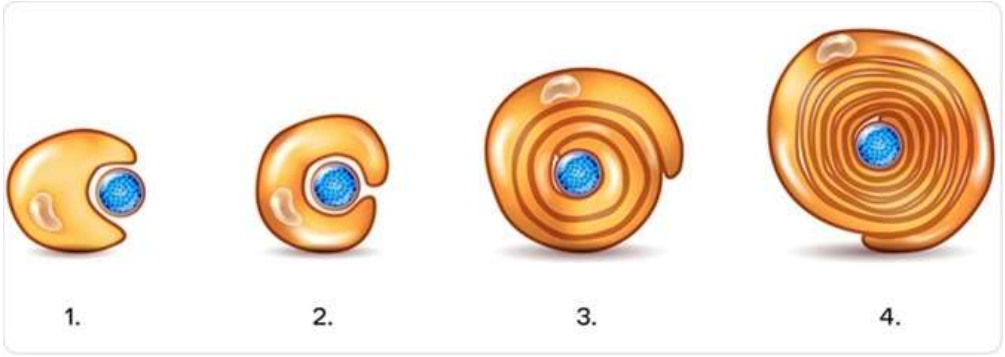
3. Contribute to the flow of the cerebrospinal fluid



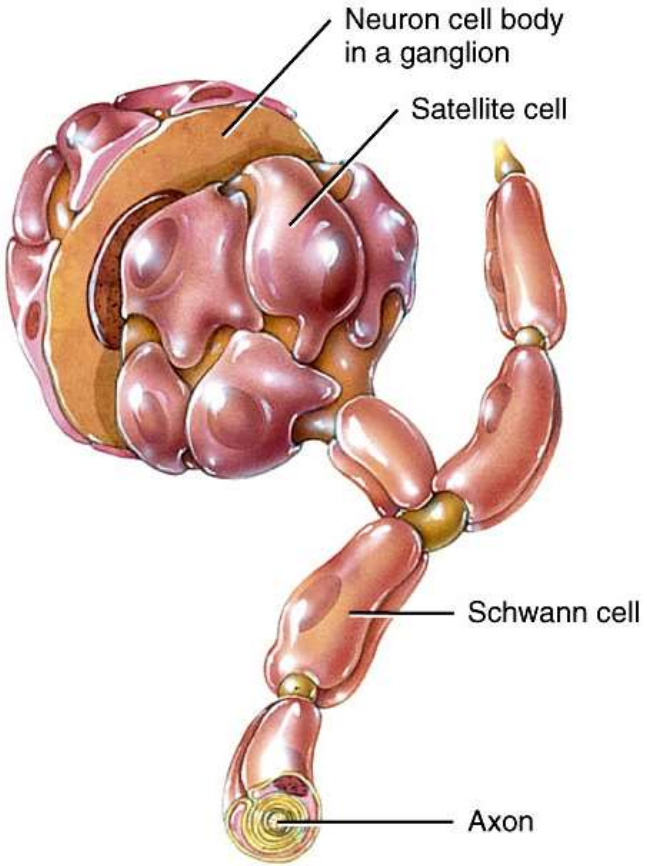
Neuroglia of the **Peripheral Nervous System**

