Notes: Neurons

The human body is made up of trillions of cells. Cells of the nervous system, called nerve cells or neurons, are specialized to carry "messages" through an electrochemical process. The human brain has about 100 billion neurons. To learn how neurons carry messages, read about the action potential.

Neurons come in many different shapes and sizes. Some of the smallest neurons have cell bodies that are only 4 microns wide. Some of the biggest neurons have cell bodies that are 100 microns wide. (Remember that 1 micron is equal to one thousandth of a millimeter!!).

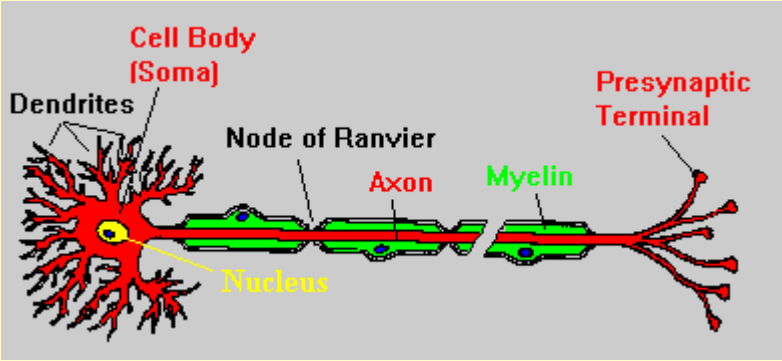
Neurons are similar to other cells in the body because:

1. **Neurons are surrounded by a cell membrane.**
2. **Neurons have a nucleus that contains genes.**
3. **Neurons contain cytoplasm, mitochondria and other "organelles".**
4. **Neurons carry out basic cellular processes such as protein synthesis and energy production.**

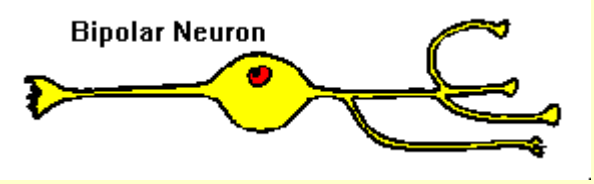
However, neurons differ from other cells in the body because:

1. **Neurons have specialized extensions called dendrites and axons. Dendrites bring information to the cell body and axons take information away from the cell body.**
2. **Neurons communicate with each other through an electrochemical process.**
3. **Neurons contain some specialized structures (for example, synapses) and chemicals (for example, neurotransmitter)**

The Neuron



One way to classify neurons is by the number of extensions that extend from the neuron's cell body (soma).



Bipolar neurons have two processes extending from the cell body (examples: retinal cells, olfactory epithelium cells).

Unipolar cells (example: dorsal root ganglion cells). One axon extends centrally toward the spinal cord, the other axon extends toward the skin or muscle.

Multipolar neurons have many processes that extend from the cell body. However, each neuron has only one axon (examples: spinal motor neurons, pyramidal neurons, Purkinje cells).

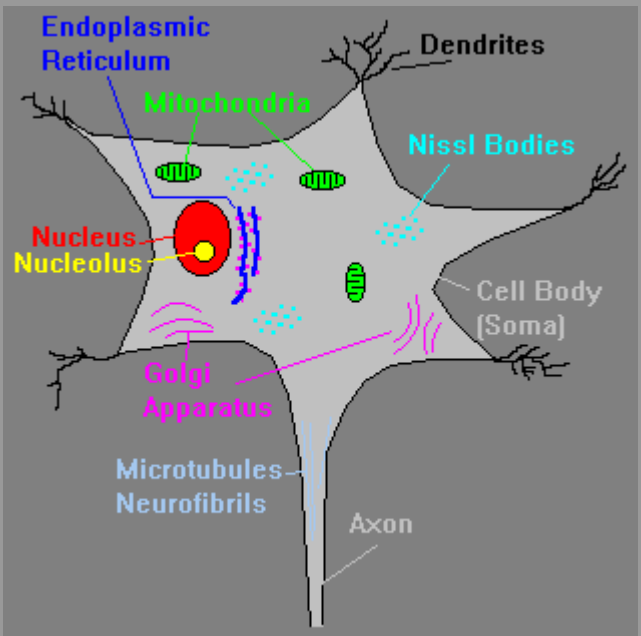
Neurons can also be classified by the direction that they send information.

- **Sensory (or afferent) neurons: send information from sensory receptors (e.g., in skin, eyes, nose, tongue, ears) TOWARD the central nervous system.**

- **Motor (or efferent) neurons: send information AWAY from the central nervous system to muscles or glands.**
- **Interneurons: send information between sensory neurons and motor neurons. Most interneurons are located in the central nervous system.**

There are several differences between axons and dendrites:

Axons	Dendrites
• Take information away from the cell body • Smooth Surface • Generally only 1 axon per cell • No ribosomes • Can have myelin • Branch further from the cell body	• Bring information to the cell body • Rough Surface (dendritic spines) • Usually many dendrites per cell • Have ribosomes • No myelin insulation



What is inside of a neuron? A neuron has many of the same "organelles," such as mitochondria, cytoplasm and a nucleus, as other cells in the body.

- **Nucleus - contains genetic material (chromosomes) including information for cell development and synthesis of proteins necessary for cell maintenance and survival. Covered by a membrane.**
- **Nucleolus - produces ribosomes necessary for translation of genetic information into proteins**
- **Nissl Bodies - groups of ribosomes used for protein synthesis.**
- **Endoplasmic reticulum (ER) - system of tubes for transport of materials within cytoplasm. Can have ribosomes (rough ER) or no ribosomes (smooth ER). With ribosomes, the ER is**

	important for protein synthesis. • Golgi Apparatus - membrane-bound structure important in packaging peptides and proteins (including neurotransmitters) into vesicles. • Microfilaments/Neurotubules - system of transport for materials within a neuron and may be used for structural support. • Mitochondria - produce energy to fuel cellular activities.

Did you know? 	Neurons are the oldest and longest cells in the body! You have many of the same neurons for your whole life. Although other cells die and are replaced, many neurons are never replaced when they die. In fact, you have fewer neurons when you are old compared to when you are young. On the other hand, data published in November 1998 show that in one area of the brain (the hippocampus), new neurons CAN grow in adult humans. Neurons can be quite large - in some neurons, such as corticospinal neurons (from motor cortex to spinal cord) or primary afferent neurons (neurons that extend from the skin into the spinal cord and up to the brain stem), can be several feet long!

(http://faculty.washington.edu/chudler/cells.html)