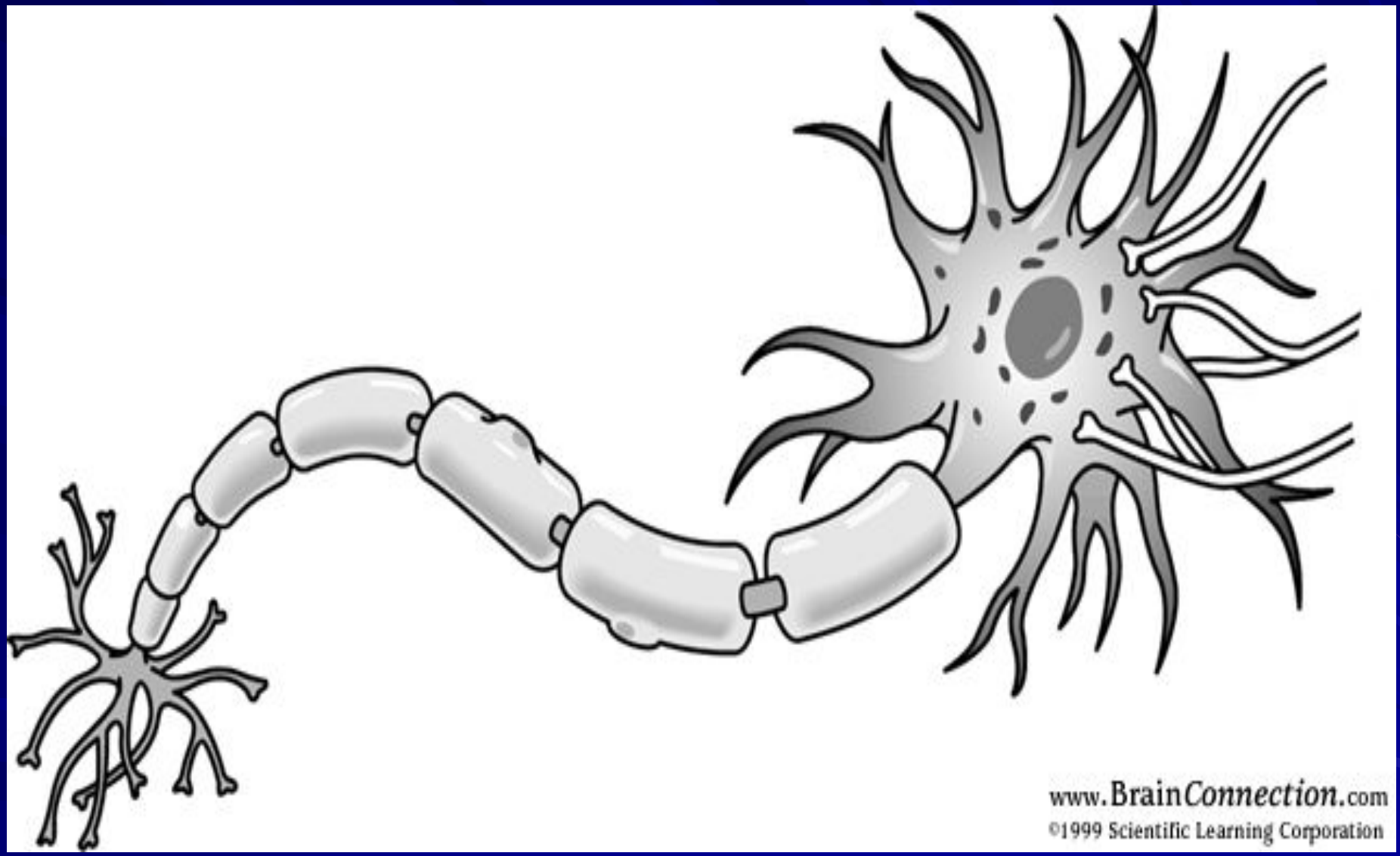
The Neuron

The neuron is the anatomical and functional unit of the nervous system, which consists of a nerve cell body, dendrites, and an axon.

- Amount of neurons – 100 billions
- A neuron can have about 10000 synapsis.


www.BrainConnection.com
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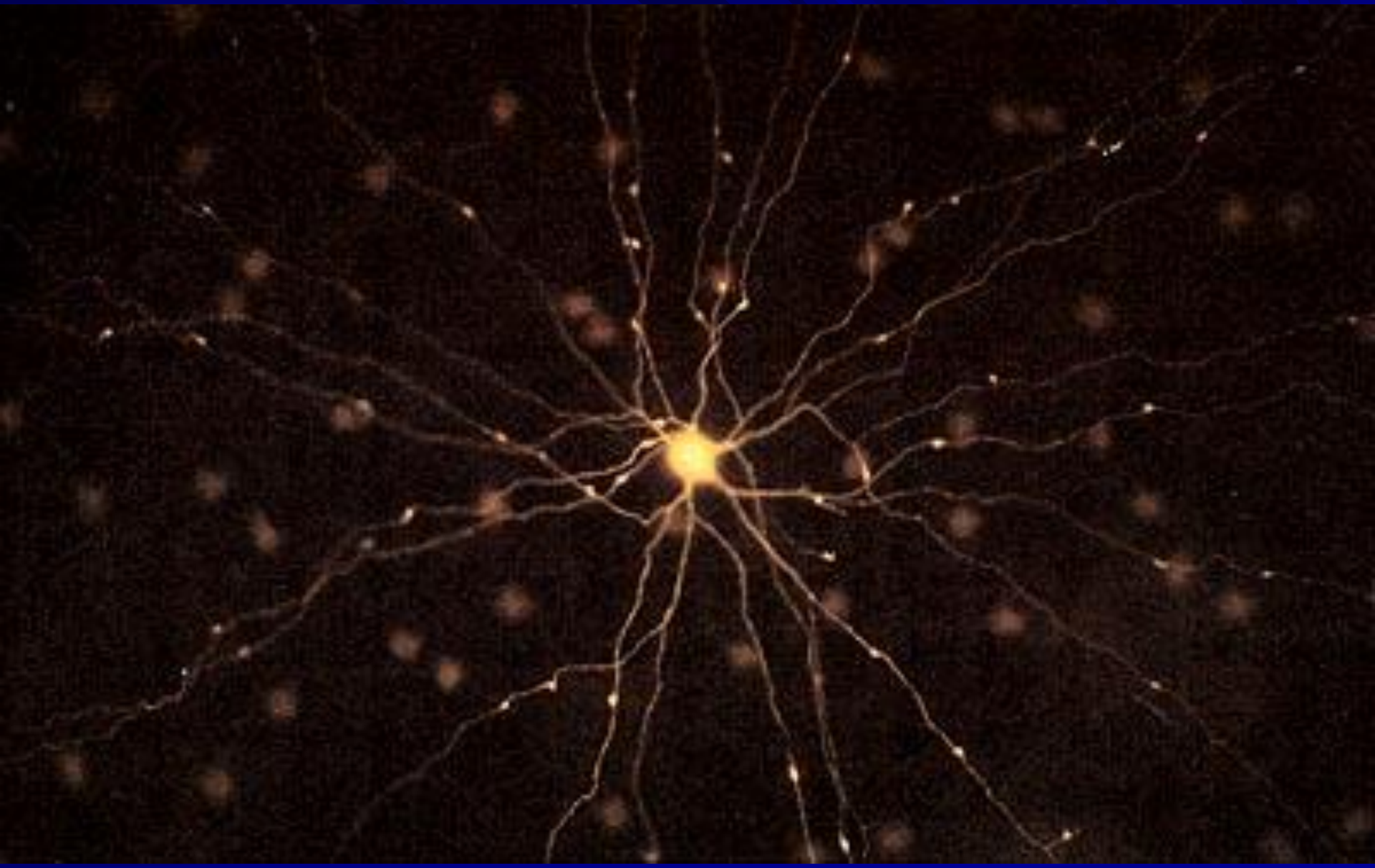

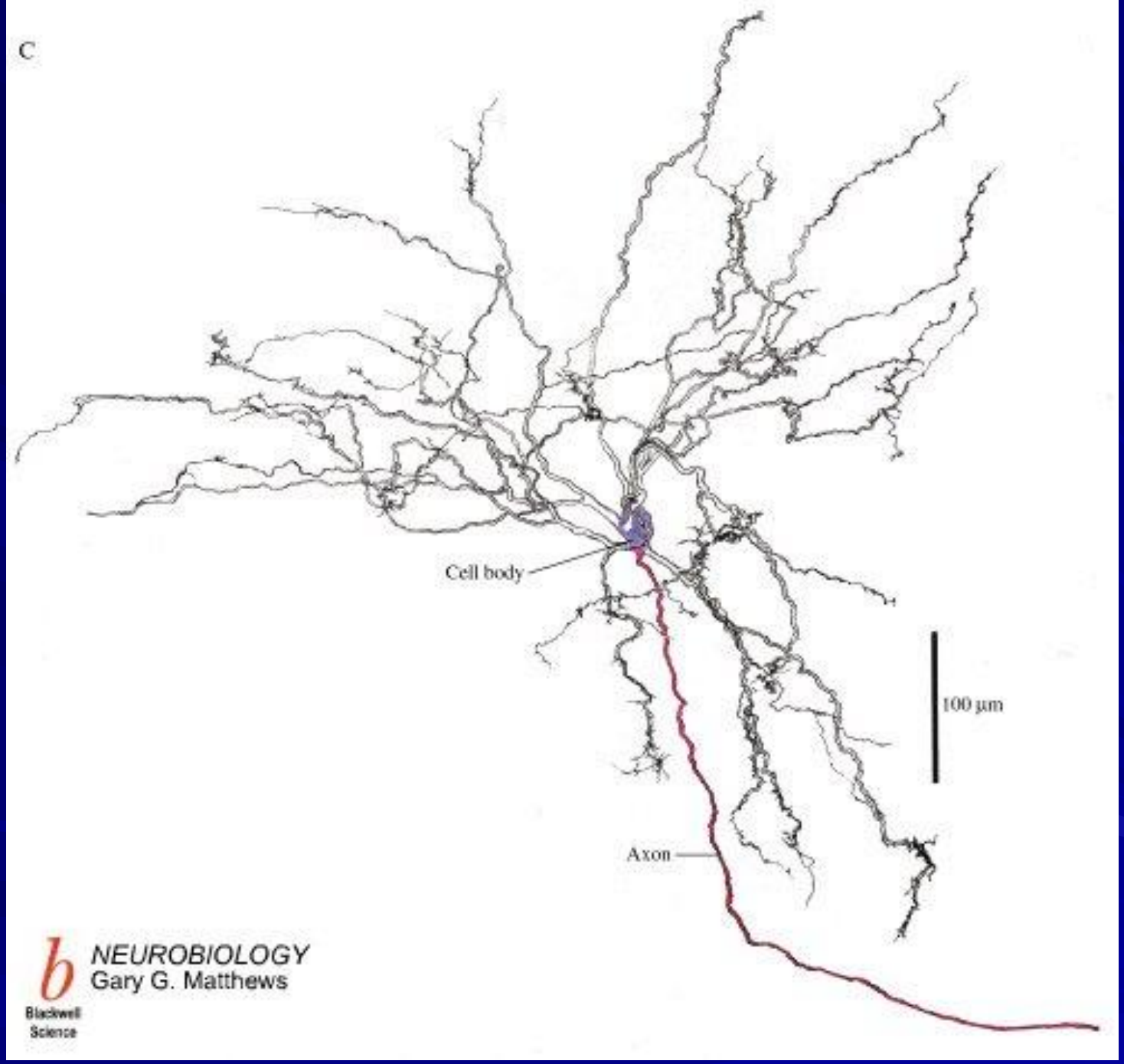
C
Cell body
100 µm
Axon
NEUROBIOLOGY
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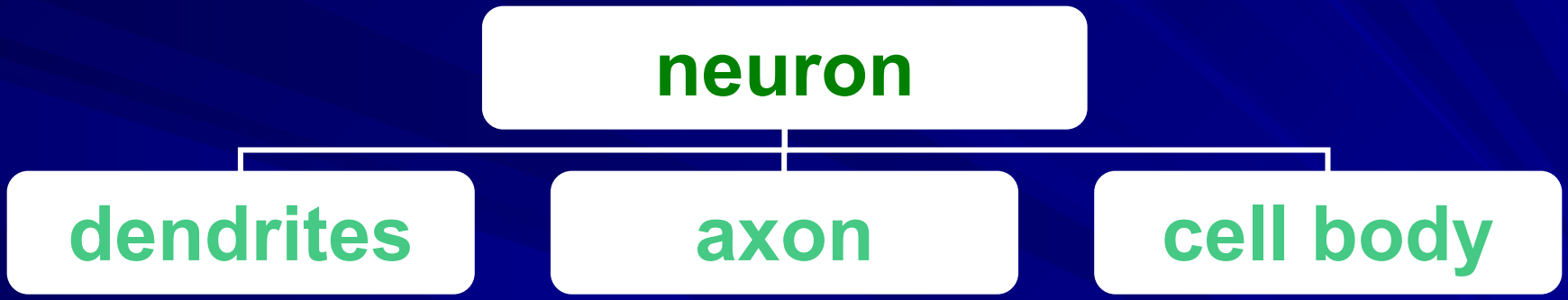
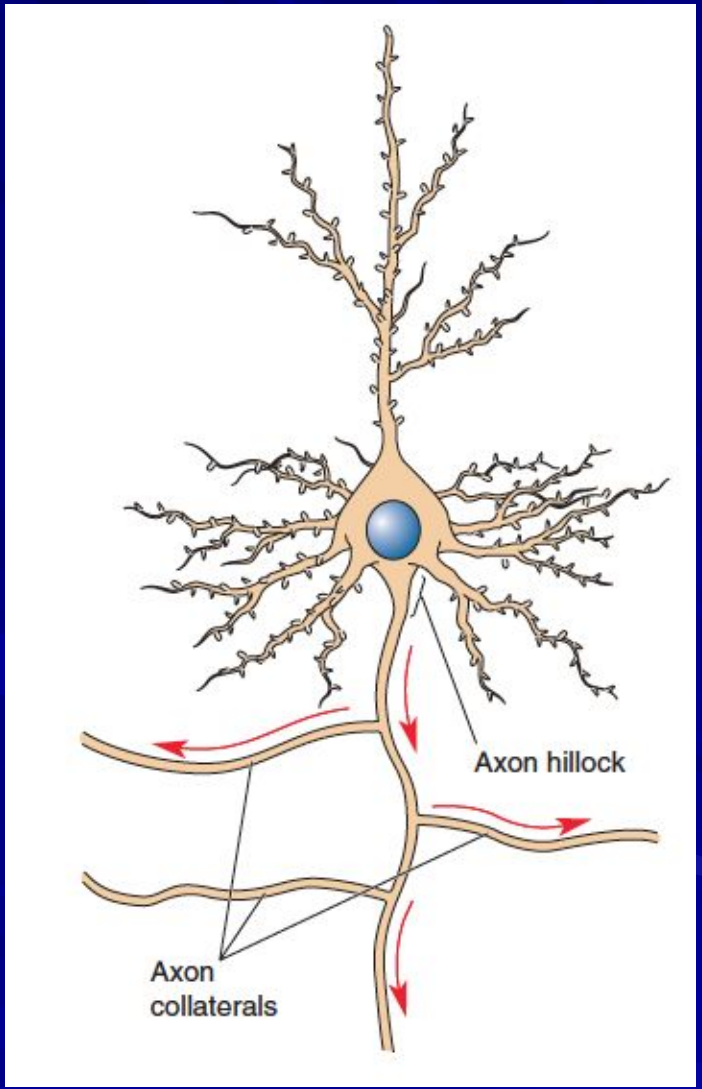
Parts of the neuron



Dendrites

The dendrites are the part of the neuron that receive signals from other neurons.