Neuroglia of the Peripheral Nervous System – Schwann Cells





Neuroglia of the Peripheral Nervous System –Satellite Cells



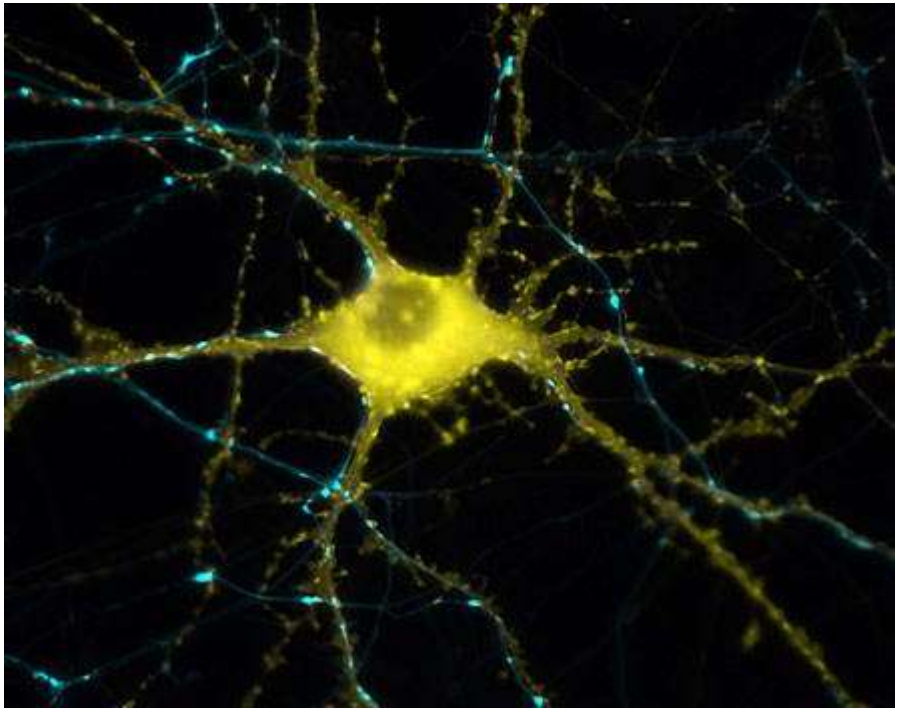
Definitions

Ganglion – cluster of neuronal cell bodies in the peripheral nervous system
Nucleus – cluster of neuronal cell bodies in the central nervous system

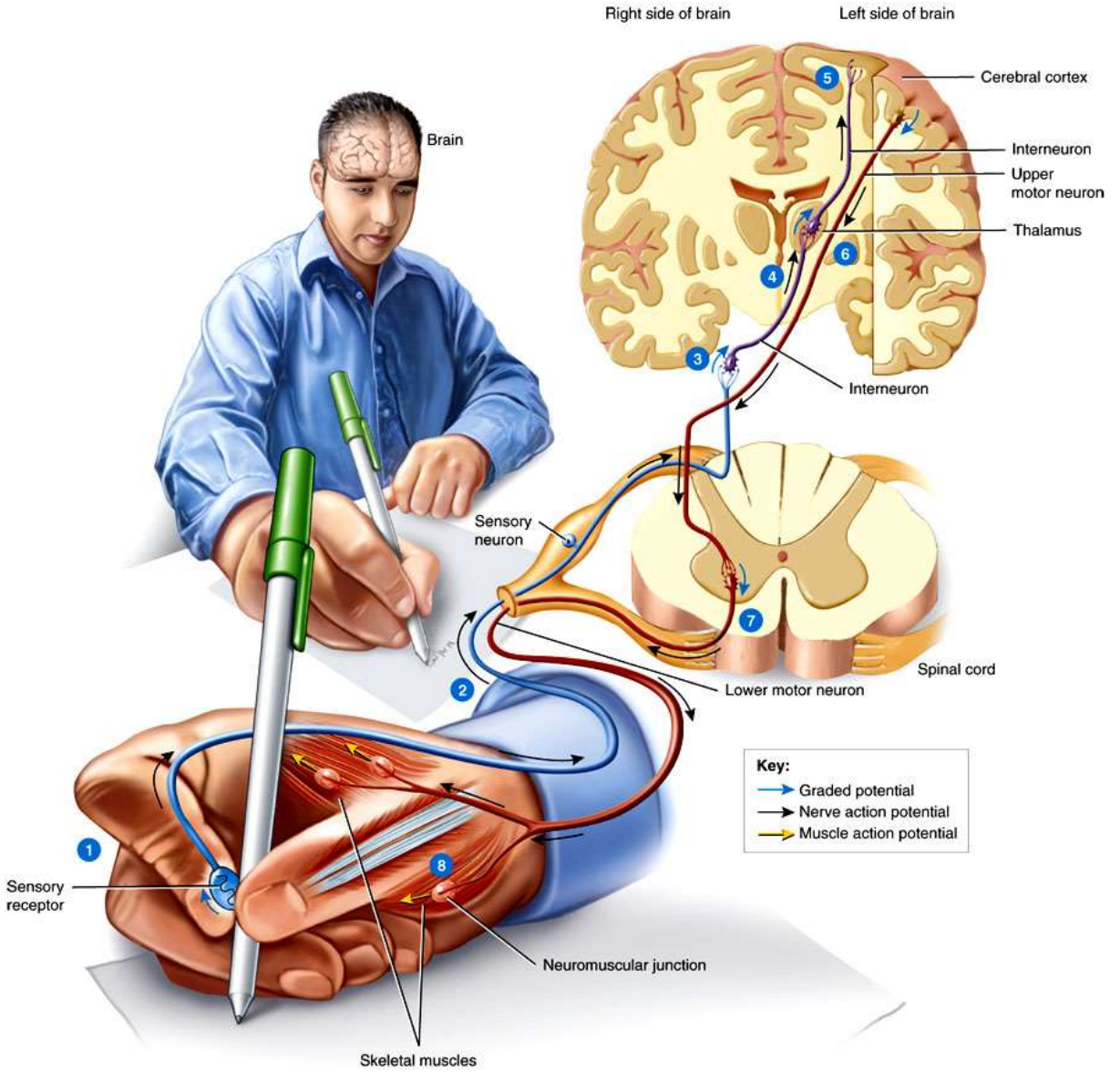
Nerve – bundle of axons in the PNS
Tract – bundle of axons in the CNS

