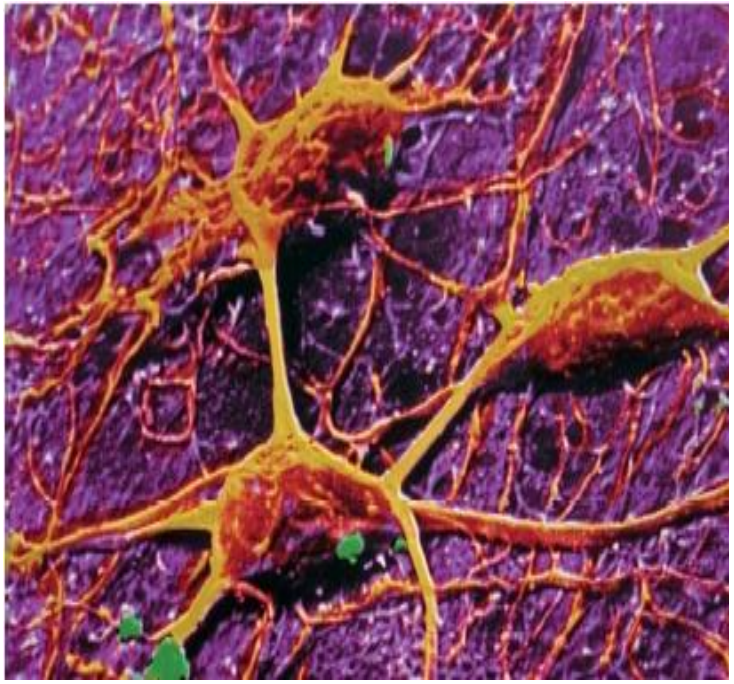
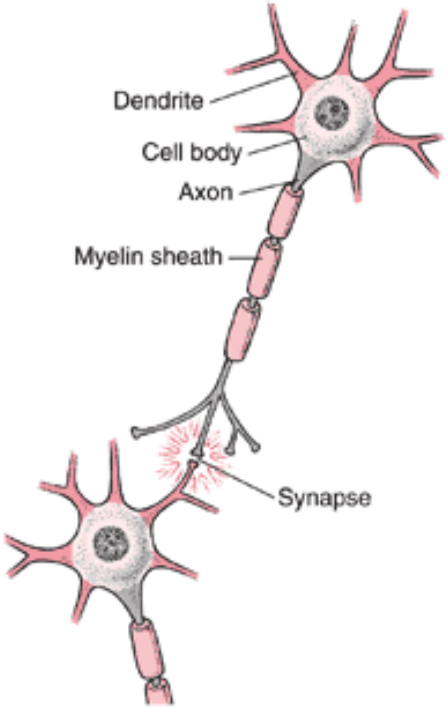
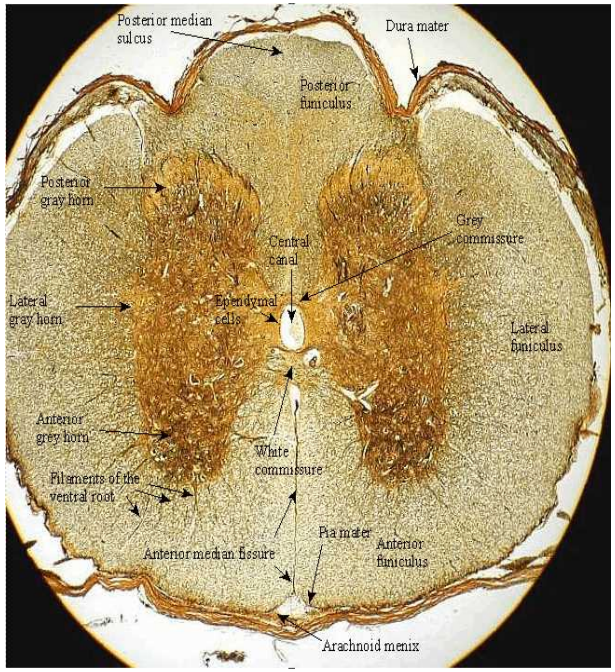
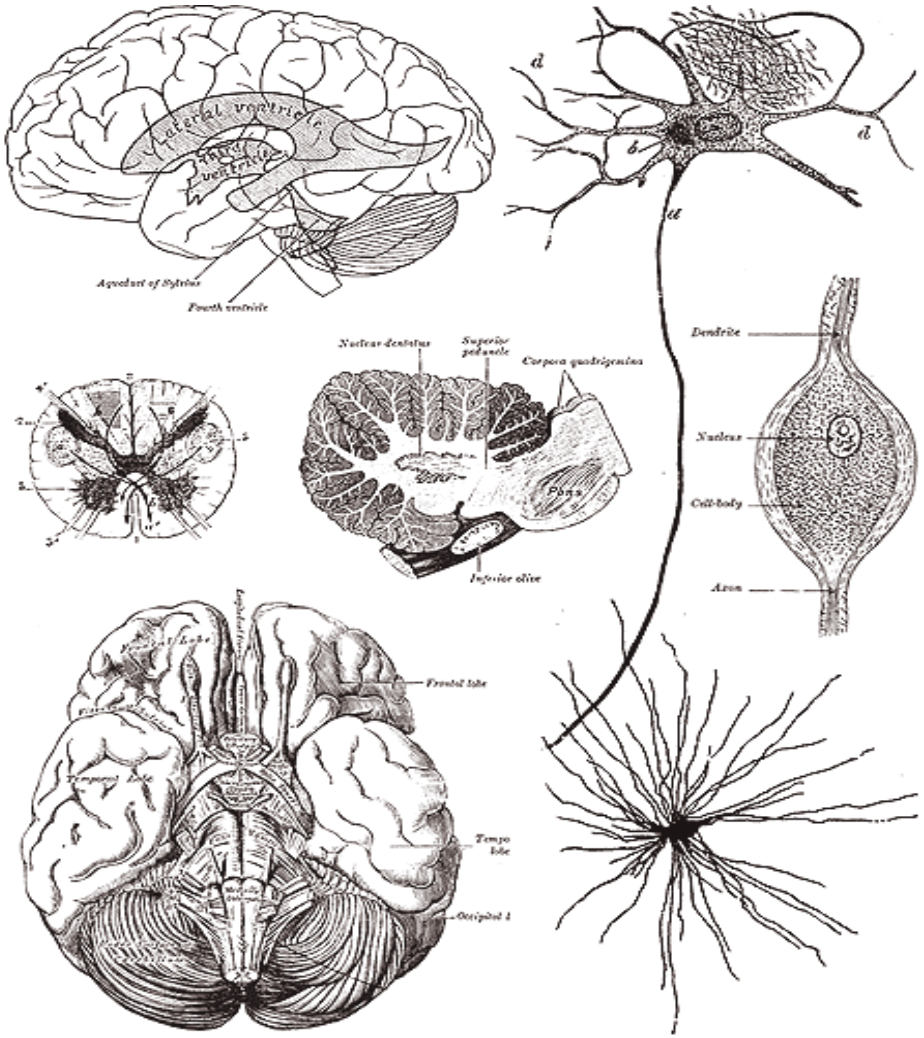
Homeostasis and the nervous system







Interesting Facts About the Nervous System



- We have 100 billion neurons in the brain
  - That's more than the number of stars in the milky way
- Octopus have 300 billion neurons in the brain
- Not all animals have a brain
  - Some, such as a leech, have a ganglia = cluster of neurons
- Neurons can transmit 1000 impulses per second