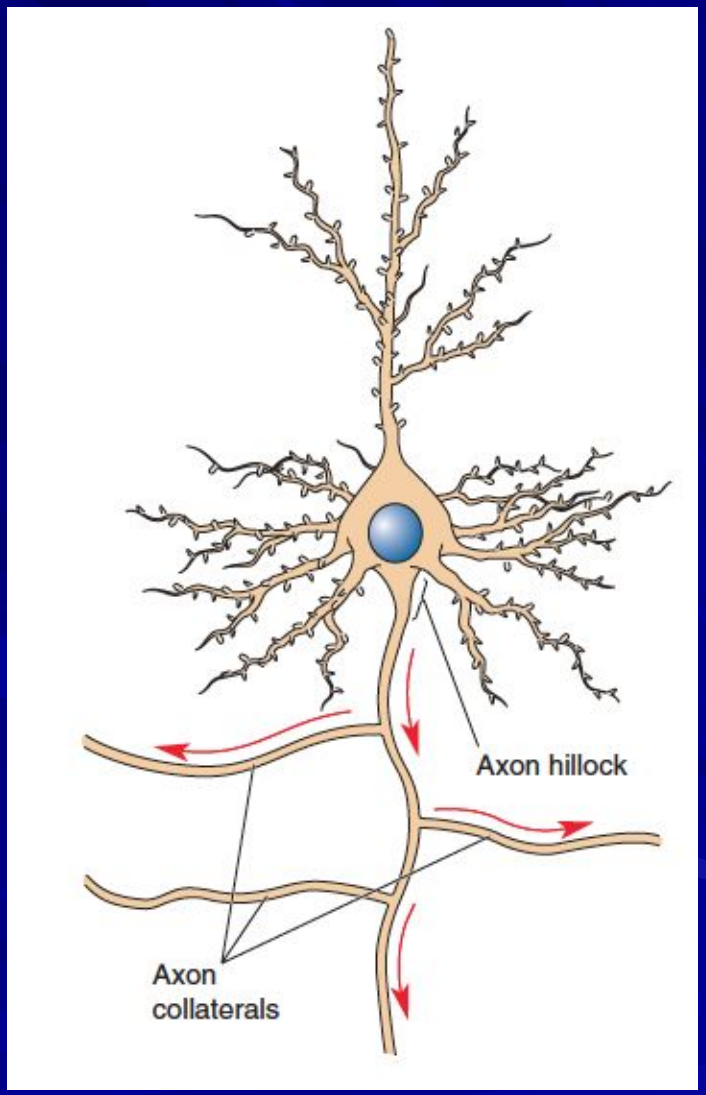
The dendrites of a single neuron are collectively called a dendritic tree

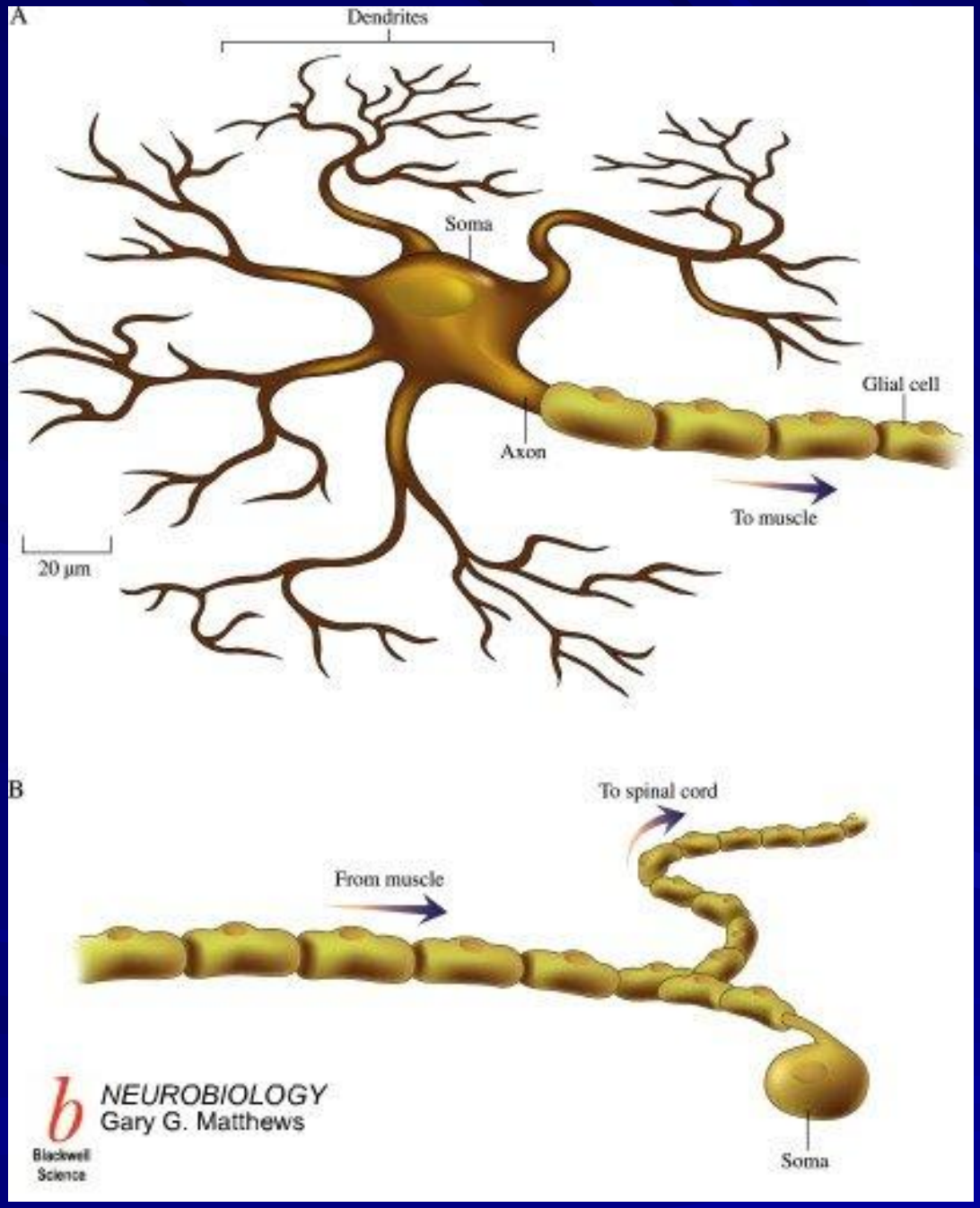


Dendrites

The dendrites are covered with specialized structures

called dendritic spines that receive some types of synaptic input




A
Dendrites
Soma
Glial cell
Axon
To muscle
20 µm
B
To spinal cord
From muscle
Soma
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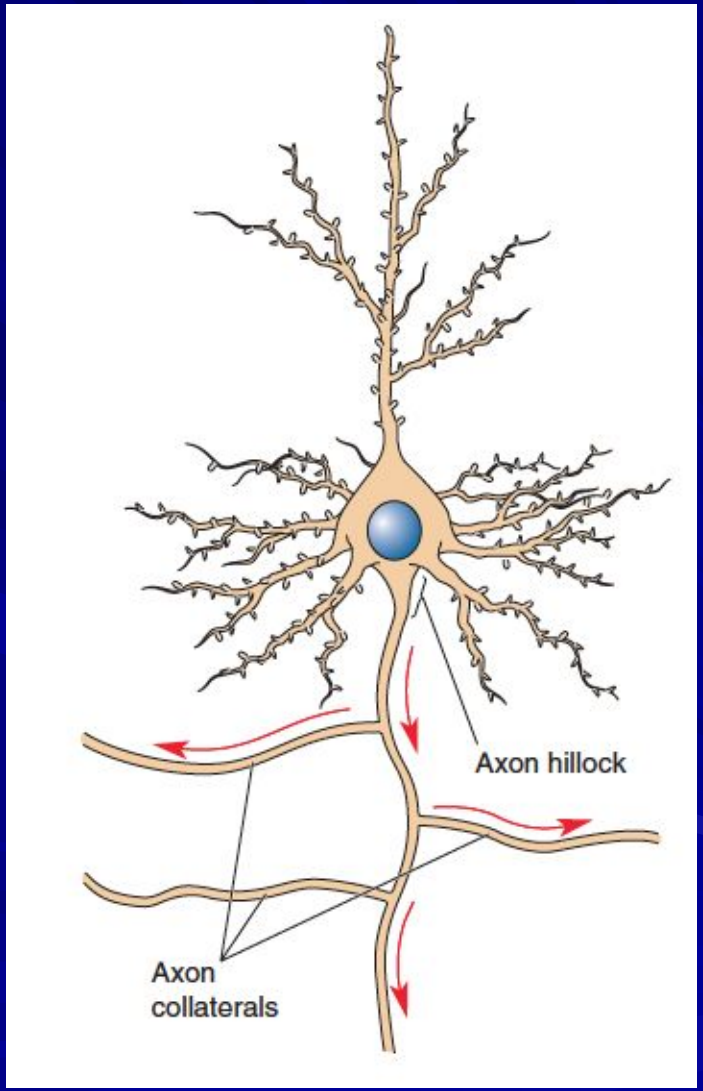
Axon

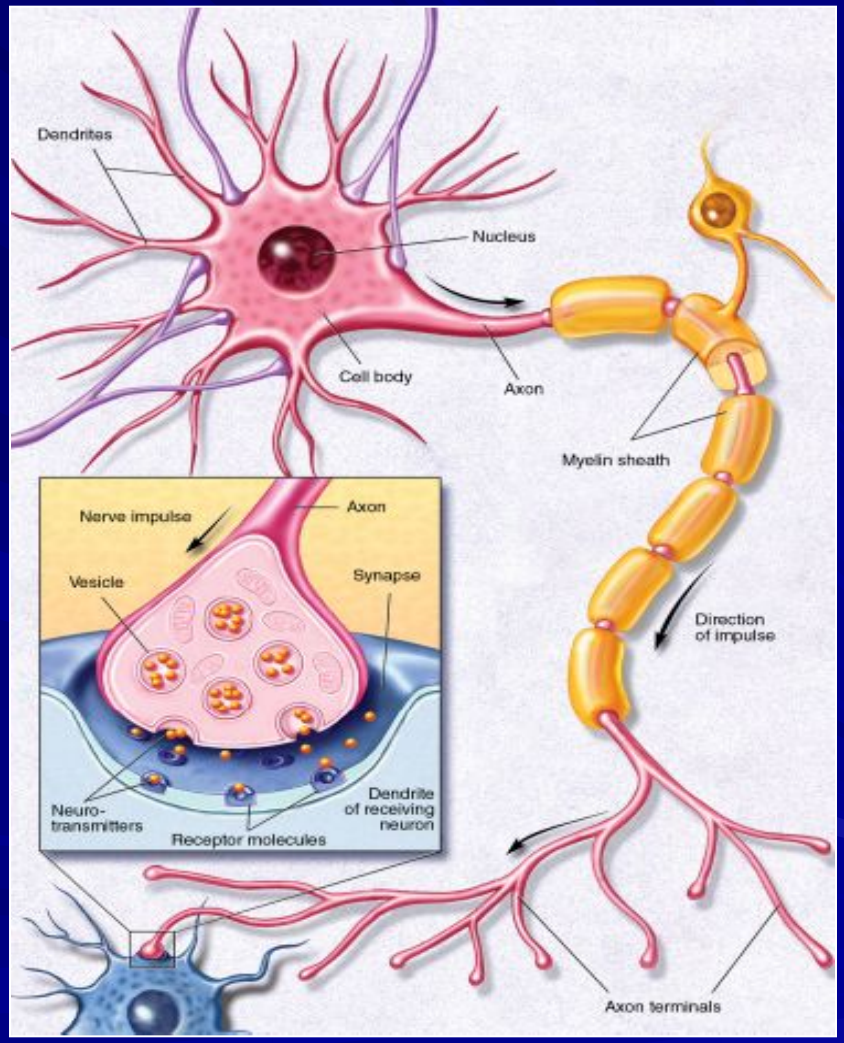
- The axon is the part of the neuron that transmits the signal to another neuron.
- The axon begins with a region called the axon hillock
- Axons may extend from less than a millimeter to over a meter long