White matter – myelinated axons
Gray matter – Cell bodies, dendrites, unmyelinated axons and neuroglia

ELECTRICAL SIGNALS IN NEURONS



Overview of Nervous System Functions



So, how do we transmit the signal down the axon?

First, some definitions:

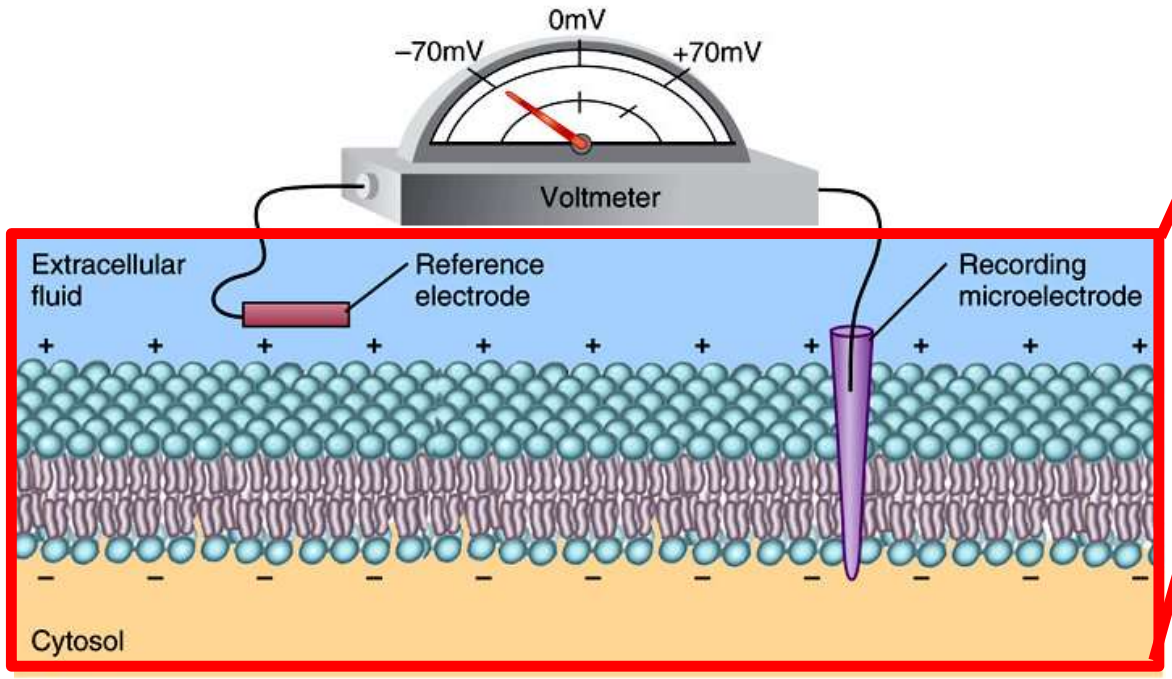
- The measure of potential energy generated by a separated charge is called voltage (measured in millivolts).

- The flow of electrical charge from one point to another is called current.