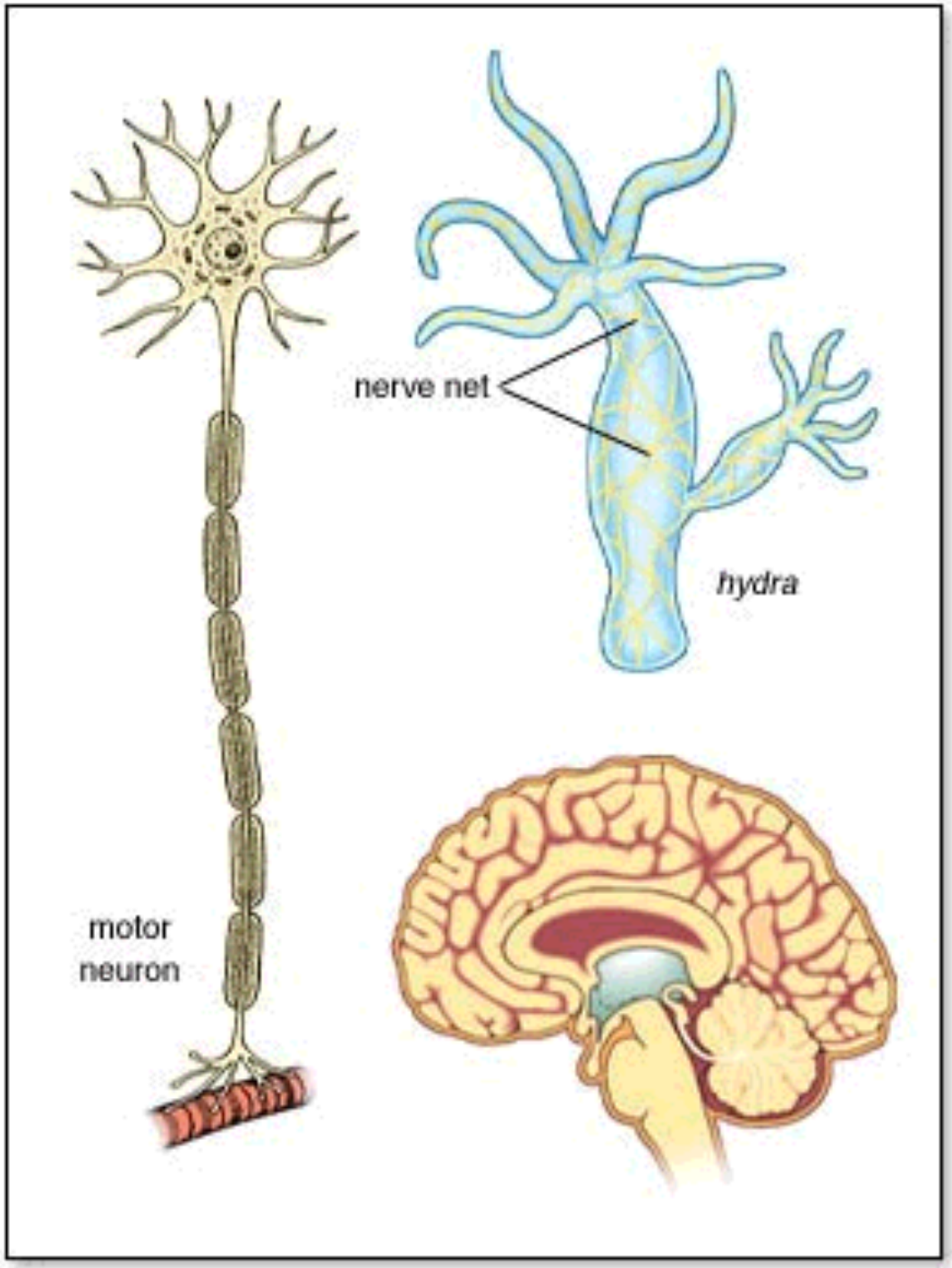
Some Organisms have Nerve Cells

↓

Some have Nerve net

↓

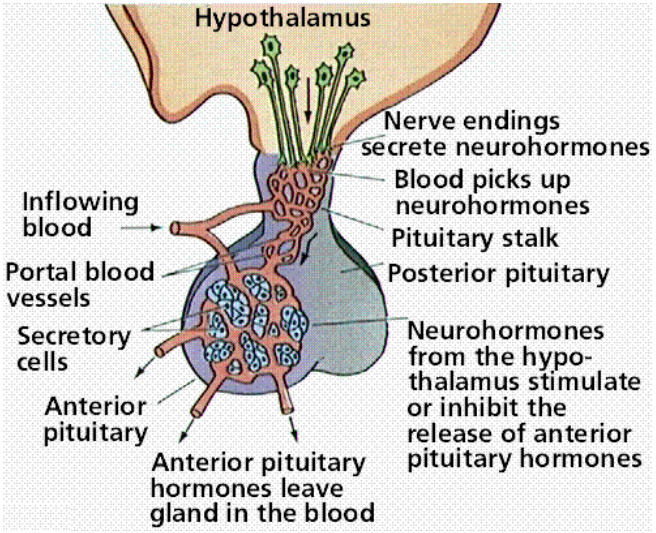
Most complex have a Brain



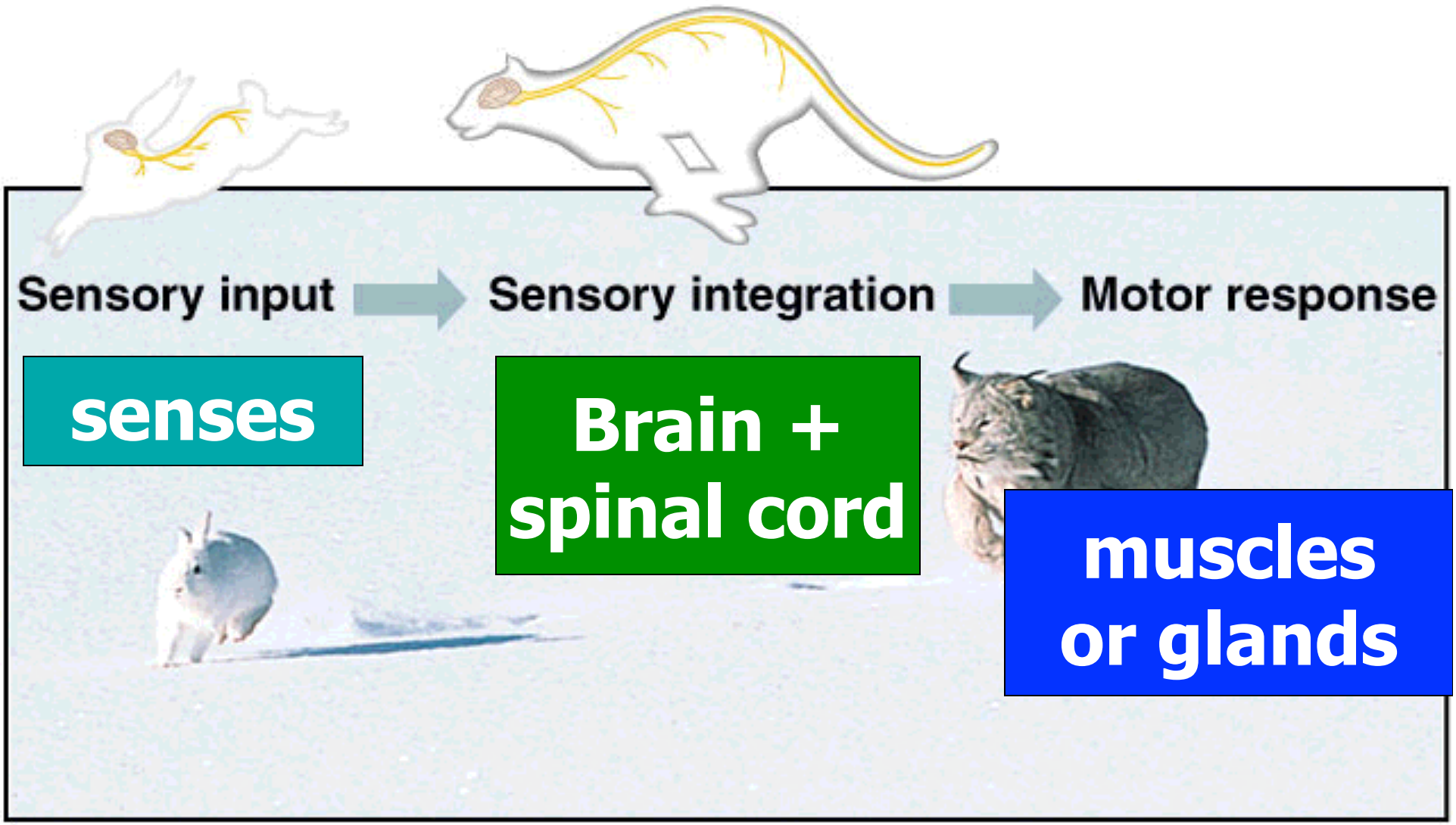
Nervous vs. Endocrine System

- **Nervous** and **endocrine** system **work together** to maintain homeostasis
- Faster than the **endocrine** system
- Relies on **electrochemical** signals
- Endocrine system relies on chemicals and **hormones**