Axon

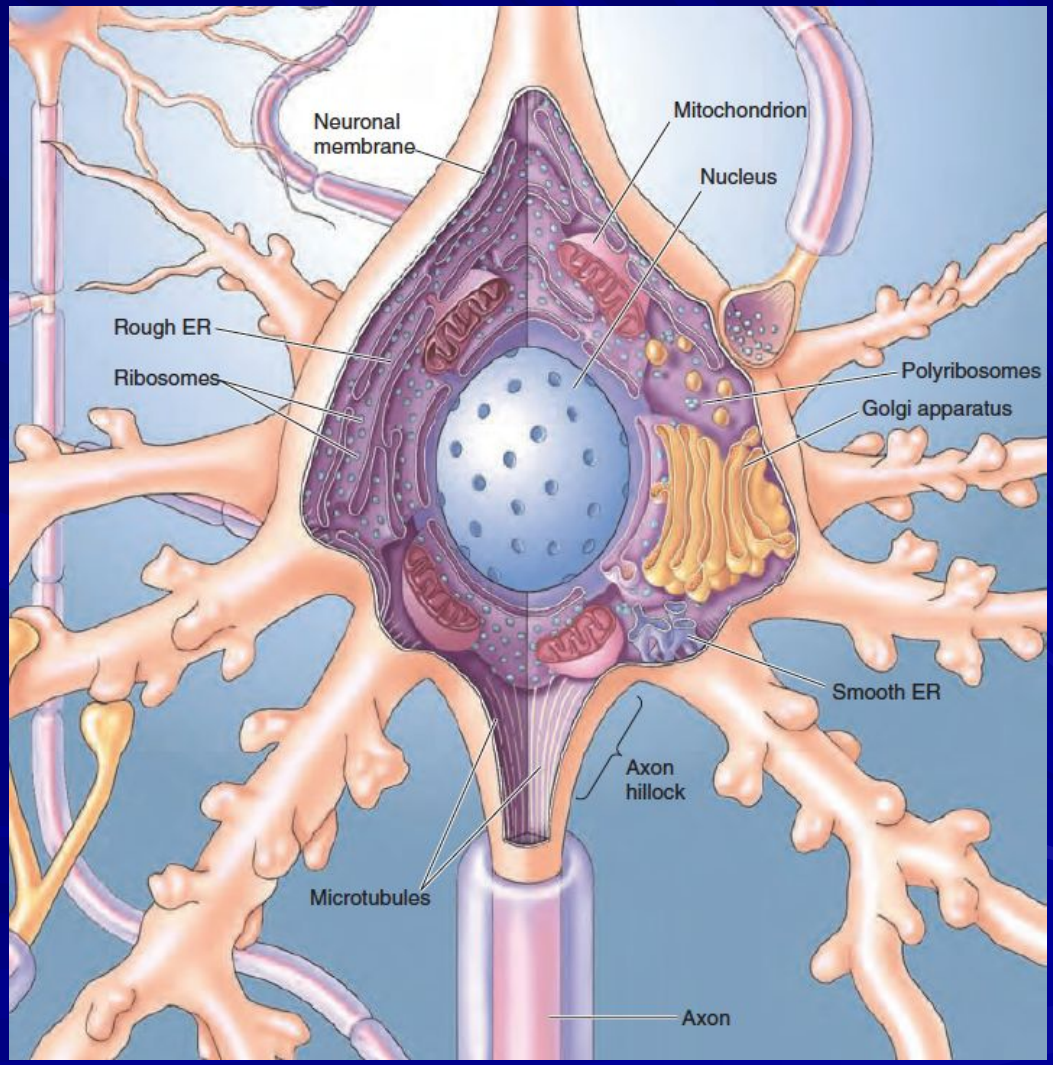
- The end of axon is called the axon terminal
- The terminal is a site where the axon comes in contact with other neurons and passes information on to them.

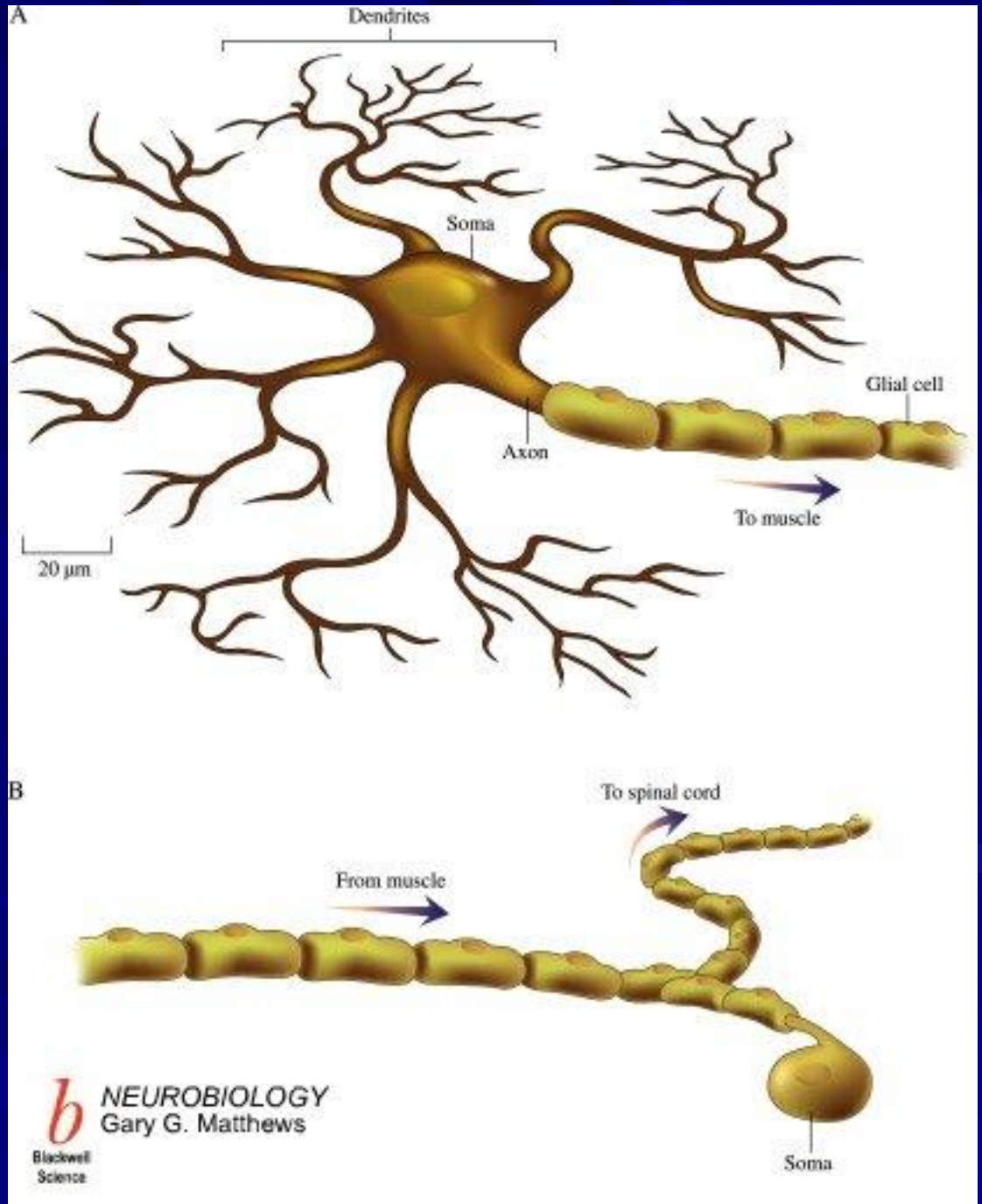
- Axon usually is covered by myelin sheath



The cell body

- The cell body is a part of neuron that contains the nucleus and various organelles
- The cell body is the metabolic and trophic center of the neuron.




A
Dendrites
Soma
Glial cell
Axon
To muscle
20 µm
B
To spinal cord
From muscle
Soma
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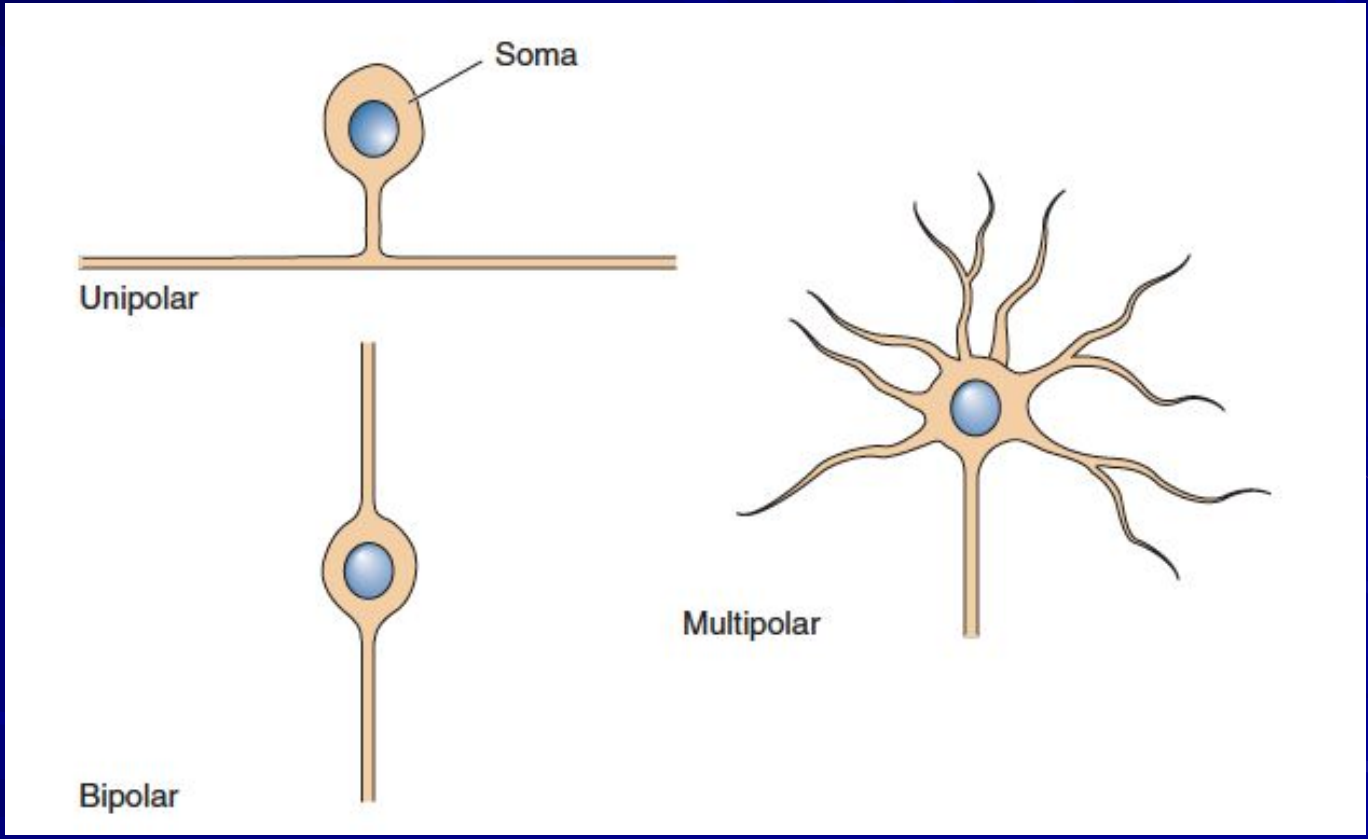
Classification of neurons

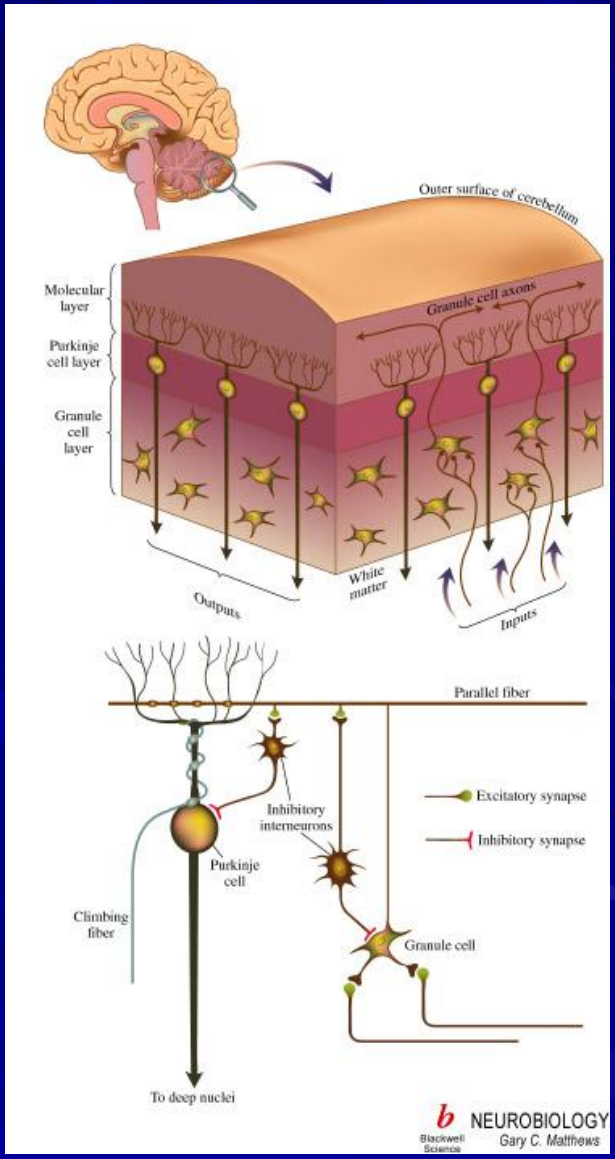
1. Classification Based on the Number of Neurites