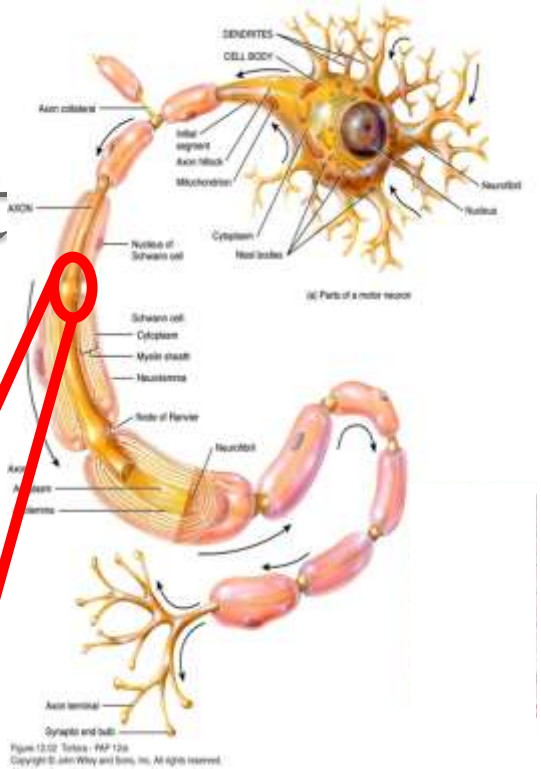
Next, some questions:

1. How do we separate the charge?
2. How to we create a current?

Resting Membrane Potent



(b) Measurement of the resting membrane potential of a neuron



Changes to the Resting Membrane Potential

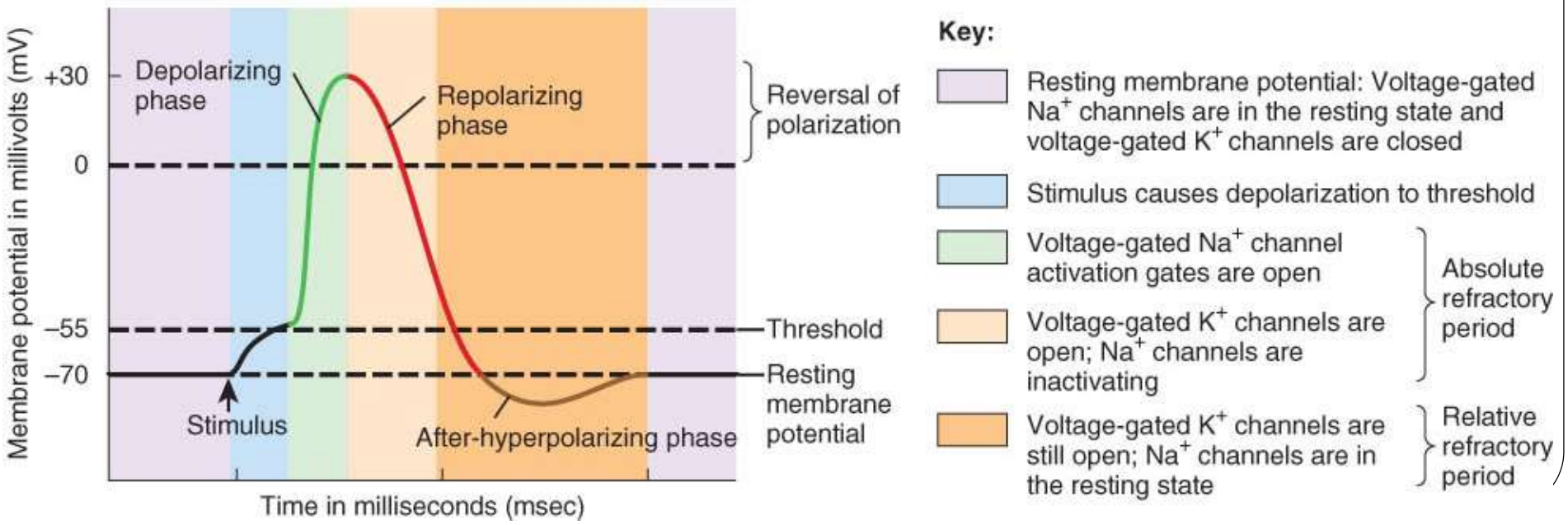
Graded Potential – short-lived local change in the membrane potential

Action Potential – a rapid sequence of changes in the voltage across a membrane. It travels (spreads) over surface of cell without dying out = propagation

Changes to the Resting Membrane Potential – Action Potential

- Series of rapidly occurring events that change and then restore the membrane potential of a cell to its resting state

- Ion channels open, Na+ rushes in (depolarization), K+ rushes out (repolarization)



Factors that Affect the Speed of Propagation

1. Myelination
2. Axon diameter
   - Larger is faster
3. Temperature
   - Hotter is faster
   - Colder is slower – one of the reasons why you ice painful regions