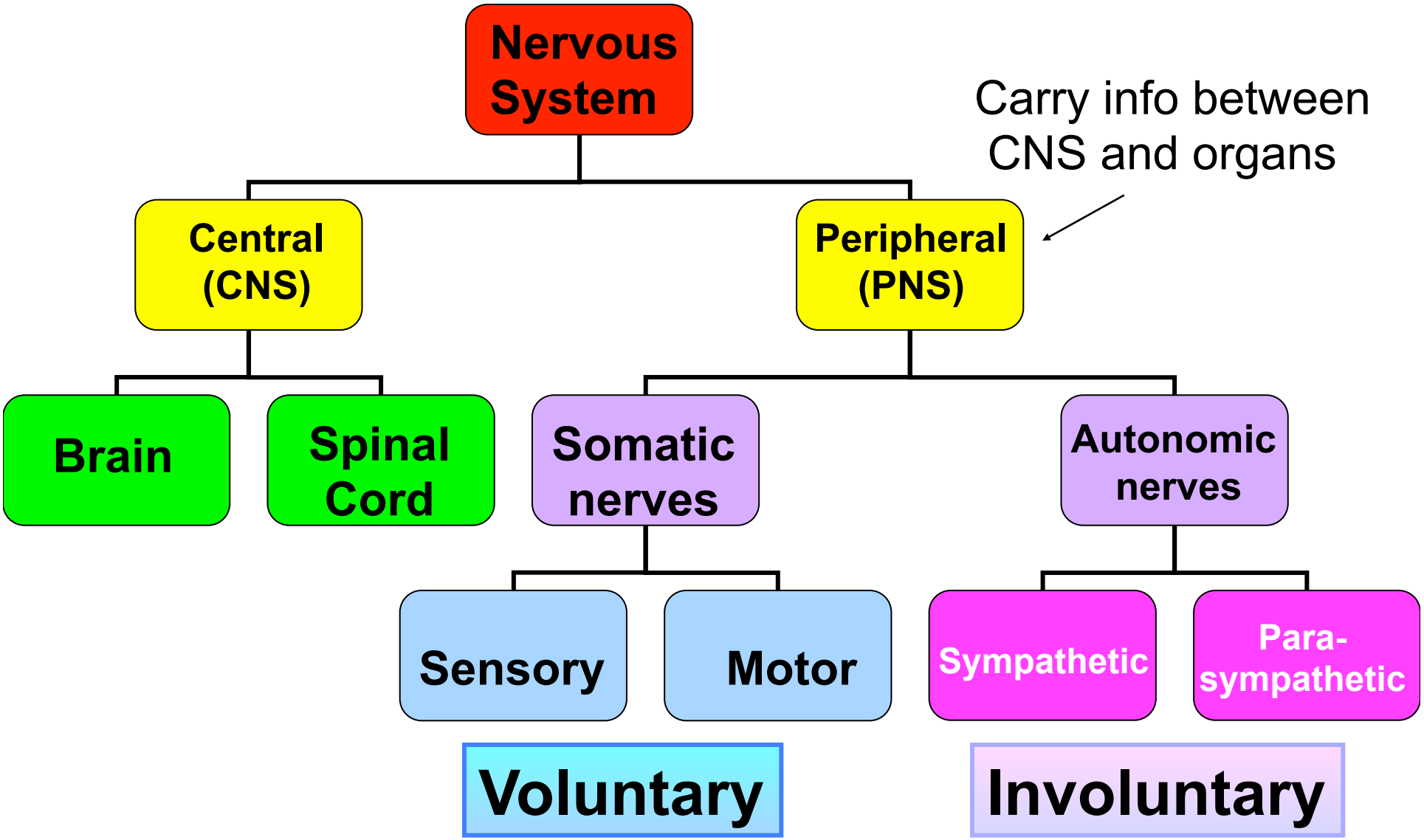
Overview website

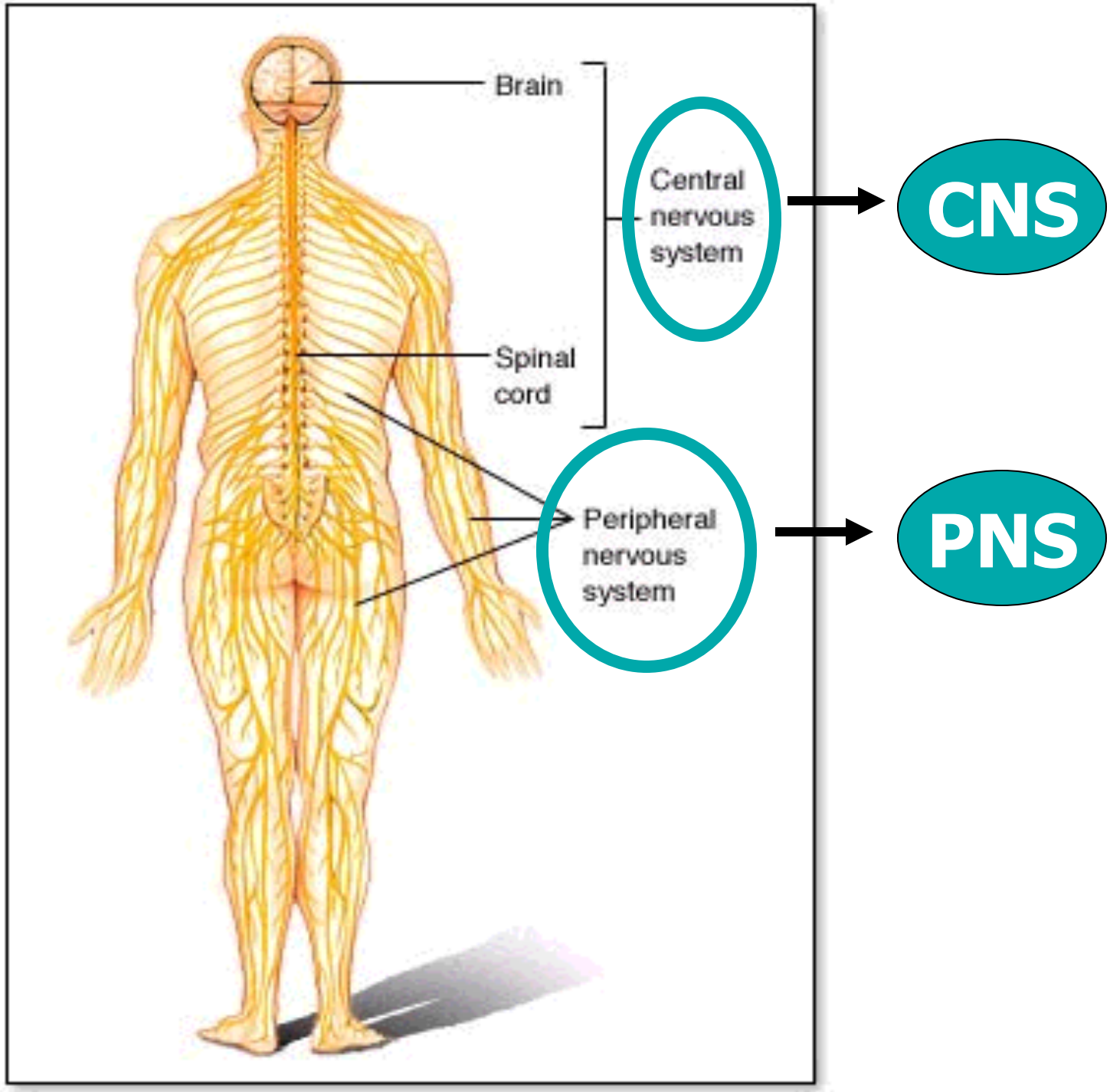


Nervous System in Action



Divisions of the Nervous System




Brain
Central nervous system
Spinal cord
Peripheral nervous system
CNS
PNS

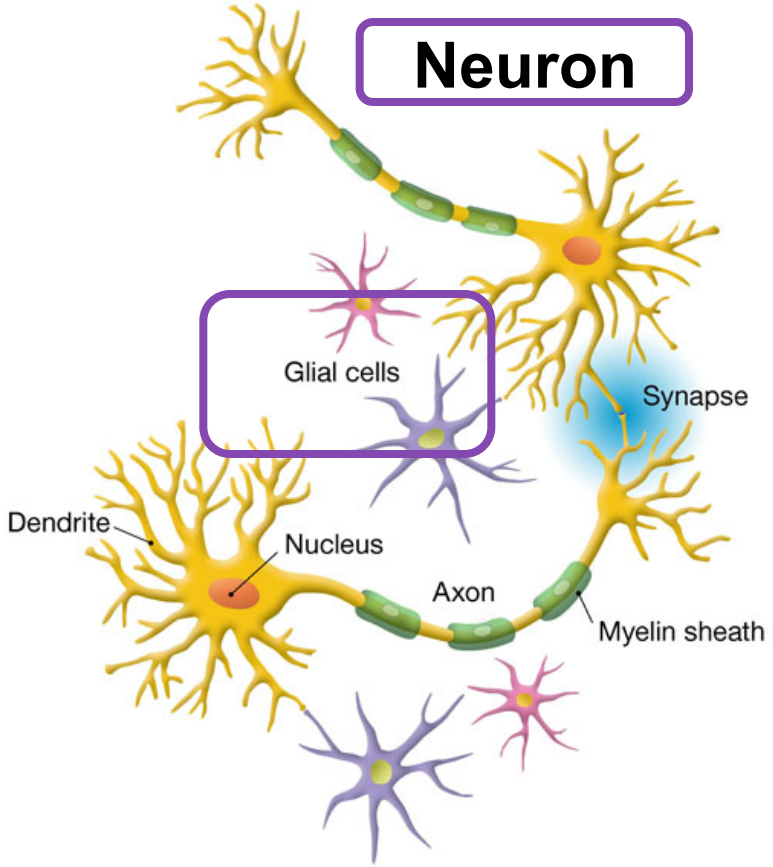
Cells of the Nervous System

Glial Cells

- Non-conducting
- Used for support and metabolism
- Helps hold neurons close together
- The word “glial” means glue

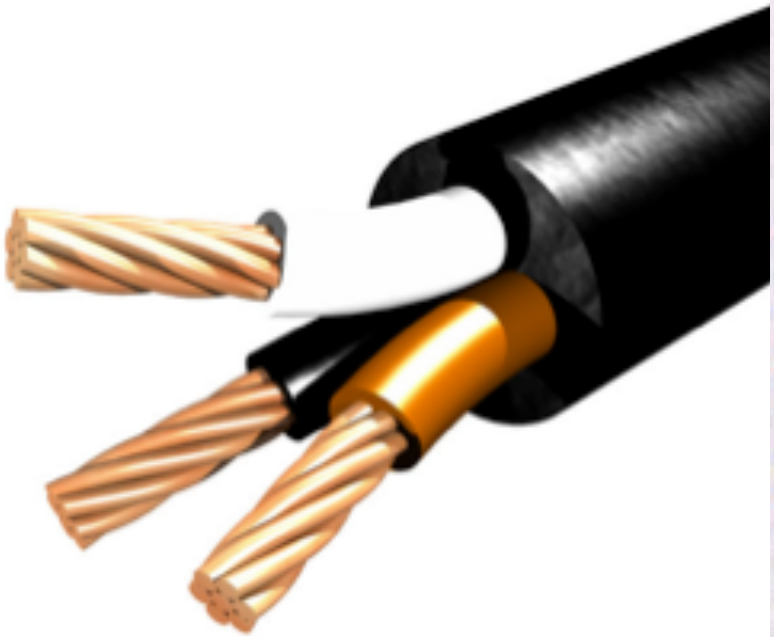
Neurons

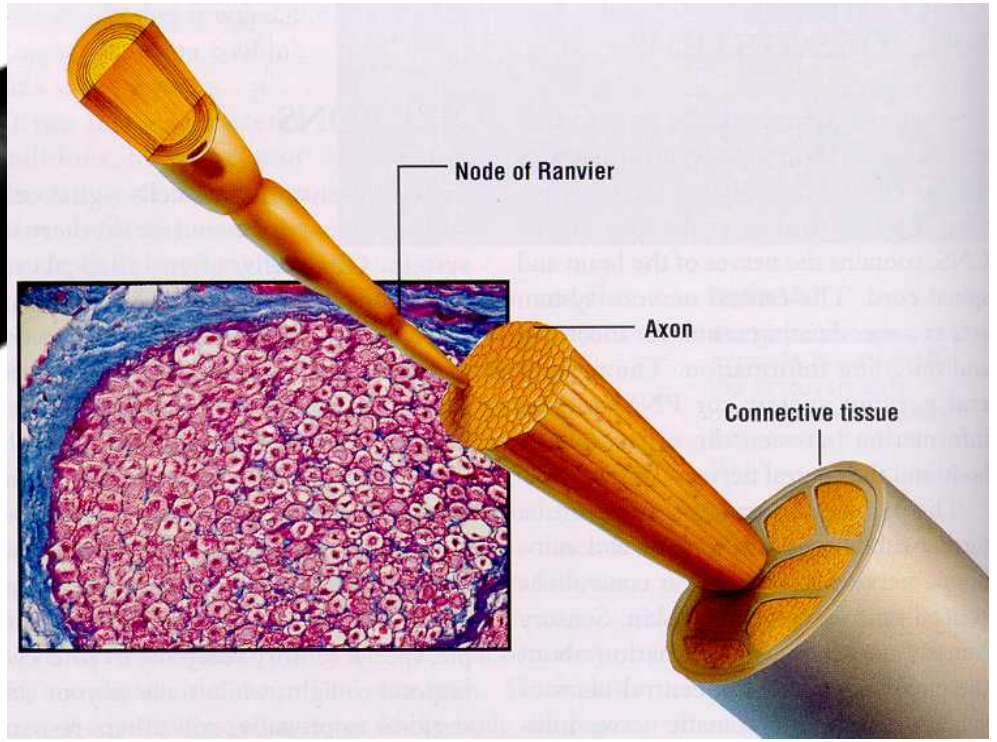
- Conducting
- Carries the nerve (electrochemical) impulse