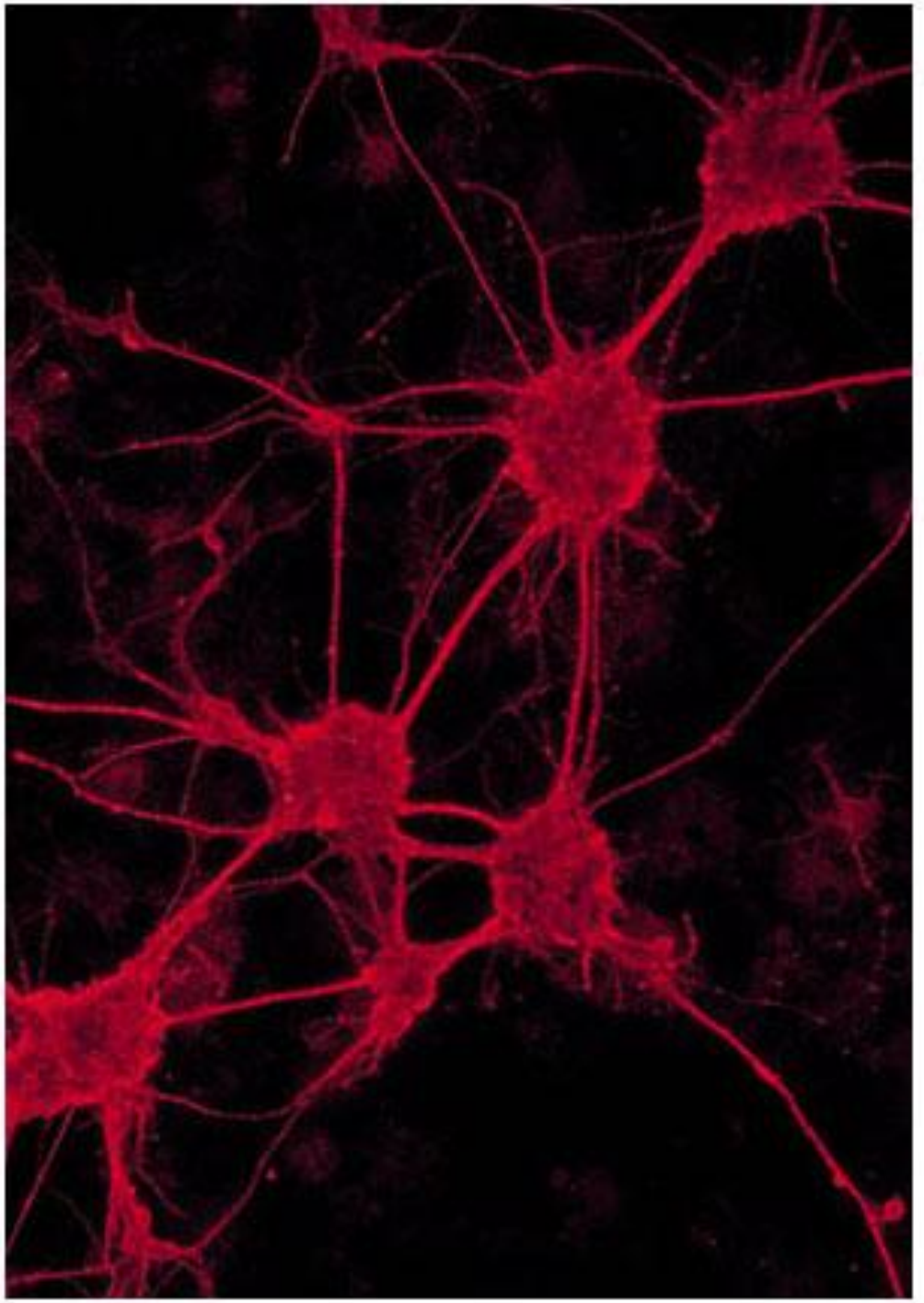
- Unipolar
- Bipolar
- Multipolar



Classification of neurons

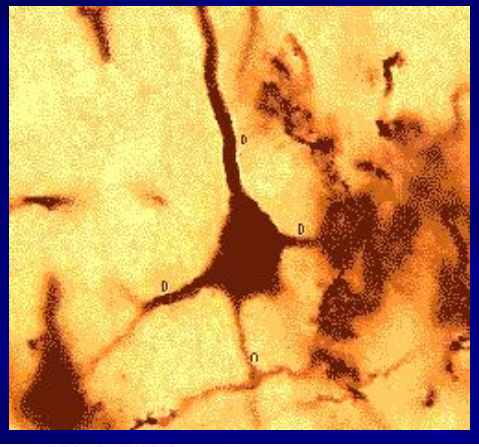
- *2. Classification Based on Axon Length*
  - projection neurons (pyramidal cells)
  - local circuit neurons (stellate cells in the cortex)

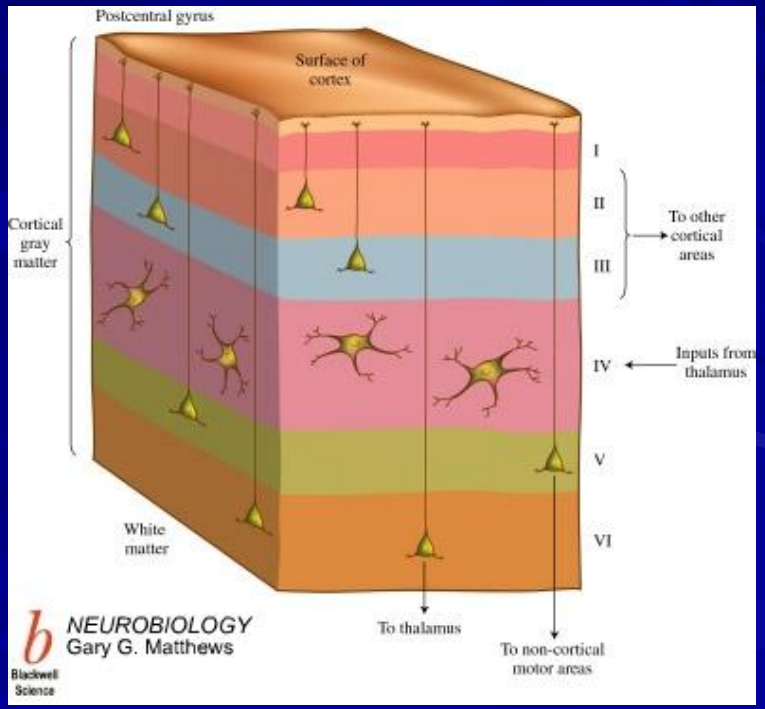




Classification of neurons

- *3. Classification Based on Body Shape*
  - pyramidal
  - Multangular
  - circular
  - oval