Communication Between Neurons

Communication Between Neurons

Synapse is **the point of communication between two neurons** or between **a neuron and a target cell (such as a muscle cell).**

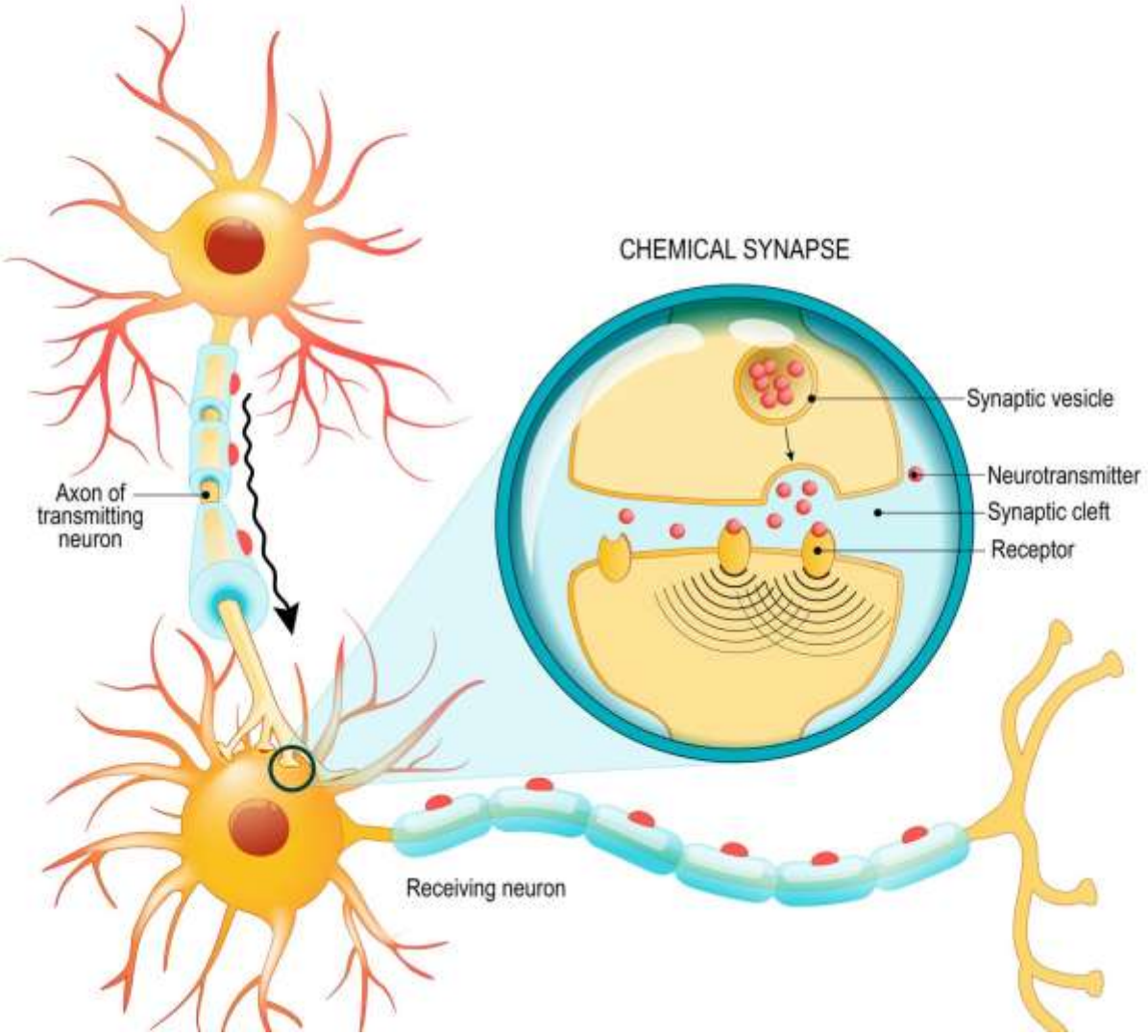
Electrical vs Chemical Synapses

Electrical Synapses send signals very fast by letting ions pass directly through gap junctions.

- Fast communication
- Found in the heart and visceral smooth muscle

Chemical Synapses are slower. They use neurotransmitters to cross the synaptic cleft.

Neuron communication



What are Neurotransmitters?

- **Neurotransmitter** – a molecule (chemical messenger) stored in the axon terminal of a neuron that is released into the synaptic cleft when a nerve impulse arrives.