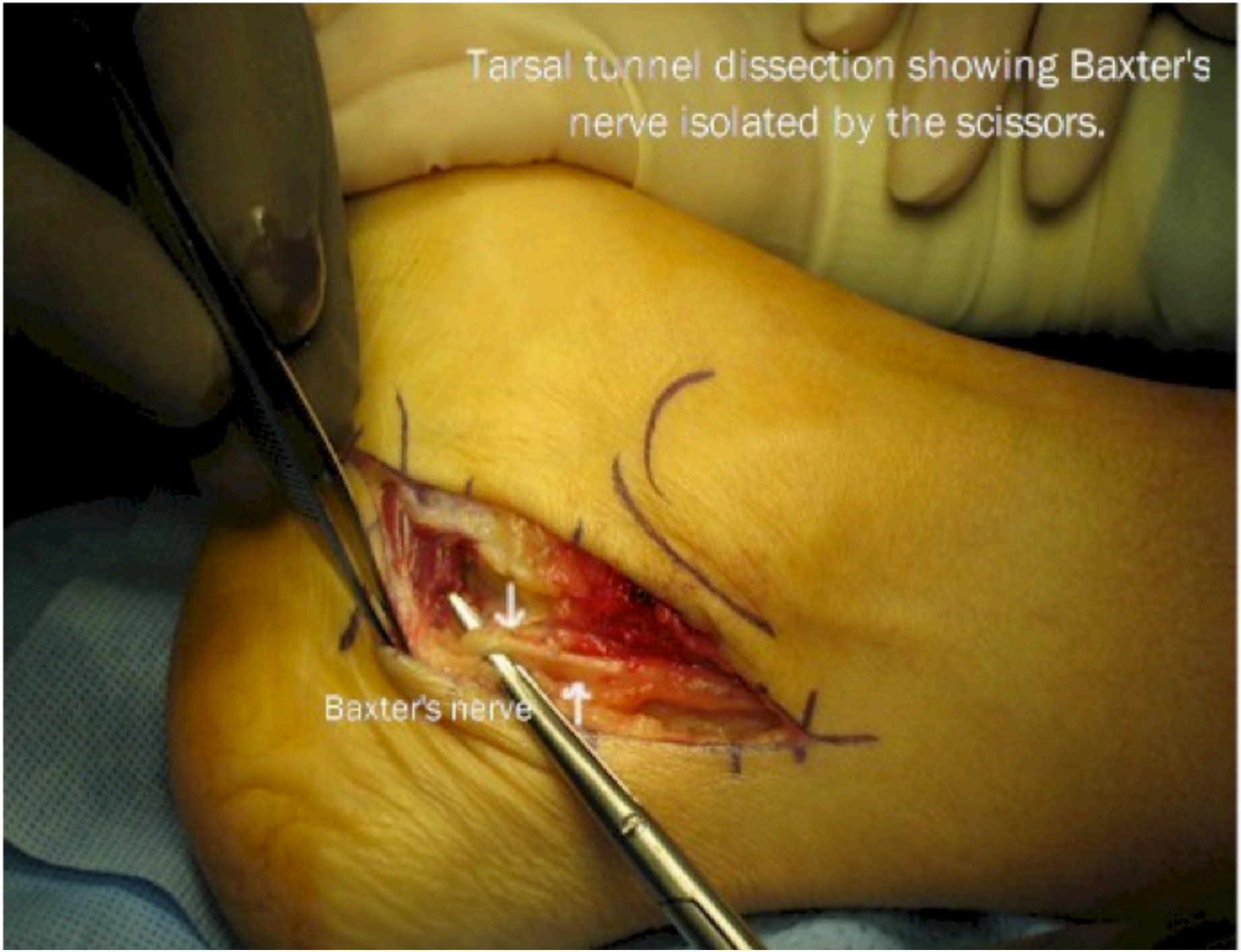


Neurons vs. Nerves

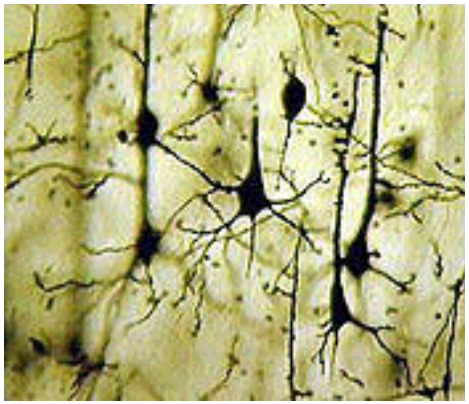
- Neurons are the individual units that make up the nervous system
- Nerves are made up of many neurons
- 1 neuron = 1 cell

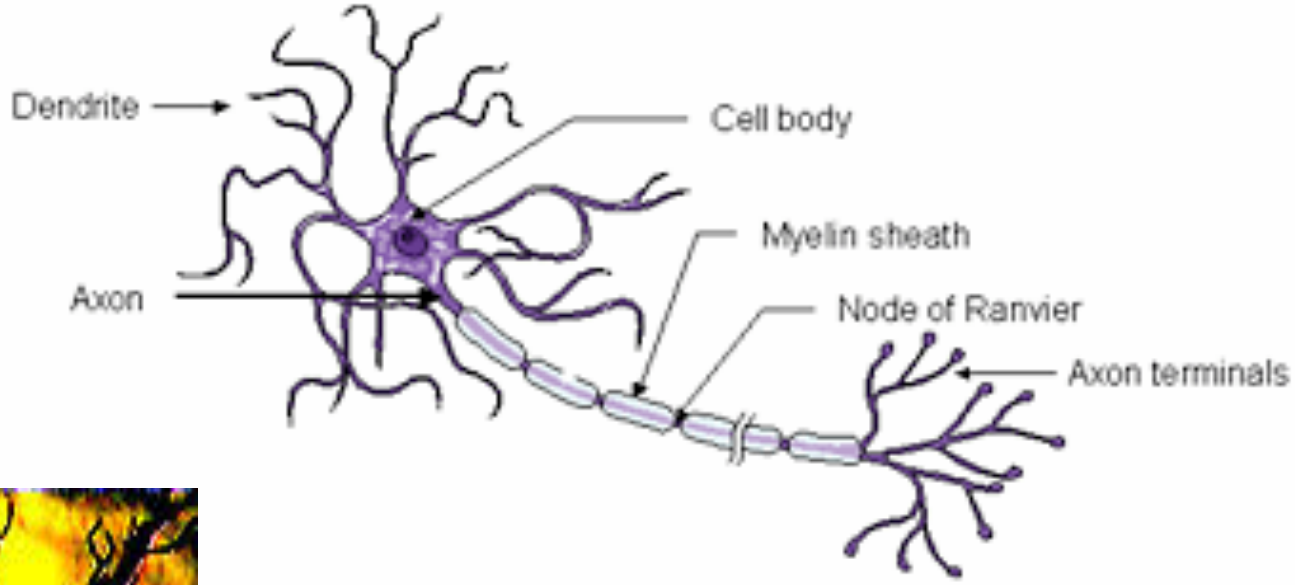


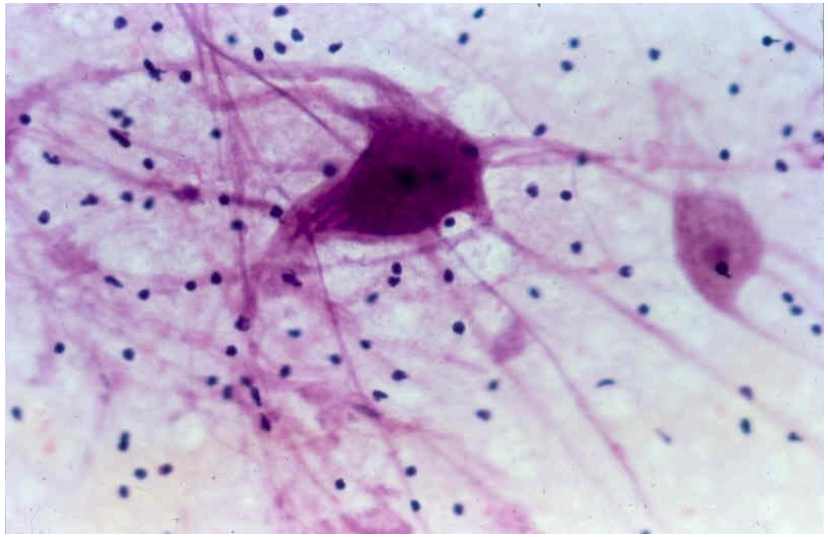



Tarsal tunnel dissection showing Baxter's nerve isolated by the scissors.
Baxter's nerve