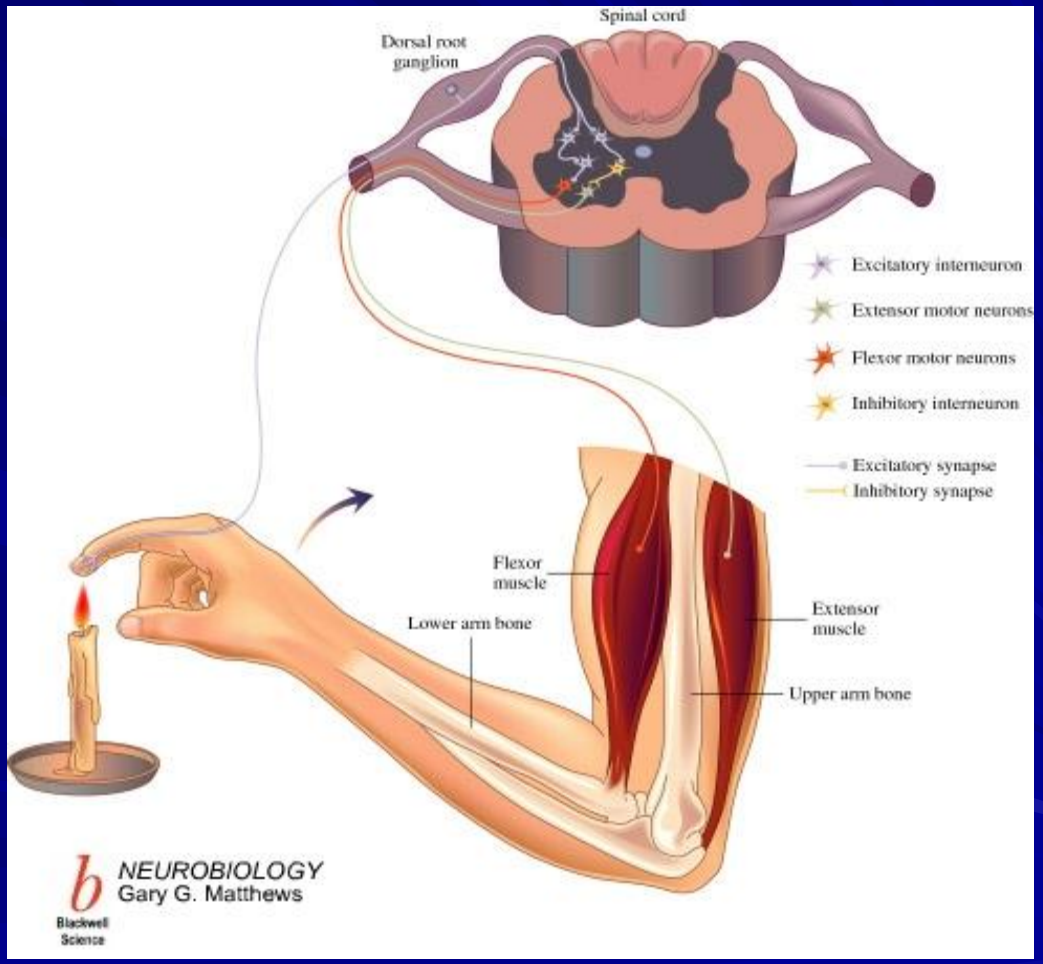




Classification of neurons

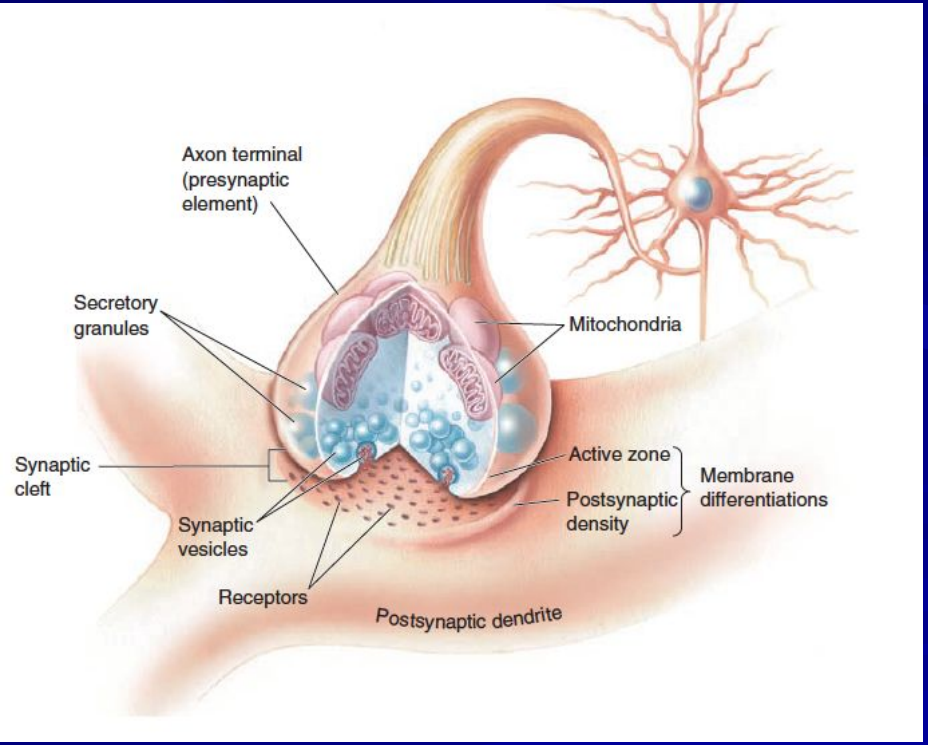
4. *Classification Based on Functions*

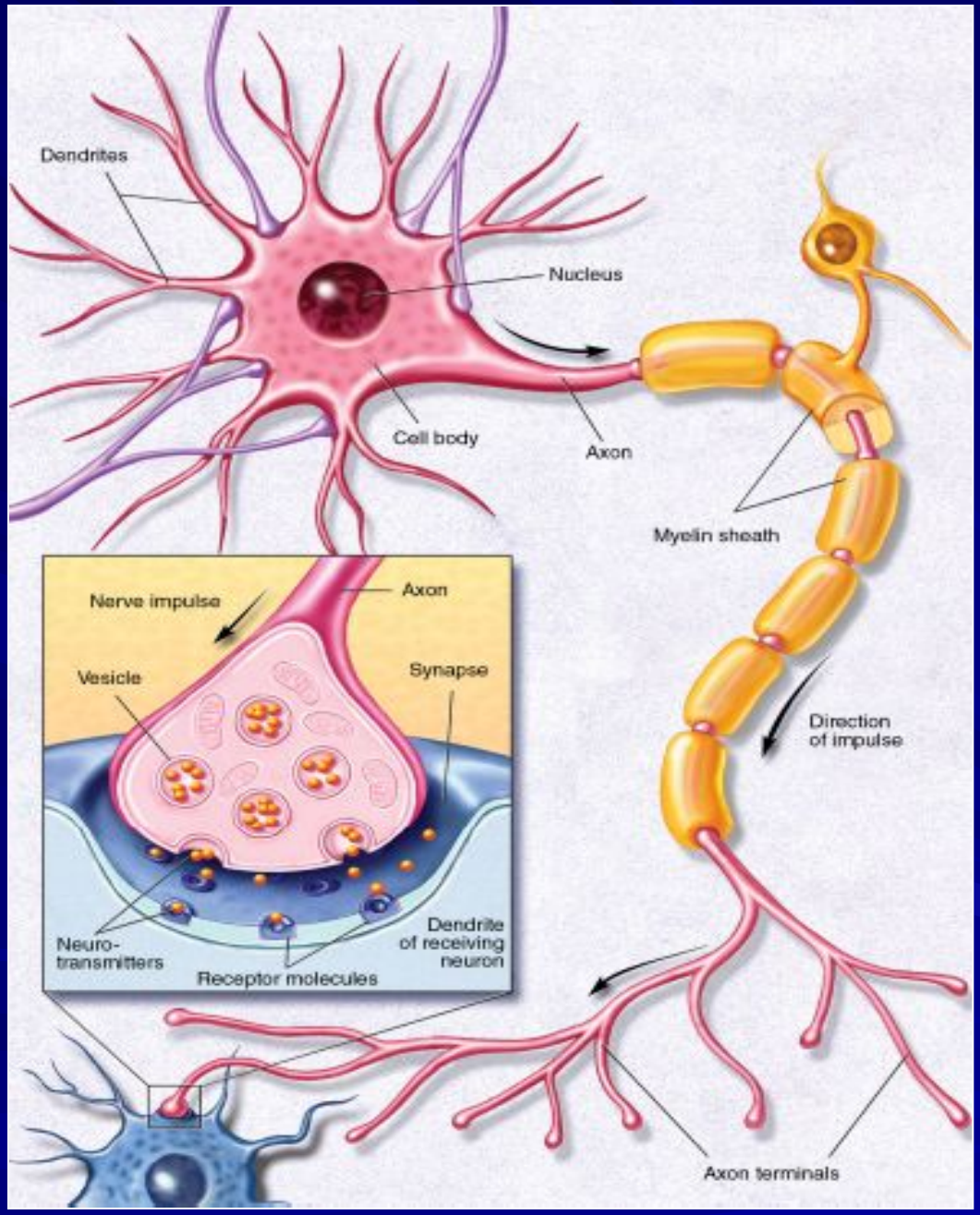
- afferent (sensory)
- efferent (motor)
- associative



Synapses

- **Synapse** the specialized junction where one part of a neuron contacts and communicates with another neuron or cell type (such as a muscle or glandular cell).

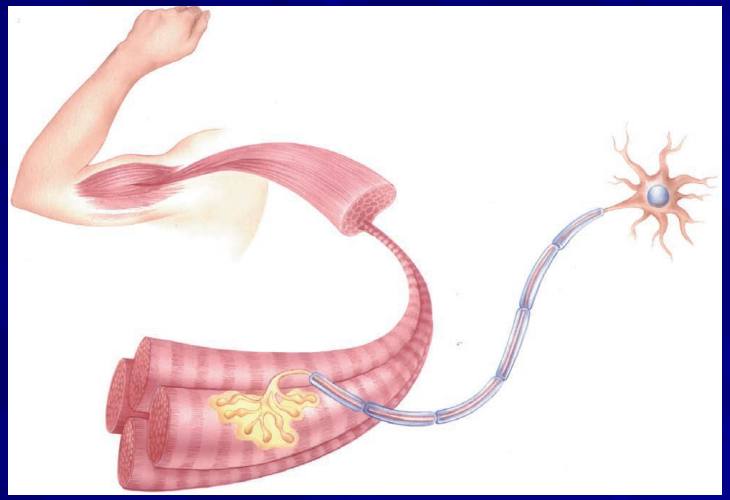


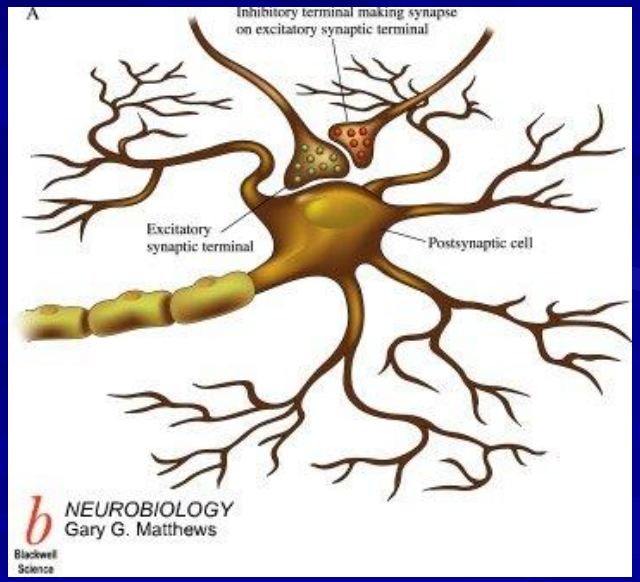

Dendrites
Nucleus
Cell body
Axon
Myelin sheath
Direction of impulse
Nerve impulse
Axon
Vesicle
Synapse
Neuro-transmitters
Receptor molecules
Dendrite of receiving neuron
Axon terminals

Classification of Synapses

1. The place of junction

1. neuromuscular junction
2. neuro-neural junction
3. neuro-glandular junction

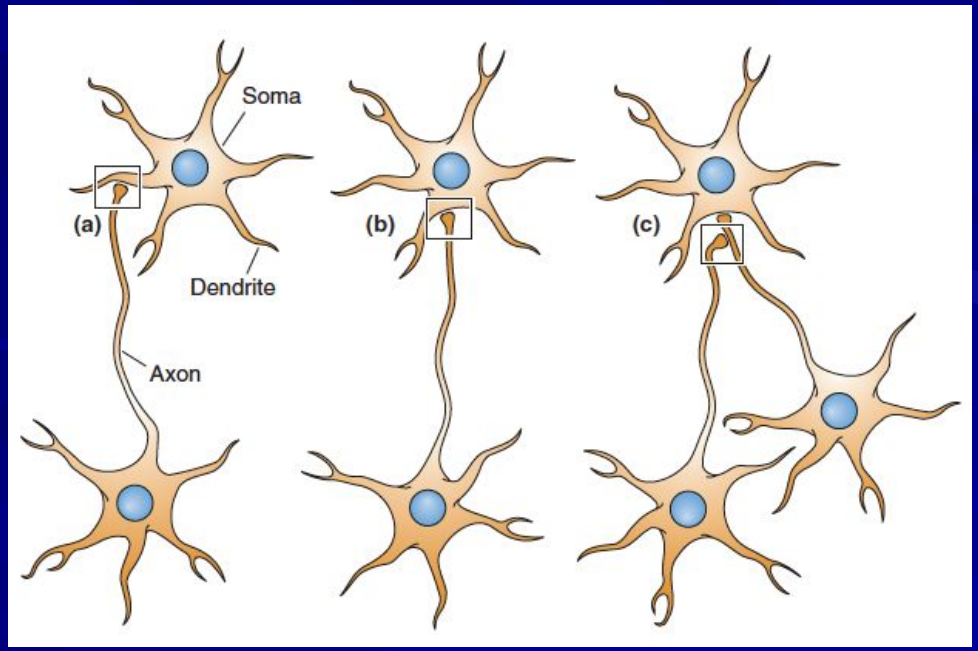


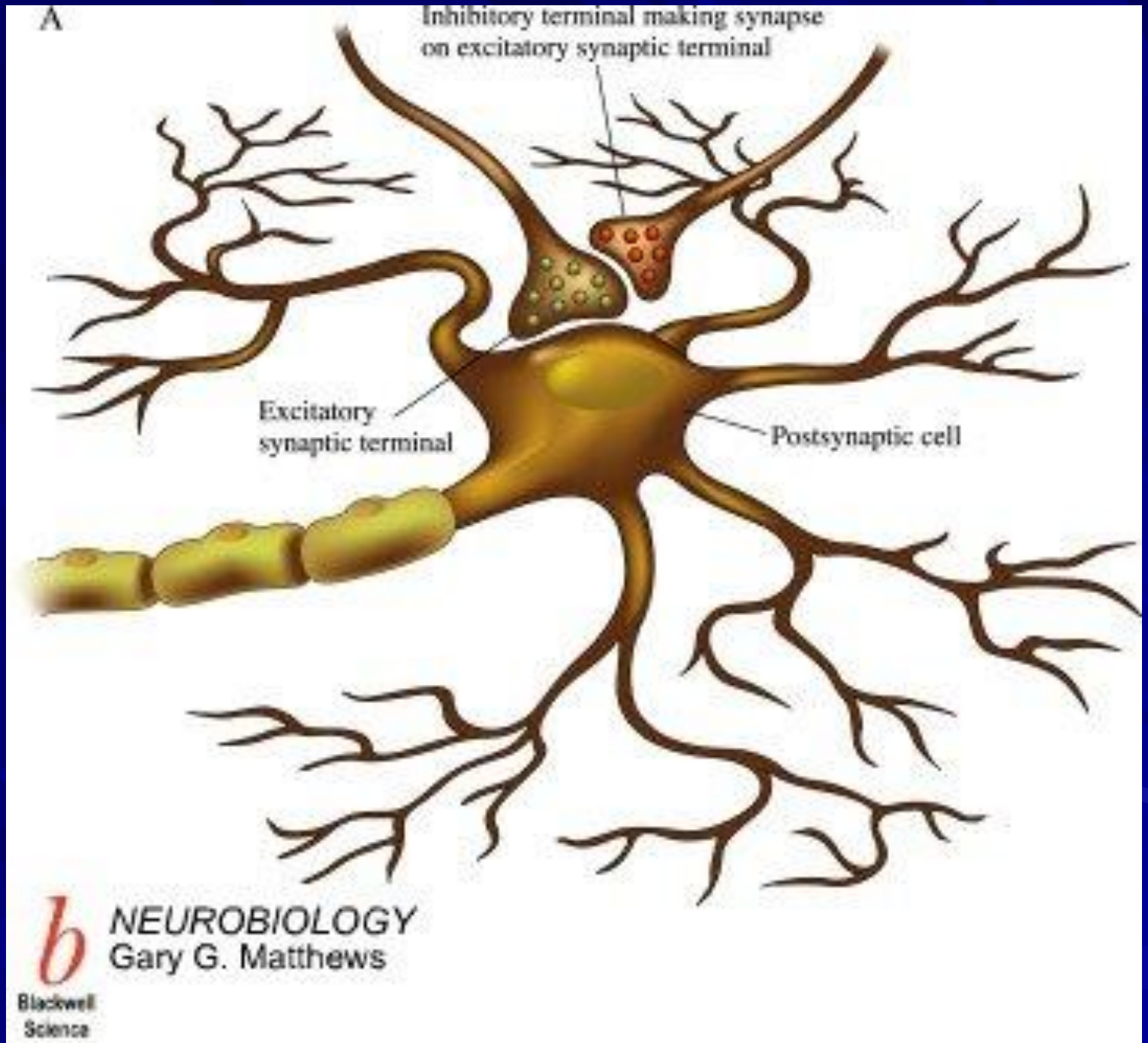


Classification of Synapses

2. Synaptic arrangements in the CNS

1. axodendritic synapse
2. axosomatic synapse
3. axoaxonic synapse




A
Inhibitory terminal making synapse
on excitatory synaptic terminal
Excitatory
synaptic terminal
Postsynaptic cell
b
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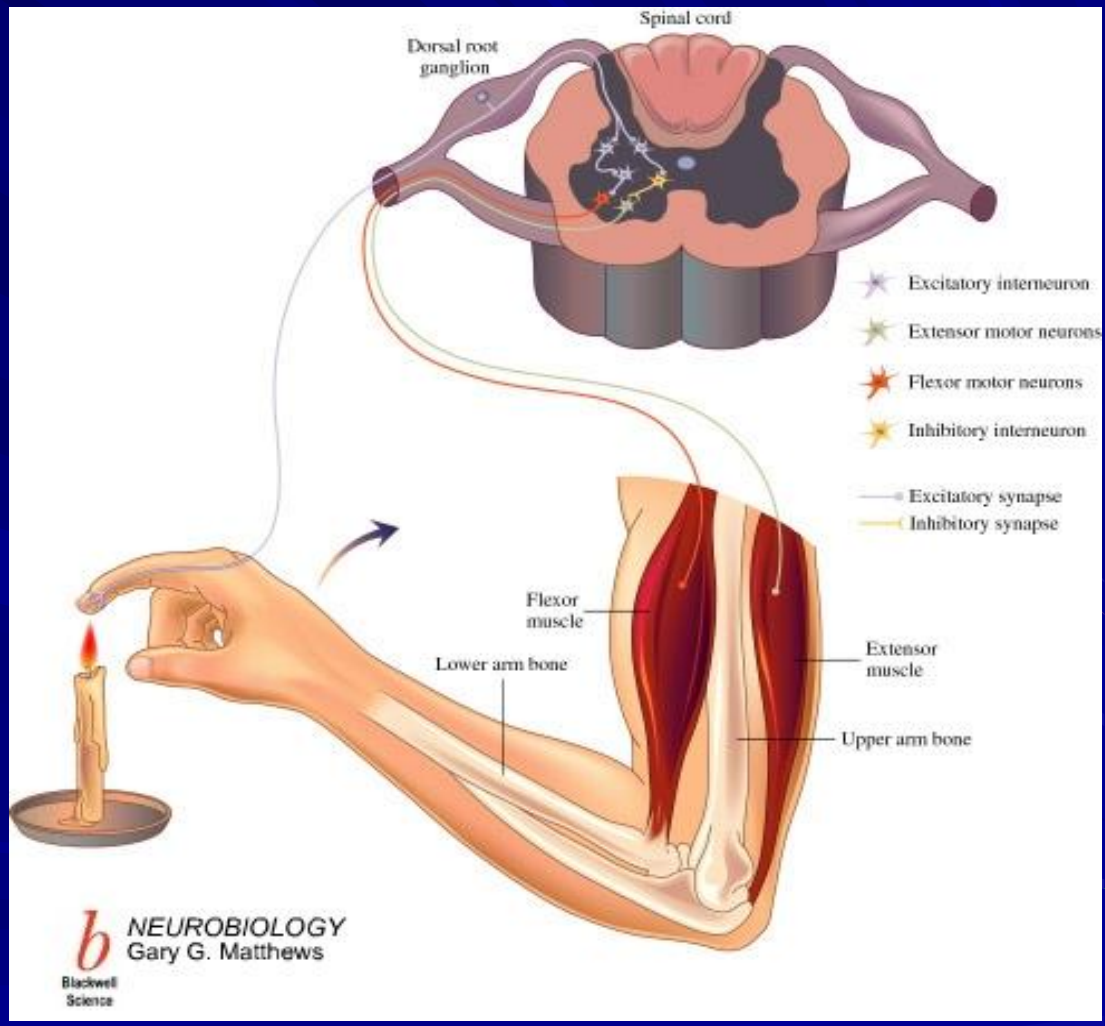
Classification of Synapses