Structure of Neurons

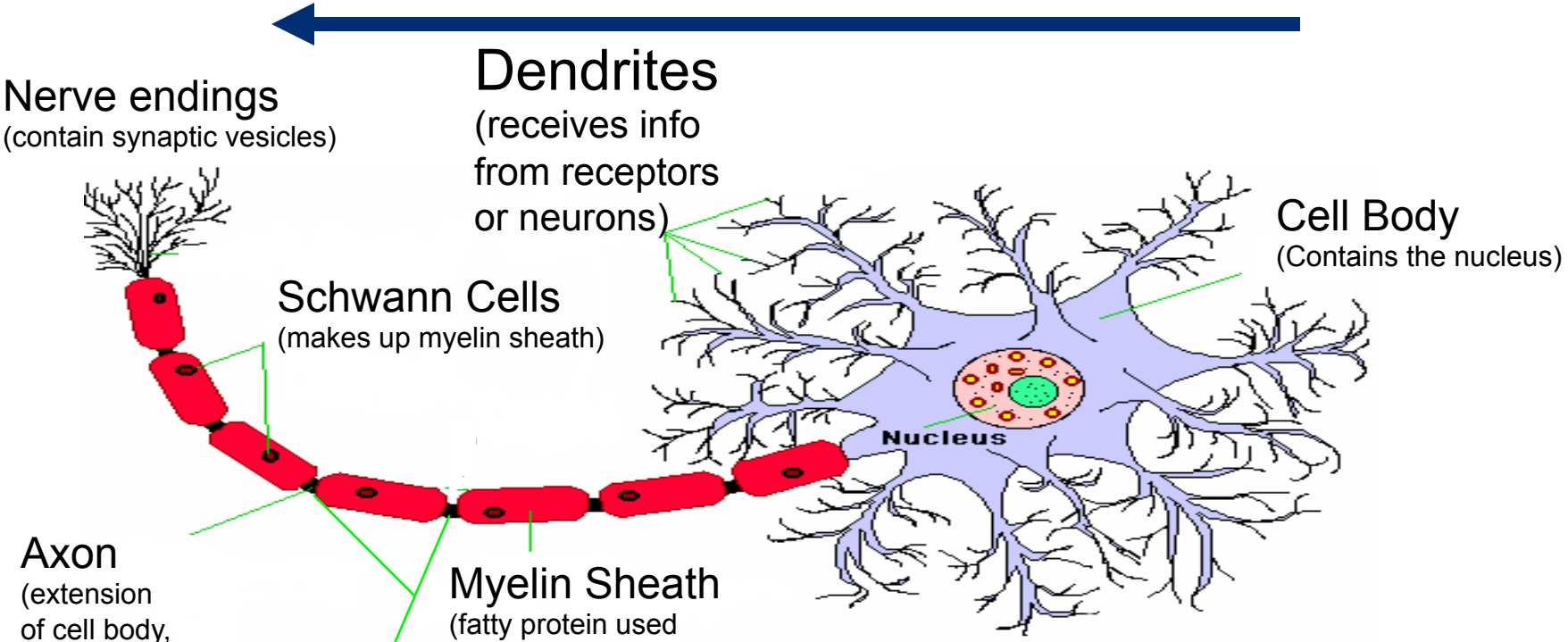






Parts of a Neuron

Direction of Nerve Impulse



The larger the diameter of the axon, the faster the speed of nerve transmission

Parts of a Neuron

Neuron Part	Function
Dendrites	Receive info from receptors or neurons -conduct impulses TOWARD the cell body
Cell Body	-Contains the nucleus and other organelles
Axon	-Longest extension of cell body. Carries the impulse. -Conducts impulses AWAY from the cell body
Myelin Sheath	-Fatty protein -Acts as an **insulation**; increases the speed of the impulse -White matter
Schwann cells (glial cells)	Forms myelin sheath

Parts of a Neuron

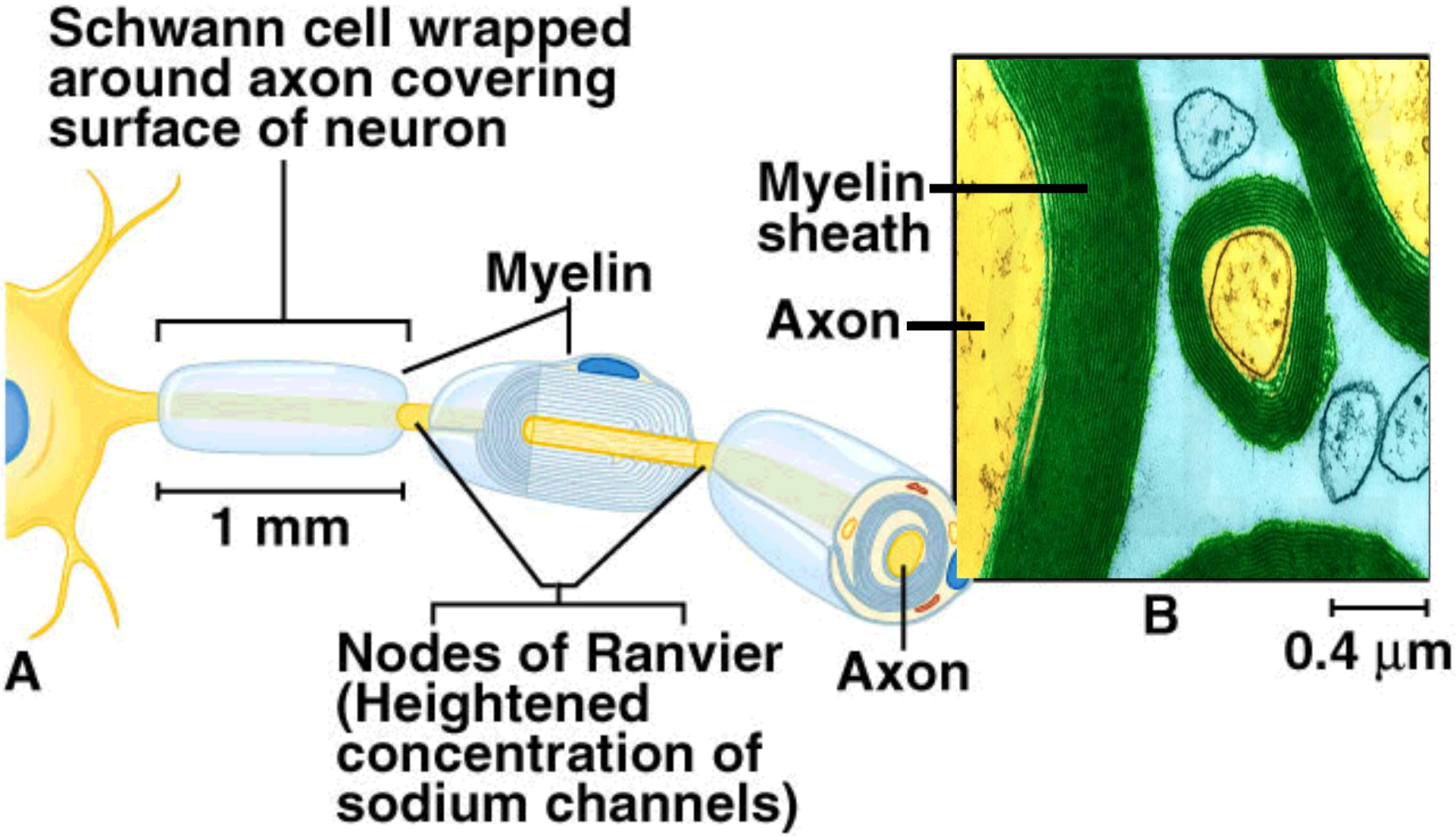
Part of Neuron	Function
Nodes of Ranvier	**Gap** between Schwann cells. Nerve impulses jump from one node to the next. (**Saltatory conduction).**
Neurilemma	Promotes the regeneration of damaged neurons (axons). Healing. Mostly in PNS.
Nerve ending / axon ending	Has synaptic vesicles containing **neurotransmitters**. Distributes (sends) the impulse to the postsynaptic membrane.

Build-Your-Own Neuron

Using the Playdough, create a neuron. Be sure to include the following structures:

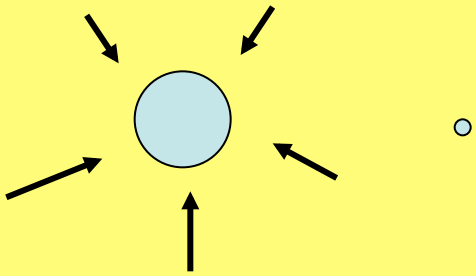
-Cell Body
-Dendrites
-Axon
-Axon Terminal
-Myelin
-Schwann Cells

Myelin Sheath



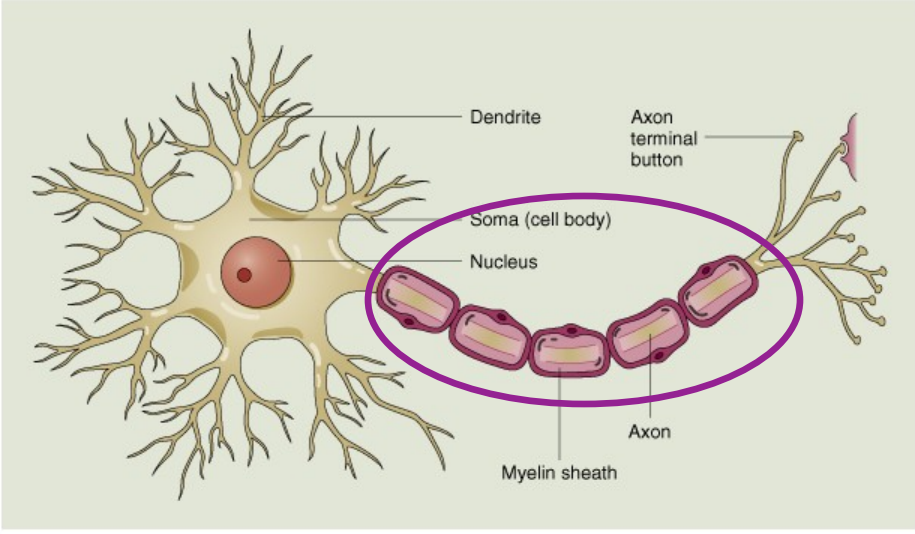
The speed of nerve transmission is increased by:

a **BIGGER axon** diameter



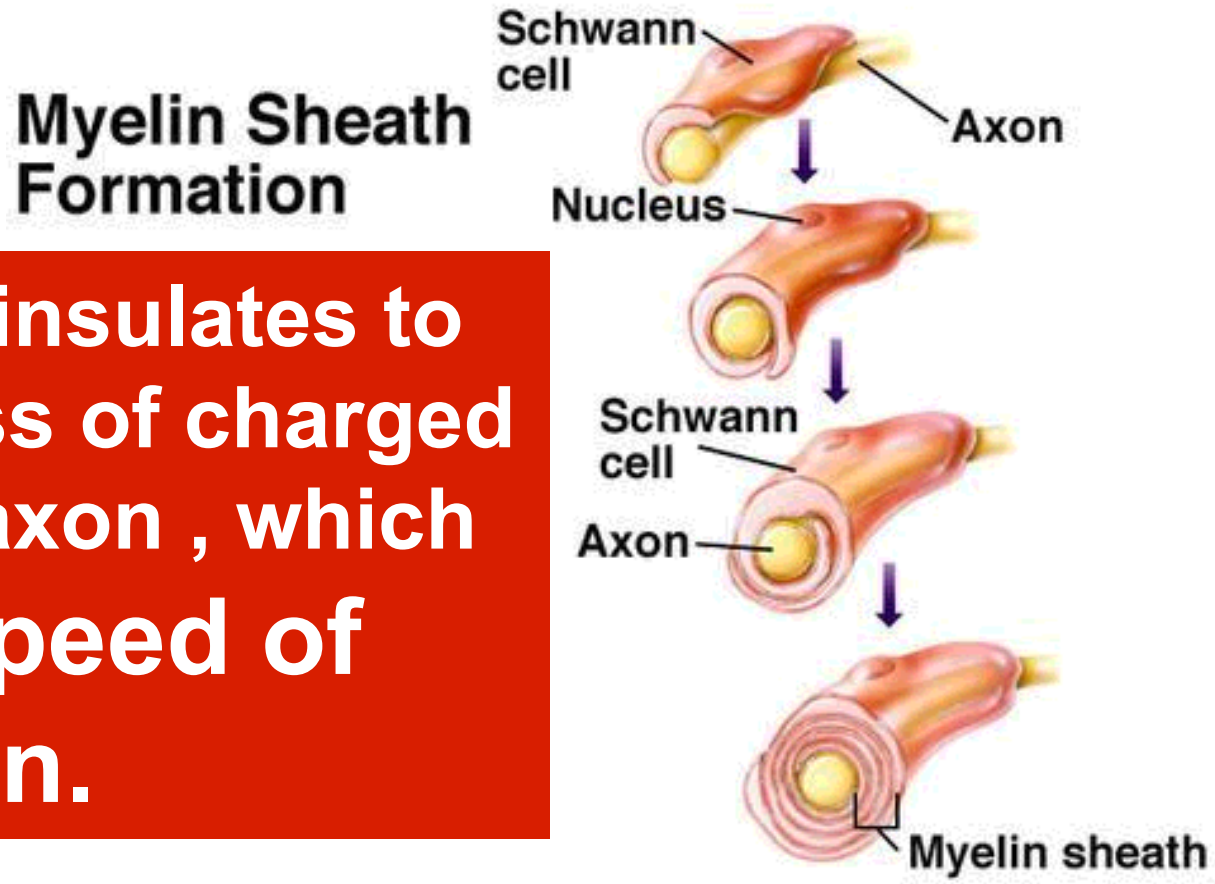
and

a **myelin sheath** around the axon



Purpose:

Myelin sheath insulates to prevent the loss of charged ions from the axon , which increases speed of transmission.

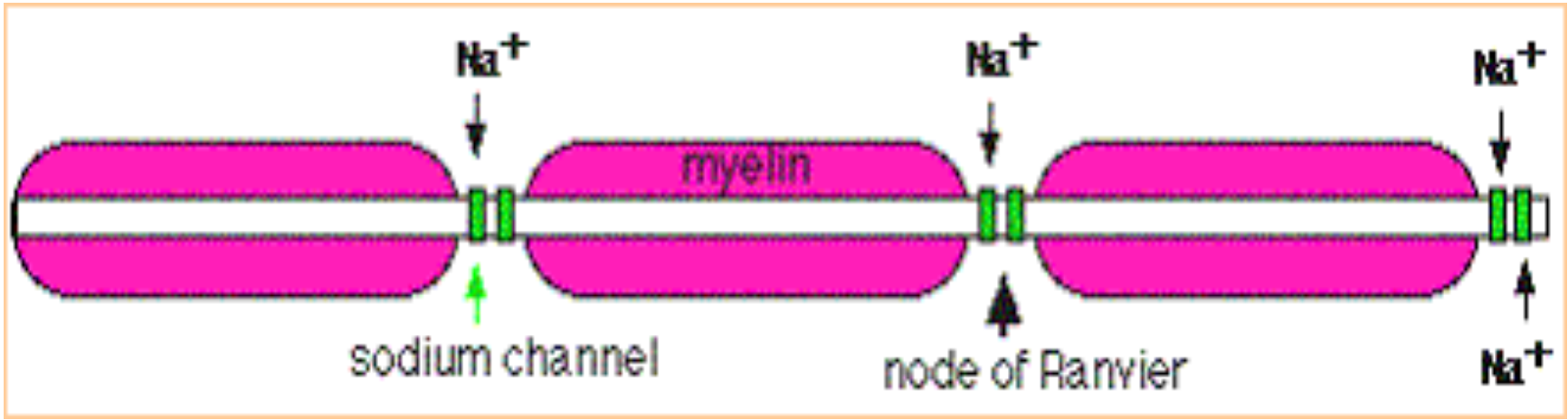


Formed by:

Schwann cells wrapping around the axon.

Nodes of Ranvier

- **Gaps between the myelin sheath.**
- **Nerve impulse slows here because the axon becomes depolarized.**
- **Nerve impulses jump from node to node = saltatory conduction**



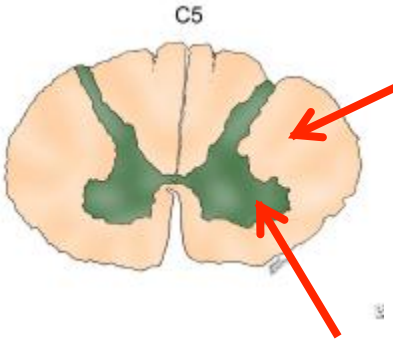
Neurilemma

Promotes regeneration of damaged neurons = Healing

– Ex. Paper cut

•Found on all PNS neurons

Spinal cord



White matter = myelin and neurilemma, so can regenerate

Grey matter = no myelin or neurilemma

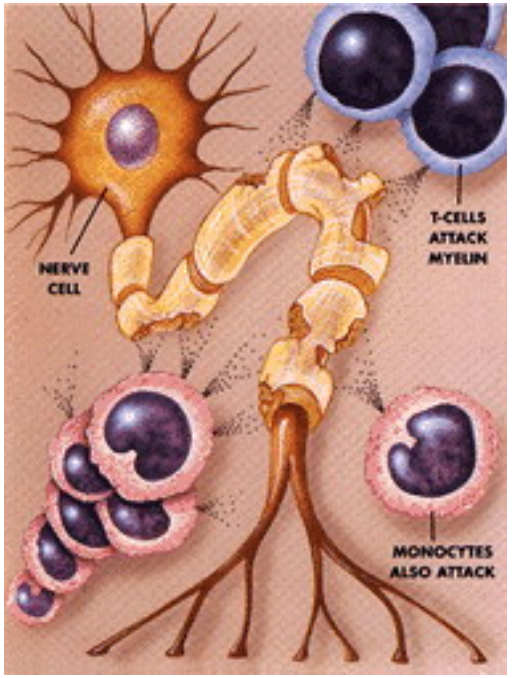
-no regeneration

– Ex. Spinal cord injuries

Multiple Sclerosis (MS)

- Autoimmune disease → **the body's own immune system breaks down the myelin sheath on the neuron**
- Due to destruction of the **myelin sheath** = *inefficient* nerve transmission

Myelin in brain and spinal cord is destroyed and hardens, forming scars



Causes: **Genetics**, viruses or the **environment**

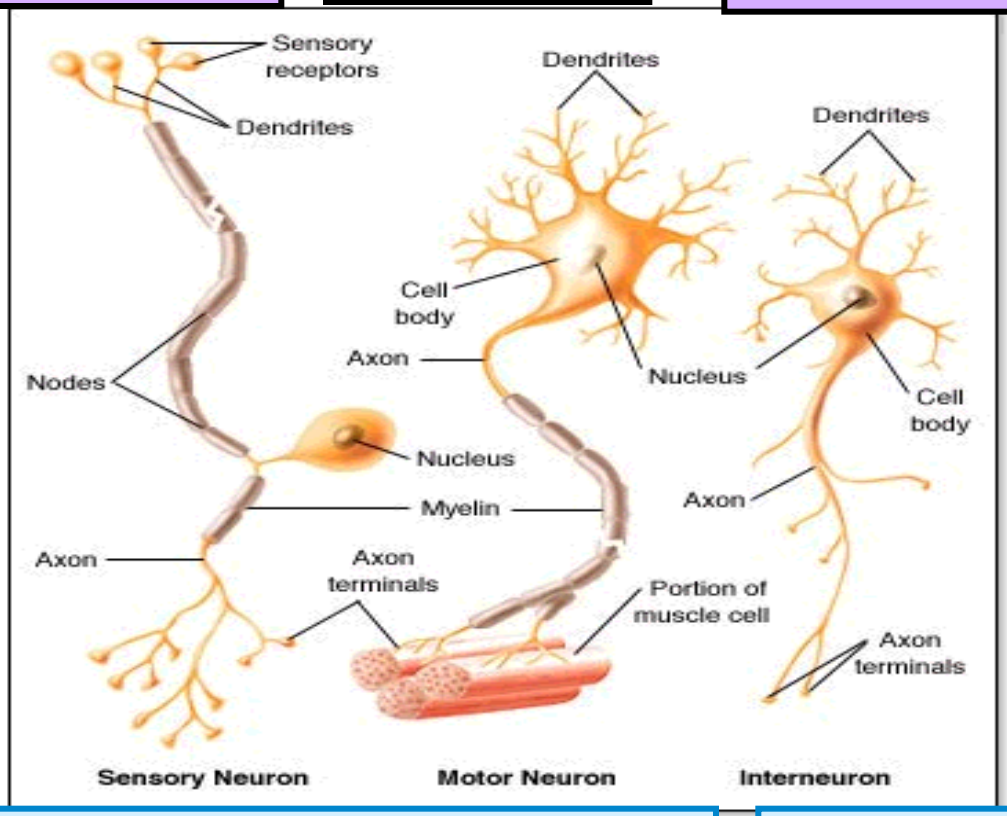
Symptoms: double vision, jerky limb movements, partial paralysis

Treatment: wheelchairs, medications to stop myelin destruction, leg braces, occupational therapy, physical therapy, gene therapy

Sensory Neuron

Motor Neuron

Interneuron



Sensory and motor neurons have a myelin sheath.

Internuerons are shorter and do not have a myelin sheath

3 Types of Neurons

Unipolar
(Sensory Neuron)

Sensory neuron: carries information from sensory receptors (affectors) to Central Nervous System (CNS)

IN

3 Types of Neurons

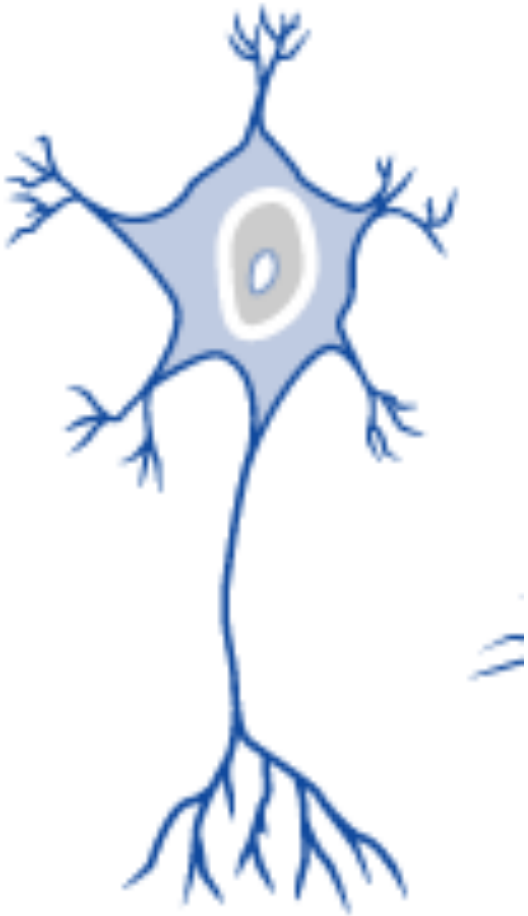
Bipolar
(Interneuron)

Interneurons

Mostly in brain and spinal cord

- **Integrate and interpret info**
- **carries info between sensory and motor neurons**
- **short, no myelin**

3 Types of Neurons

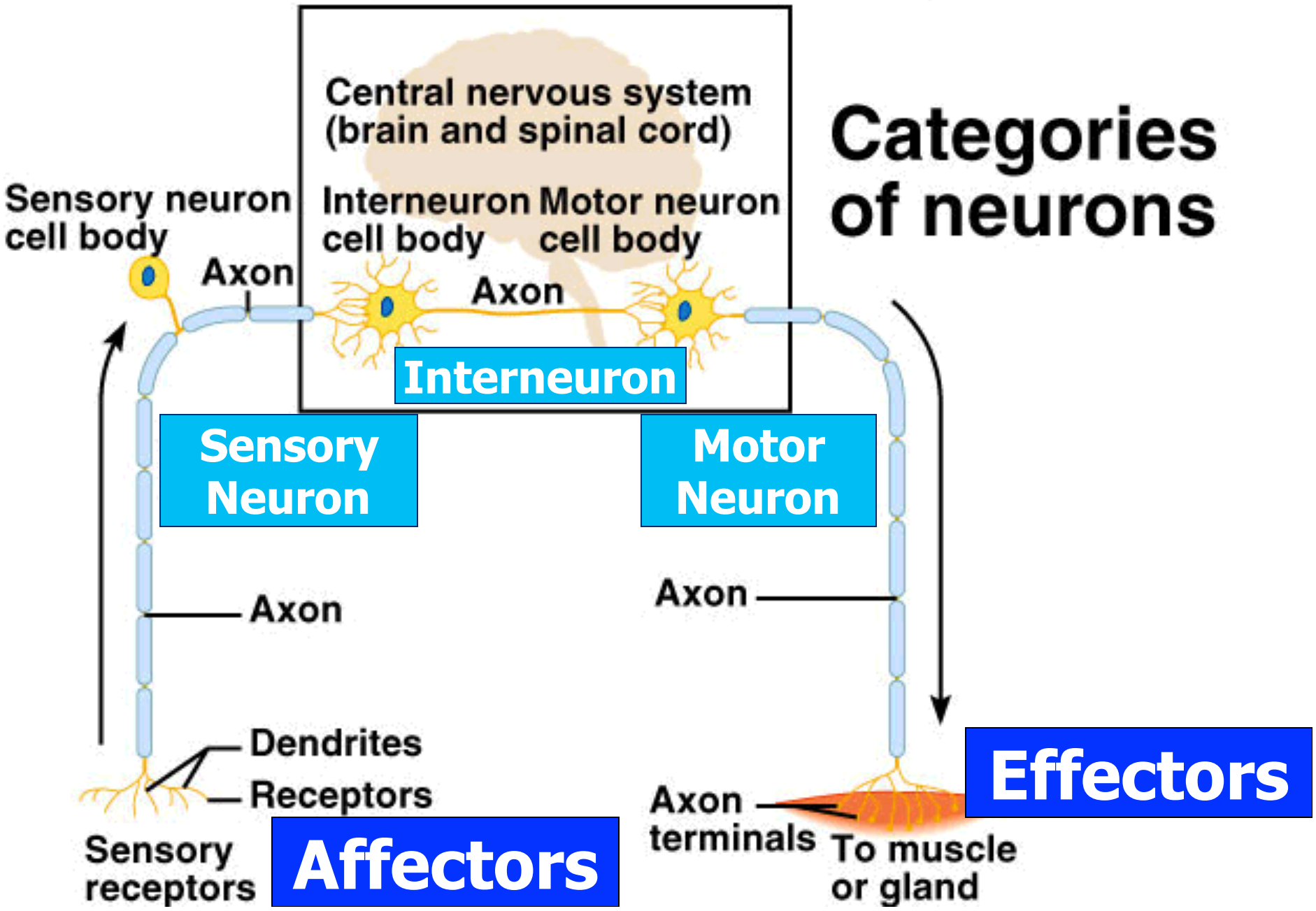


Multipolar
n) (Motoneuron)

Motor neuron: Sends info from **CNS** to **effectors** which include glands and muscles

OUT

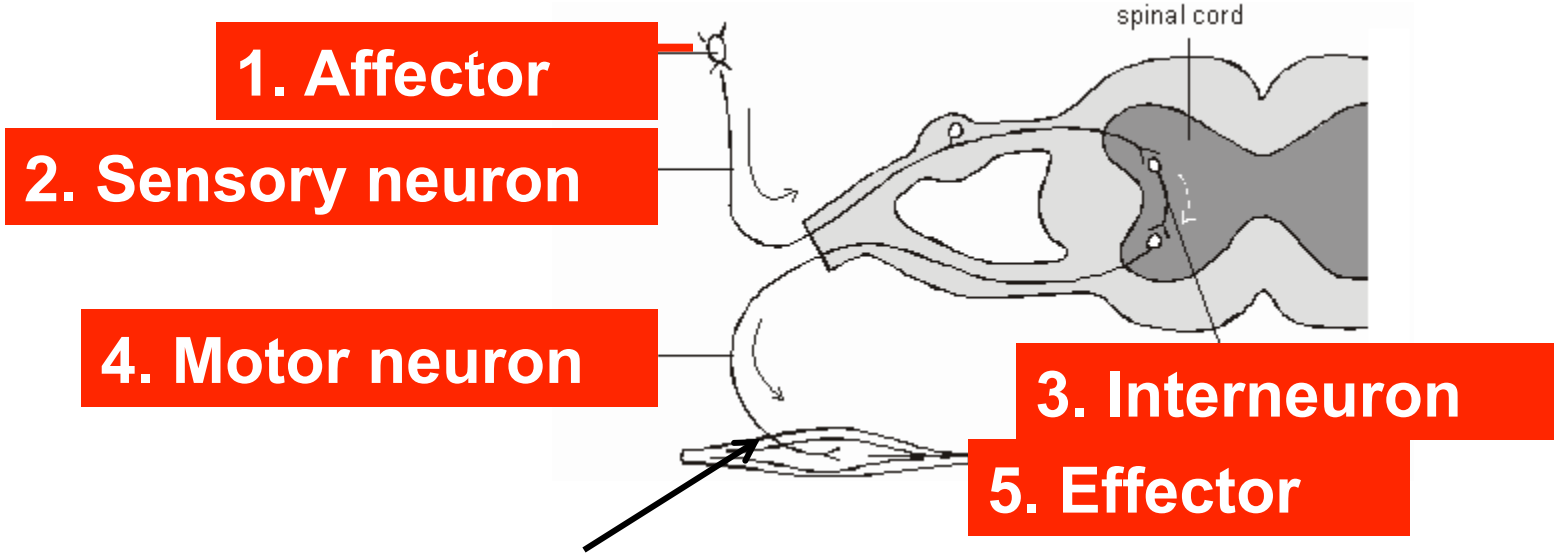
Input → Integration → Response



Reflex arc

- **Involuntary and unconscious**
  - **Bypasses the brain** Ex. Touching a hot stove, blinking
- Purpose: **to make quick responses (without thinking)**

5 main components



Neuromuscular junction or synapse
(where the motor neuron meets the muscle)