3. Based of type of influence

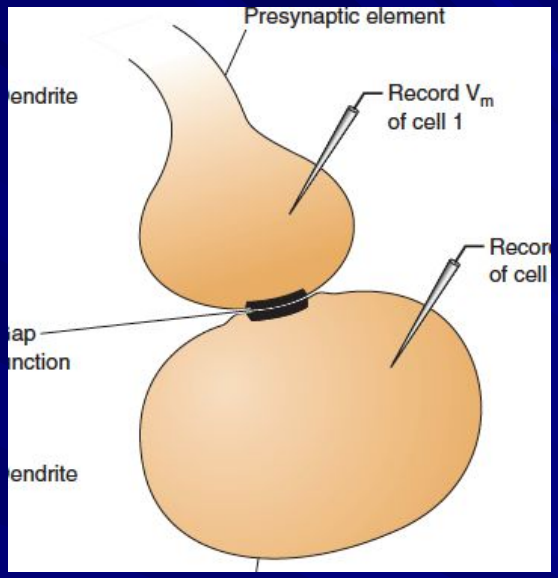
1. excitatory
2. inhibitory

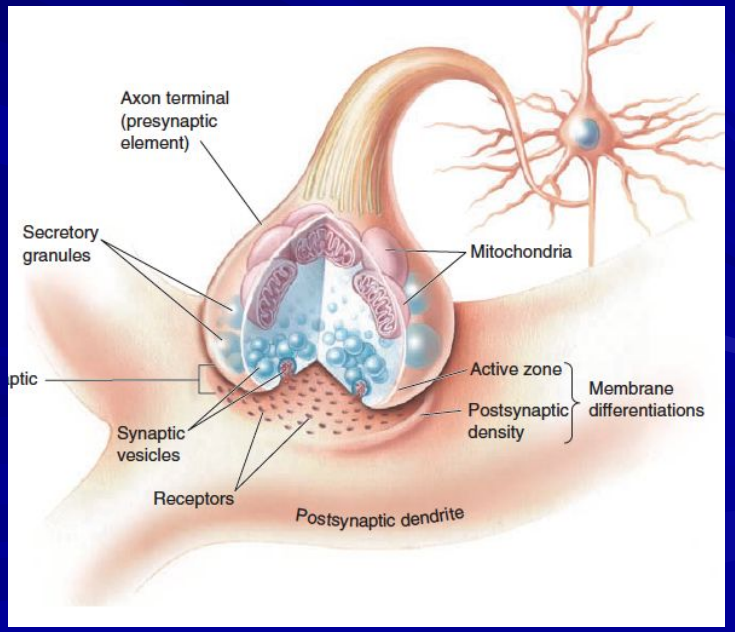


Classification of Synapses

3. Based on type of synaptic transmission

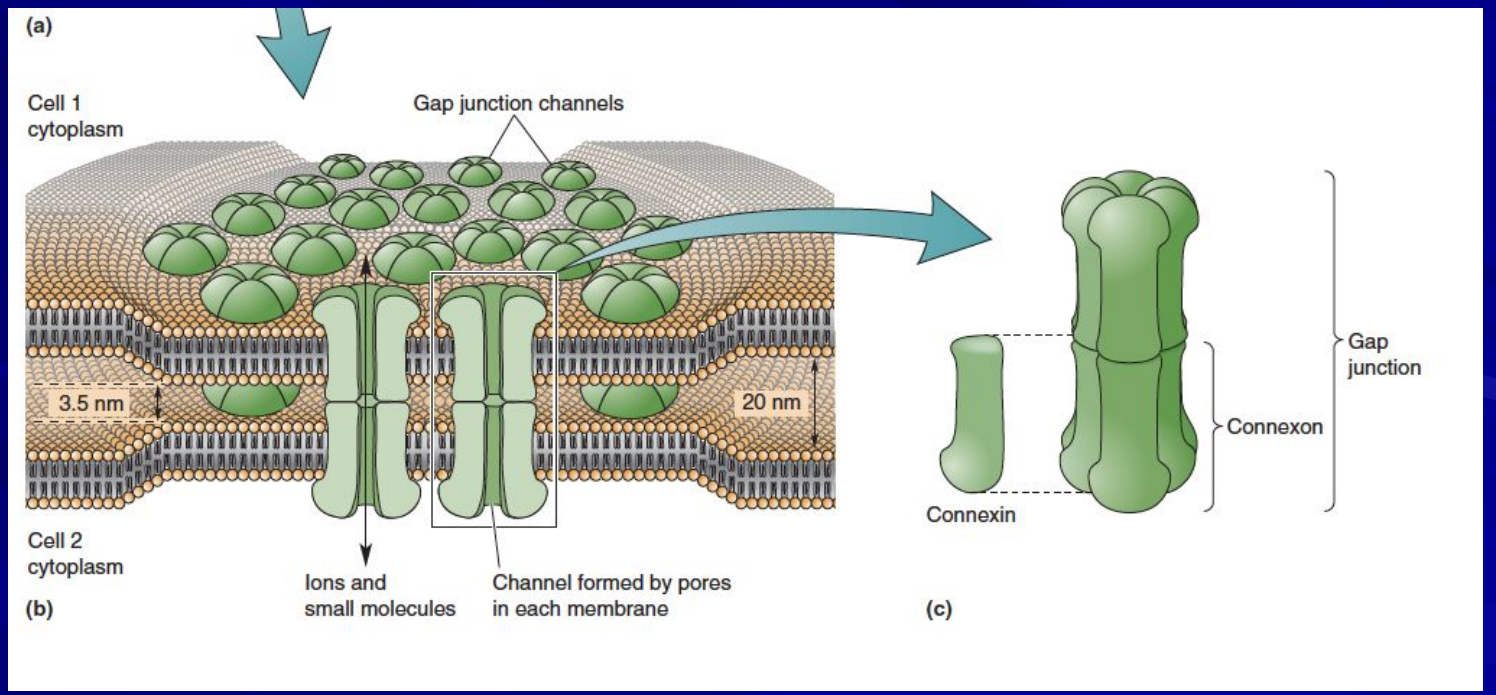
1. electrical synapses
2. chemical synapses





Electrical synapses

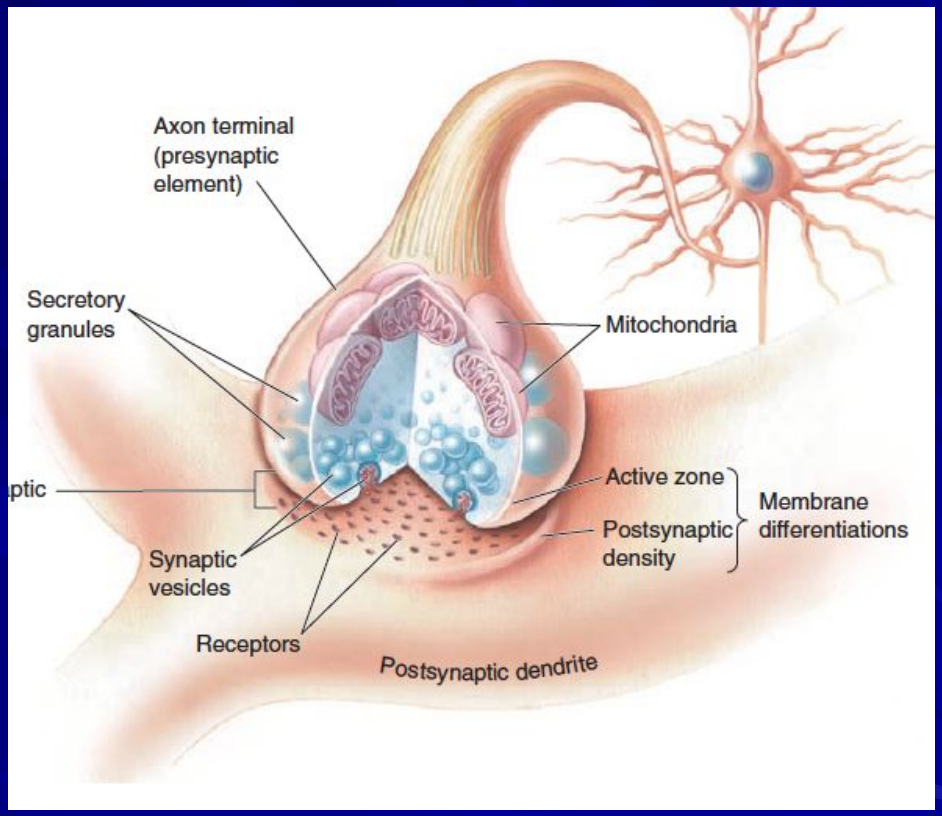
- Six connexins combine to form a channel called a connexon
- Two connexons (one from each cell) combine to form a gap junction channel

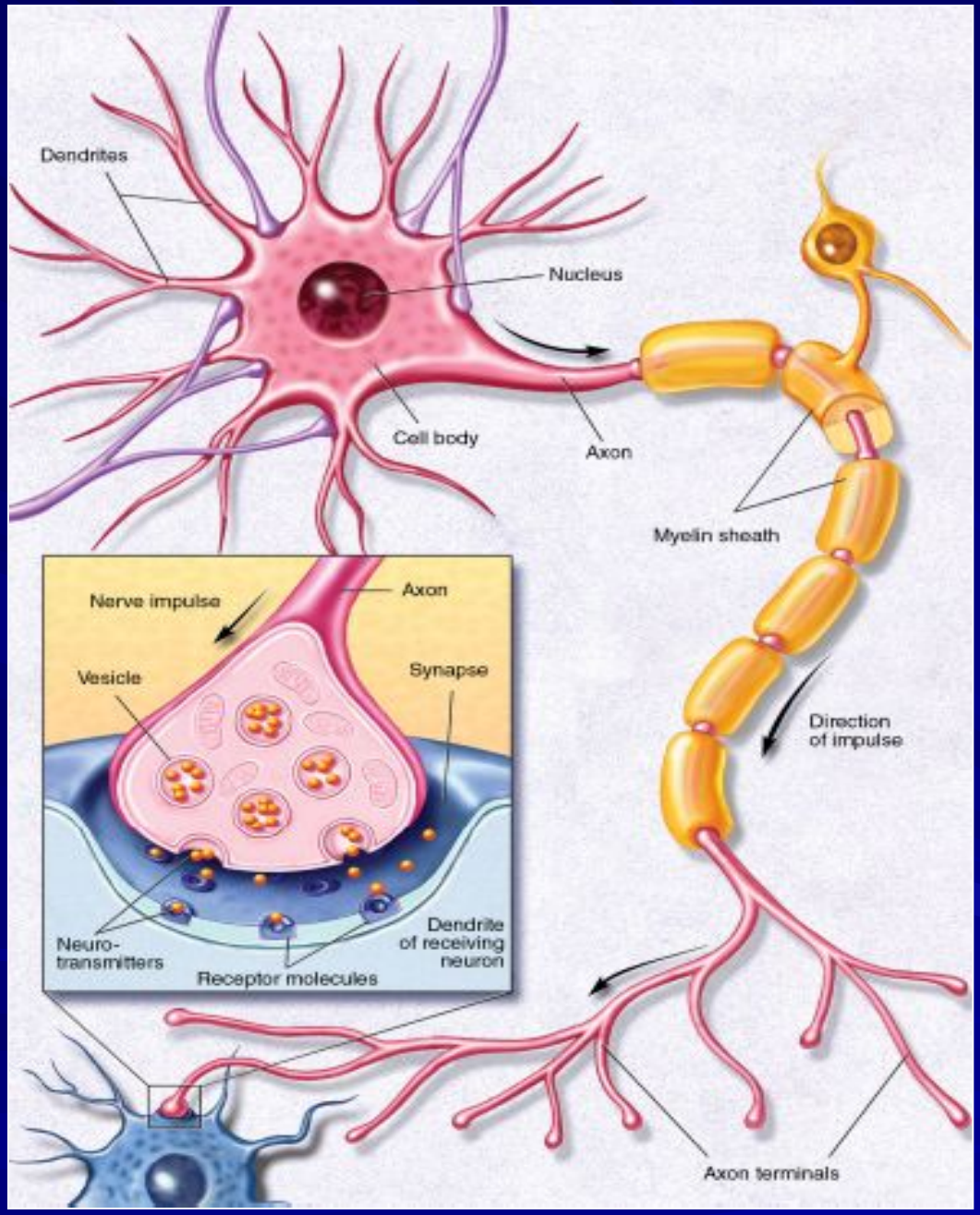


Chemical synapses

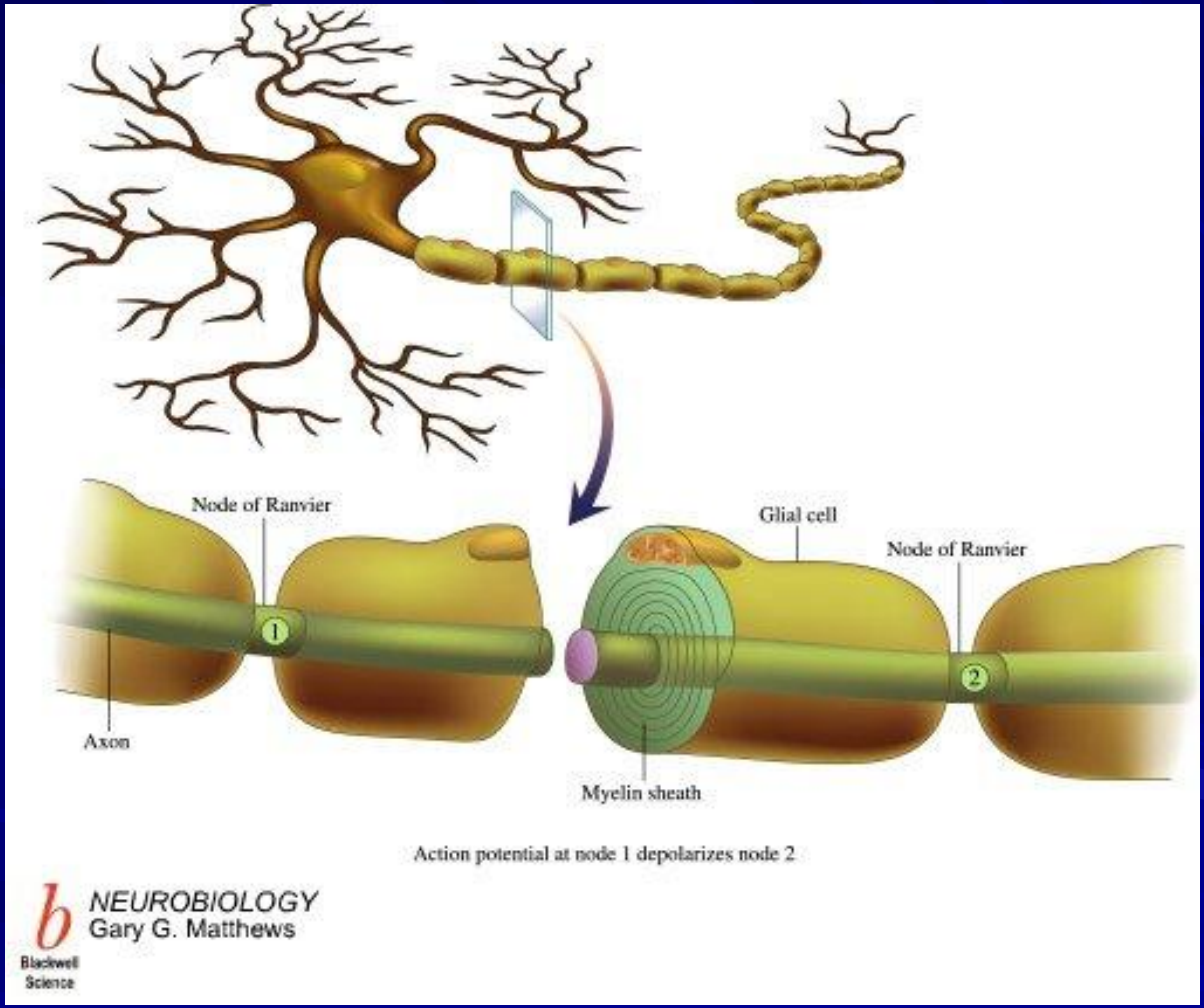
Axon terminal
Presynaptic membrane
Postsynaptic membrane
Synaptic cleft

Synaptic vesicles
Postsynaptic receptors



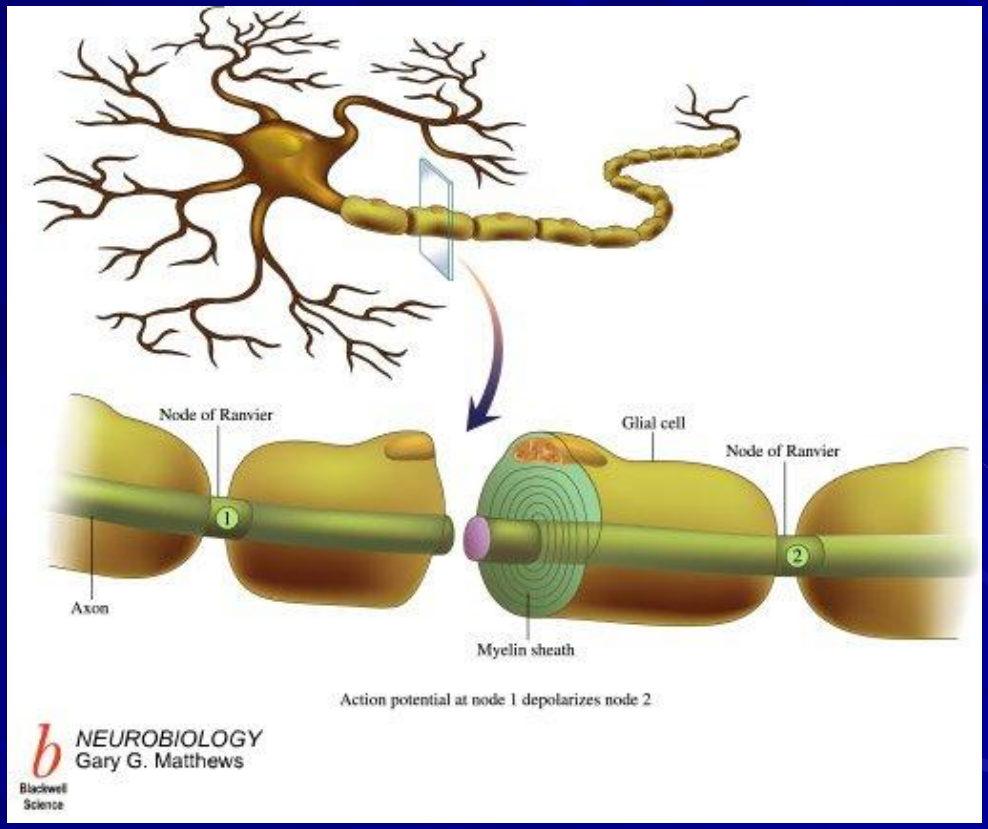

Dendrites
Nucleus
Cell body
Axon
Myelin sheath
Direction of impulse
Nerve impulse
Axon
Vesicle
Synapse
Neuro-transmitters
Receptor molecules
Dendrite of receiving neuron
Axon terminals

Nerve fibers



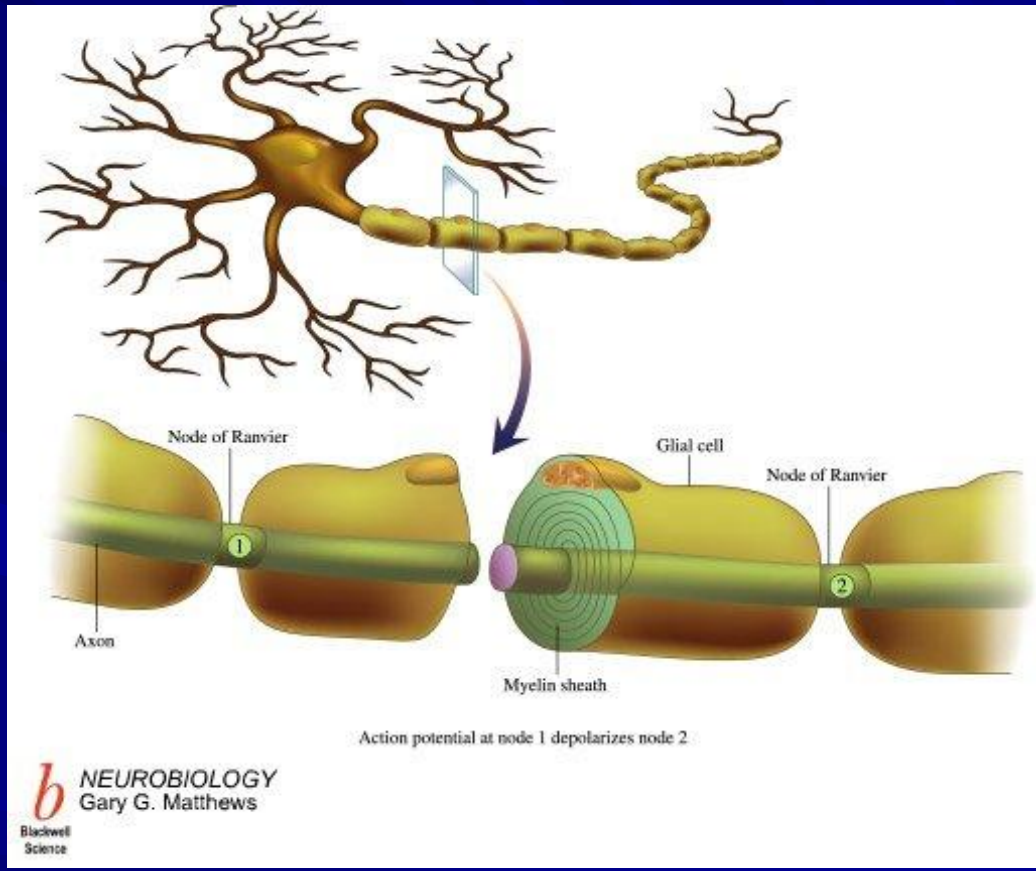
Classification of nerve fibers

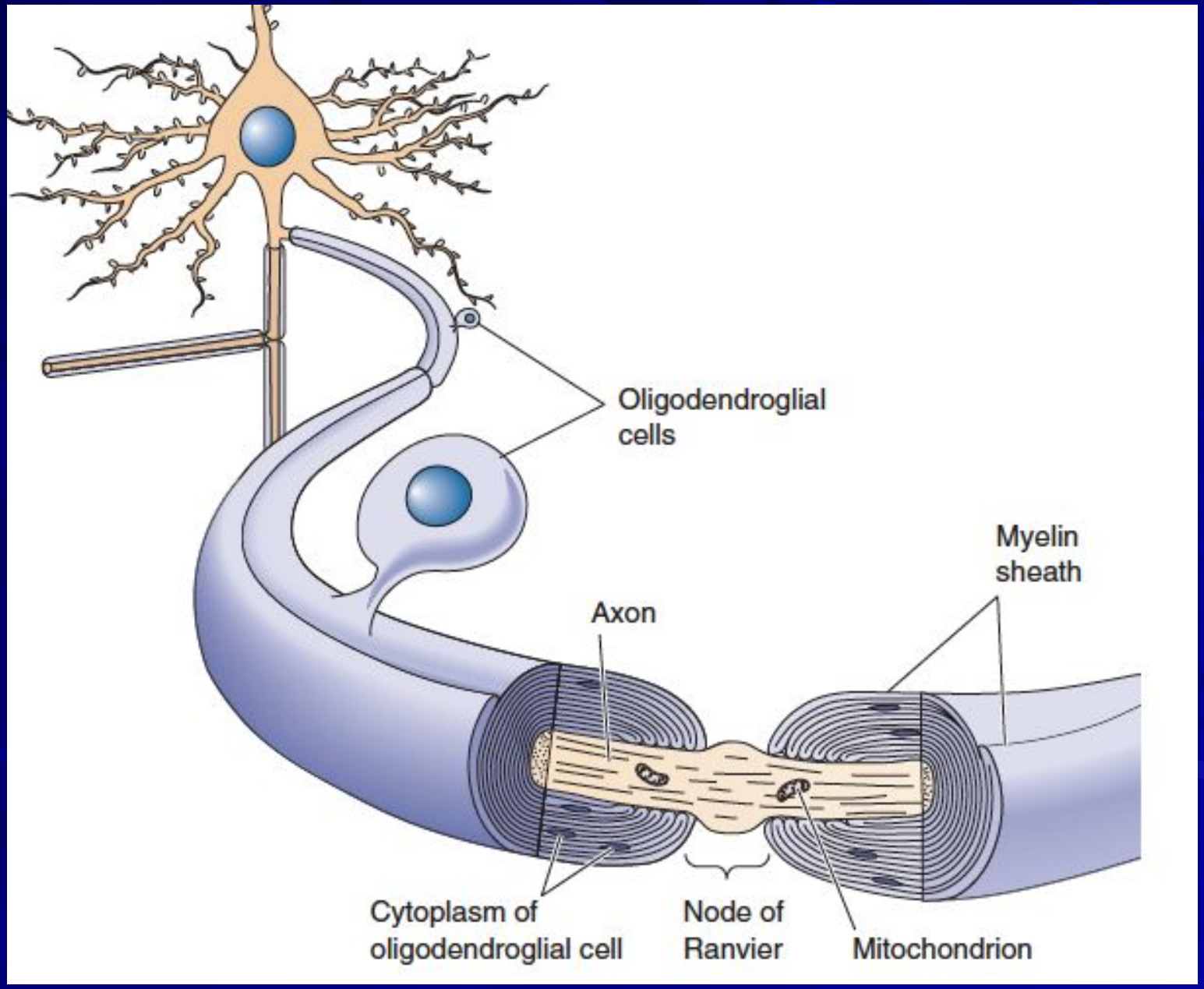
- unmyelinated fibers
- myelinated fibers