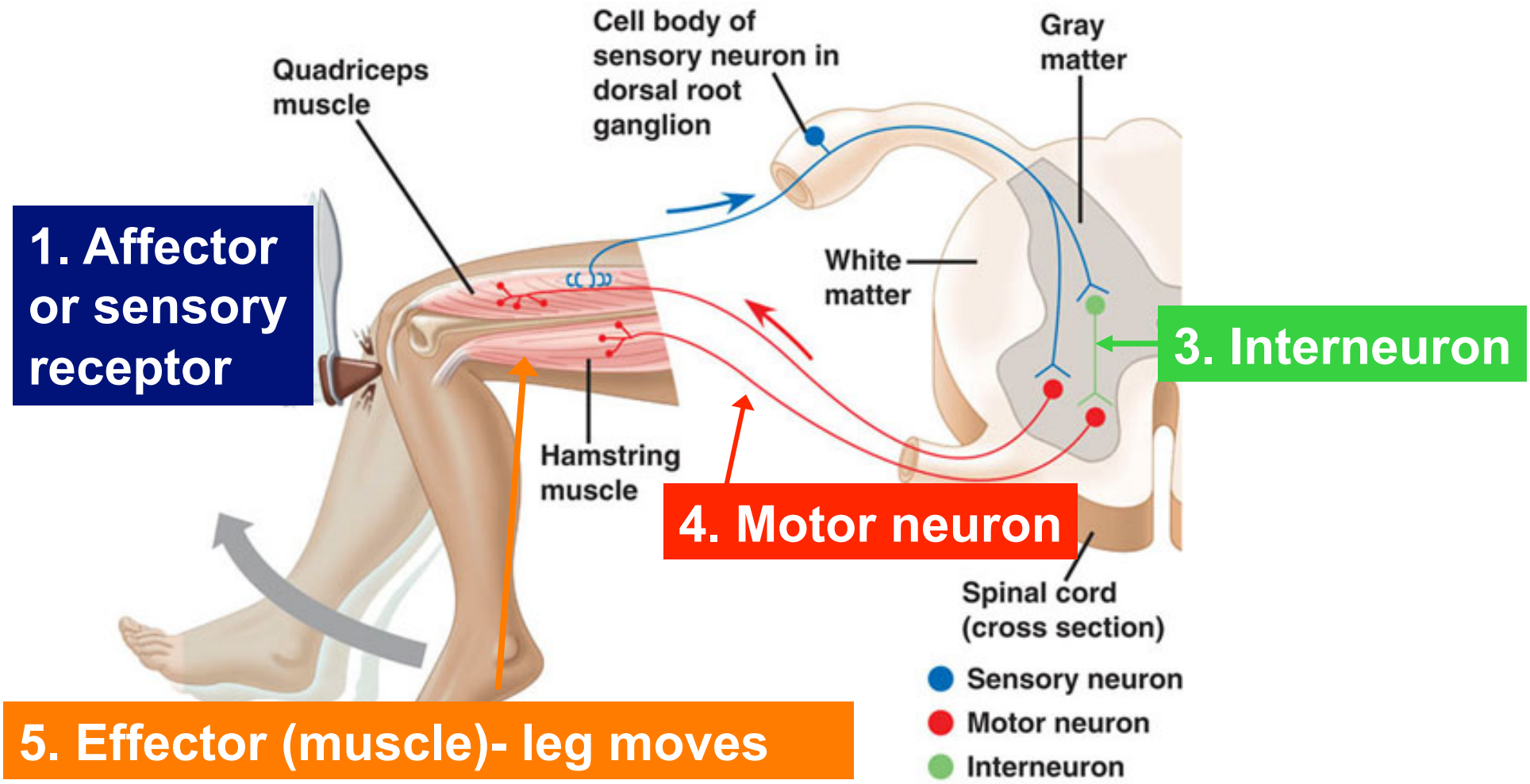
Dorsal Fin:
Jaws in 60s

http://www.youtube.com/watch?v=hZgMJ-WFzPg&safety_mode=true&persist_safety_mode=1&safe=active

Reflex arc

ASIME

2. Sensory neuron



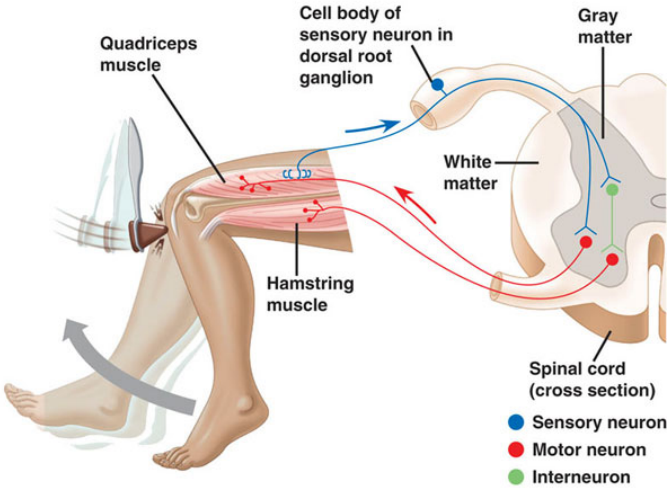
1. Affector or sensory receptor

3. Interneuron

4. Motor neuron

5. Effector (muscle)- leg moves

Reflex Arc

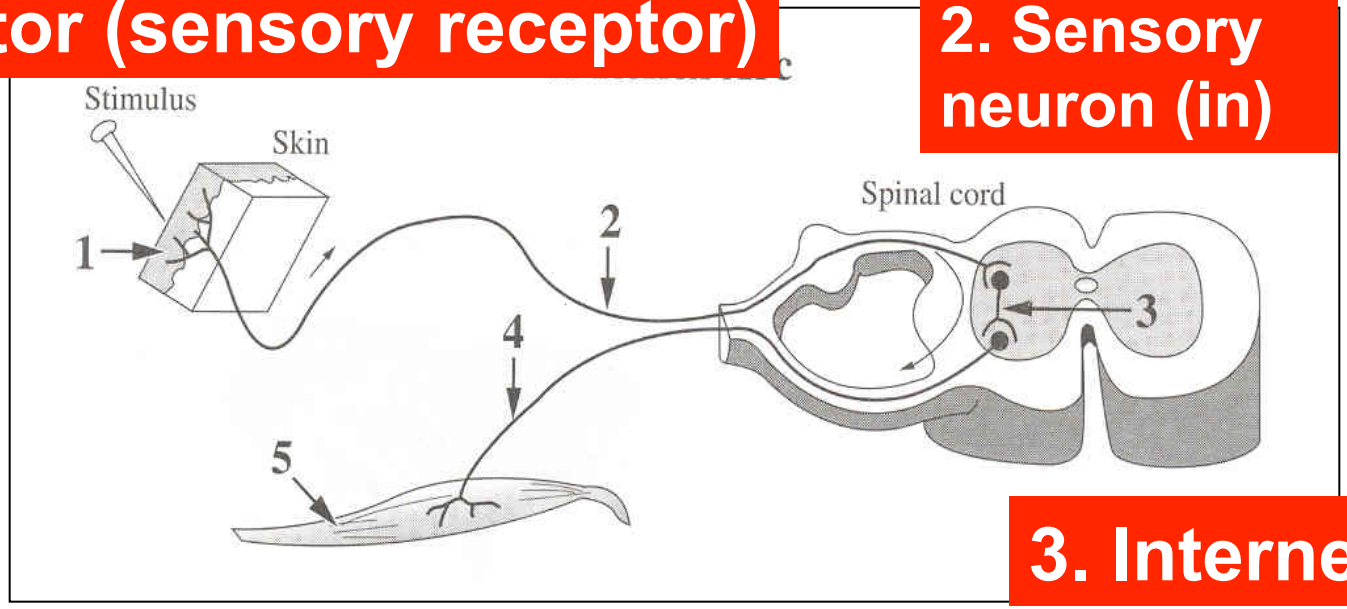


1. **Affector- receptor** (senses) detects stimulus and nerve impulse initiated
2. **Sensory neurons** carry impulse to spinal cord
3. **Interneuron** Co-ordination & Interpretation. Carries impulse to motor neuron.
4. **Motor neurons** carry impulse from spinal cord
5. **Effector** – muscle or gland that responds

Reflex arc video: http://www.youtube.com/watch?v=Y5nj3ZfeYDQ&feature=related
Patellar reflex video: http://www.youtube.com/watch?v=QmNQdLkkJHM&feature=related

Reflex Arc

1. Affector (sensory receptor)



2. Sensory neuron (in)

3. Interneuron

4. Motor neuron

5. Effector (muscle)

Neuron Assignment

1. Go to the following site, read the information, make notes (brief!) and do the 3 activities at the end.

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

2. Go to the following site and do the quiz on neuron!

http://psych.hanover.edu/Krantz/neural/struct3.html

Patellar or Knee Jerk Reflex

1. The subject is to sit on the edge of the lab table with the legs able to swing freely. (One partner will be the subject first and the other partner the tester, then you'll switch.)
2. Once the legs are relaxed and swing freely, the tester should use the side of their hand to "tap" the subject just below the kneecap.

What happened? Record your results in the data table.

3. Now have the person sit with their leg straight out. Tap the knee in the same place. Observe and record your results.
4. Switch places with your partner and repeat steps 1-3.

Record the data for both partners in your data table.

Papillary Reflex

- Have the subject close his or her eyes for one minute (no peeking). After one minute, stare into the subject's eyes and tell him/her to open his/her eyes.
- Observe and record what happens to the pupils.
- After the subject has been tested switch places and repeat with the partner.

Babinski's Response

•Have the subject remove one shoe and sock. Have the subject sit on the lab table with his/her foot extending just over the edge. Using a pen cap or fingernail, the experimenter is to scratch the subject's foot in one smooth stroke motion from toe to heel.

•Describe the response in the toes in your data table.

•After the subject has been tested switch places and repeat with the partner.

Blink Reflex

•Have the subject hold a sheet of clear plastic (transparency) in front of their face. Crumple up a small piece of paper and toss it toward their eyes. Observe what happens and record your data.

•After the subject has been tested switch places