Myelin sheath

- *Myelin sheath* is a fatty white substance that surrounds the axon of nerve fibers, forming an electrically insulating layer
- The production of the myelin sheath is called myelination

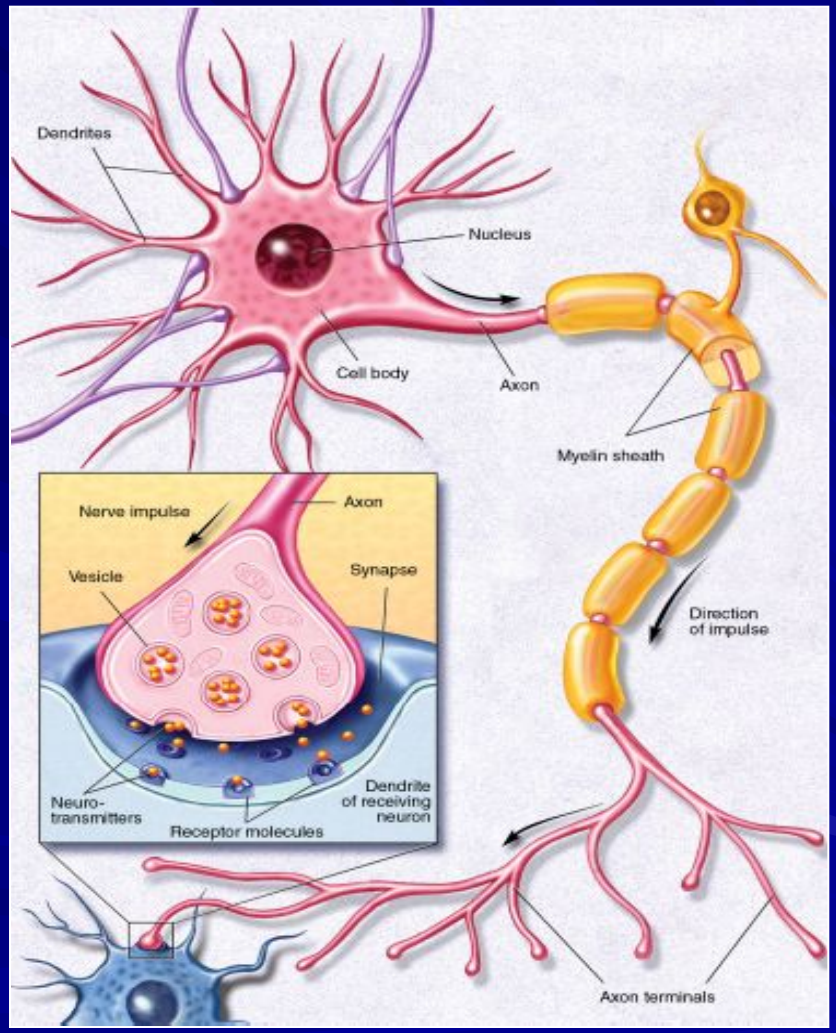


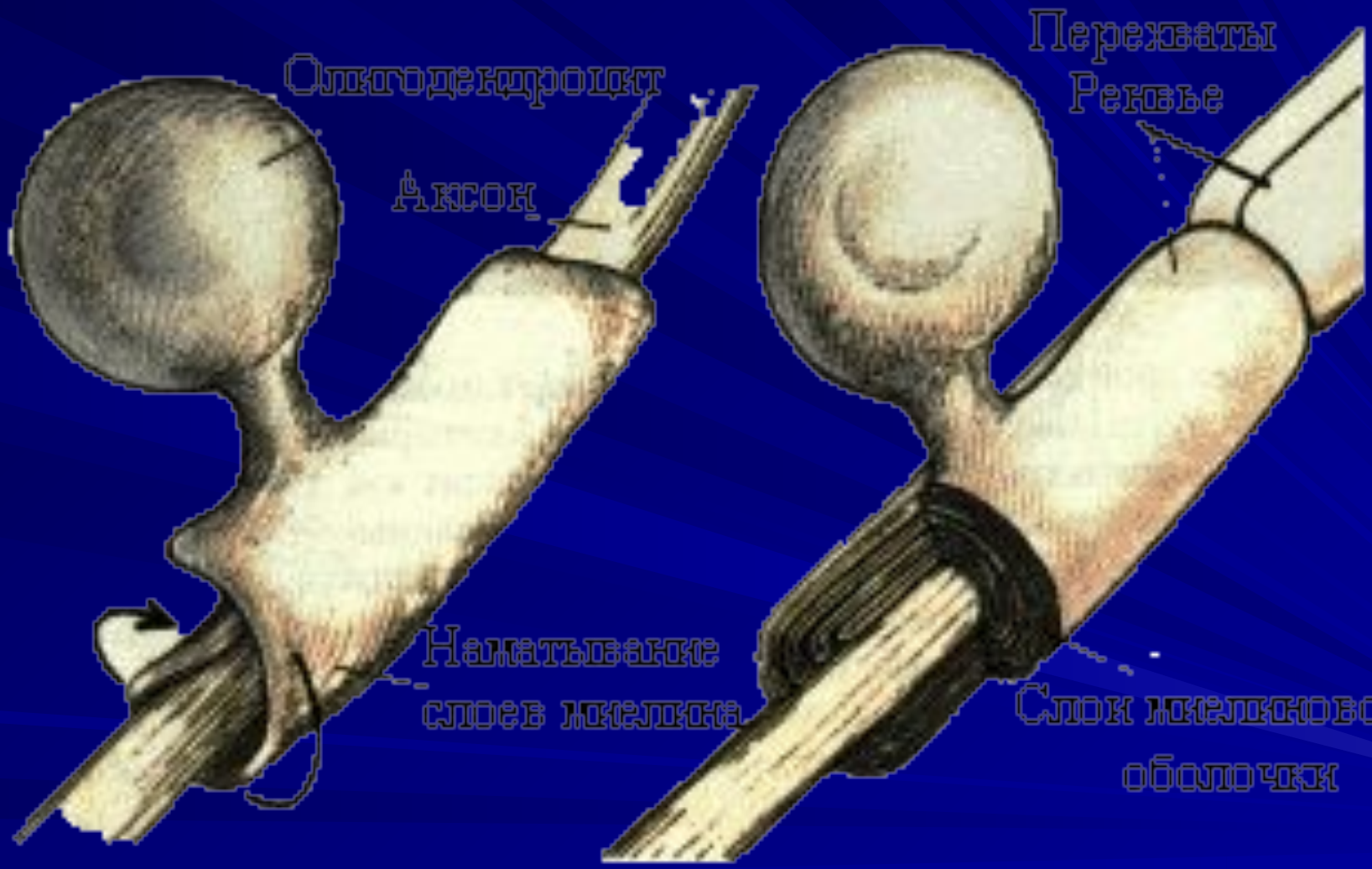

Oligodendroglial cells
Myelin sheath
Axon
Cytoplasm of oligodendroglial cell
Node of Ranvier
Mitochondrion

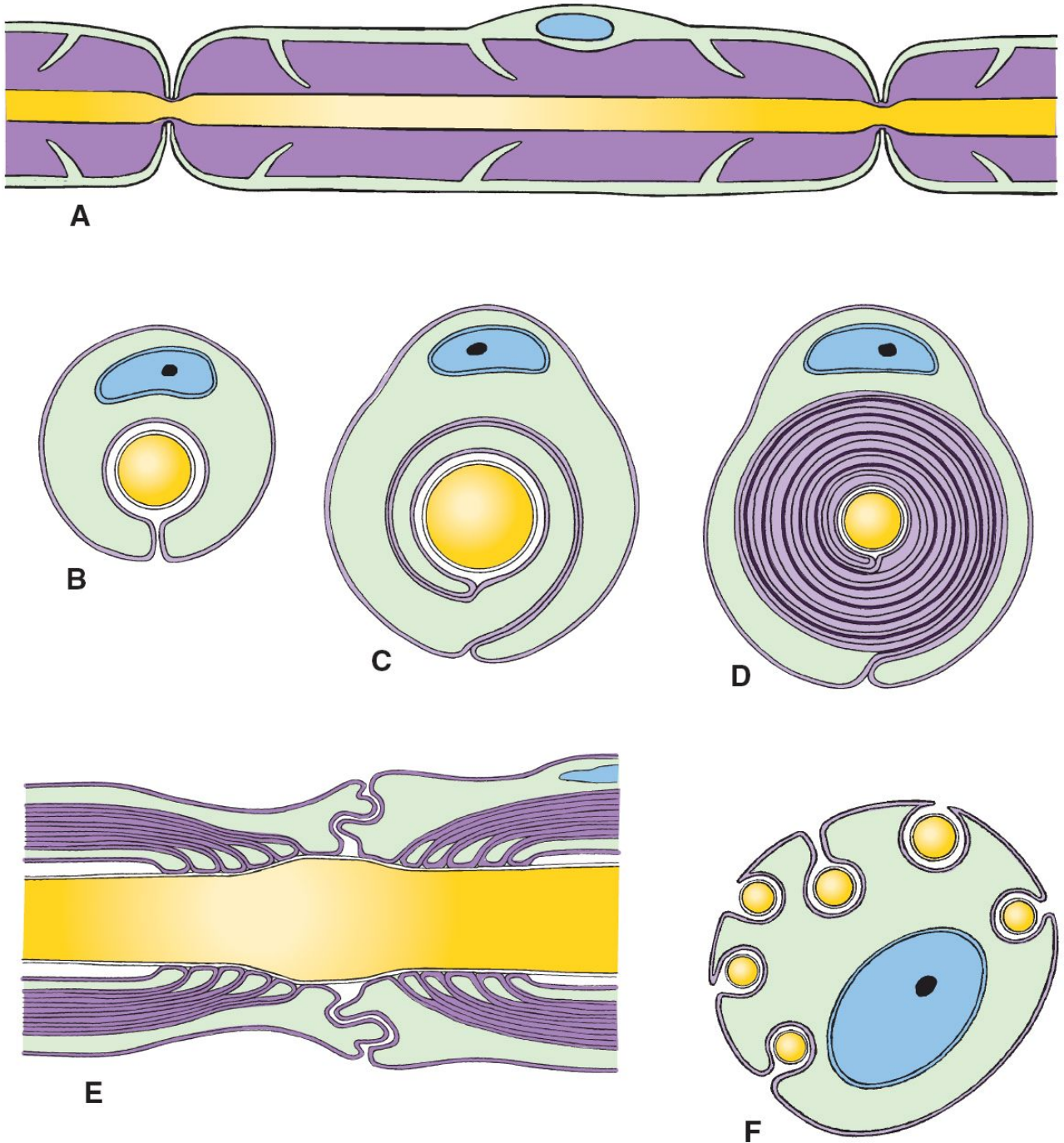
Nodes of Ranvier

- Nodes of Ranvier are periodic gaps in the insulating myelin sheaths of myelinated axons where the axonal membrane is exposed to the extracellular space

- Nerve conduction in myelinated axons is referred to as saltatory conduction.




Олигодендроцит
Аксон
Наматывание слоев миелина
Перехваты Ранвье
Слои миелиновой оболочки

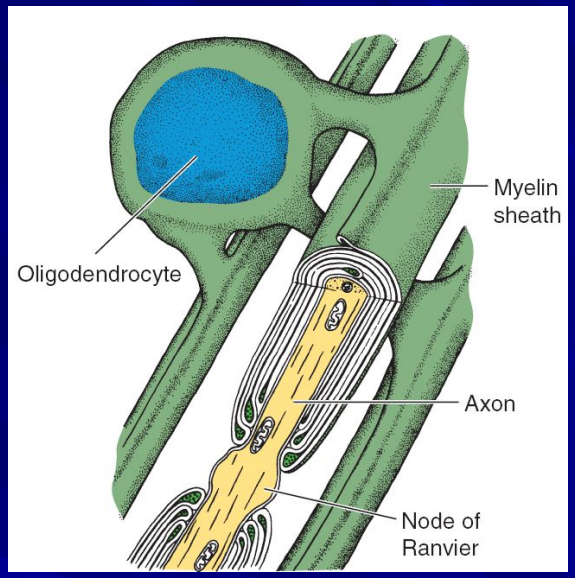

A
B
C
D
E
F

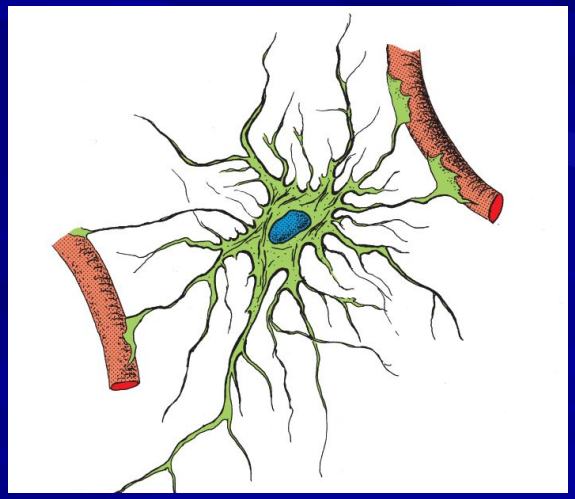
Glial cells

- Glial cells (neuroglia or glia) are non-neuronal cells that maintain homeostasis, form myelin, and provide support and protection for neurons in the central and peripheral nervous systems

Classification of glial cells

- **Schwann cells** supply the myelin for the peripheral nervous system
- **Oligodendrocytes** myelinate the axons of the central nervous system.
- **Astrocytes**





Astrocytes

Astrocytes

- fill the spaces between neurons
- is regulating the chemical content of this extracellular space.
- regulate the concentration of potassium ions in the extracellular fluid.