Nervous System

Chapter 38

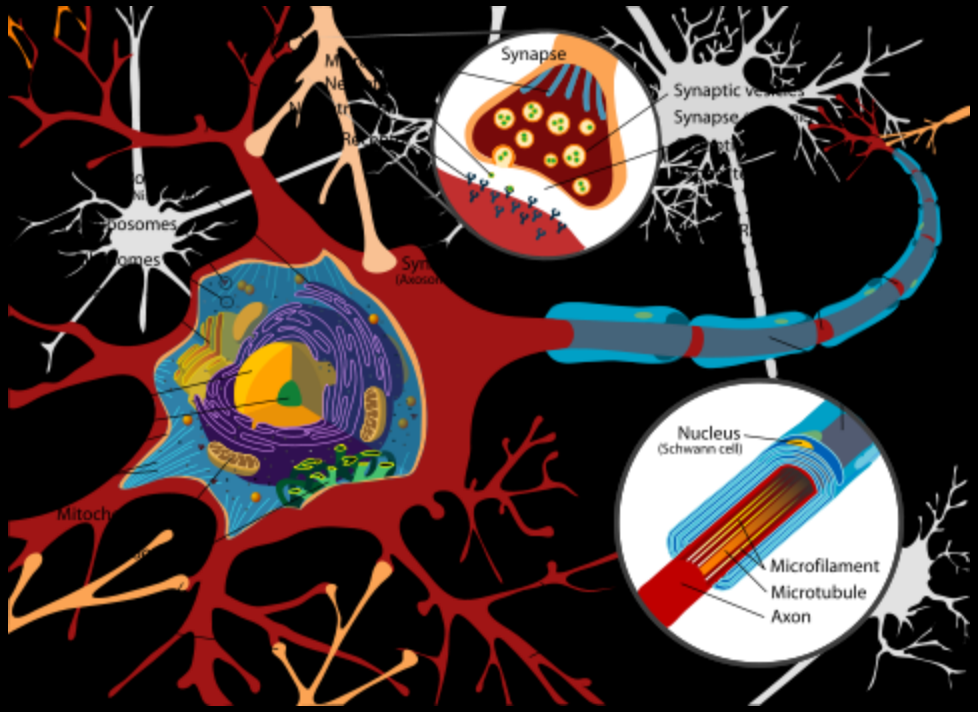
Chapter 38 Section 1: Structures of the Nervous System

Key Vocabulary Terms

Adapted from Holt Biology 2008

Neuron

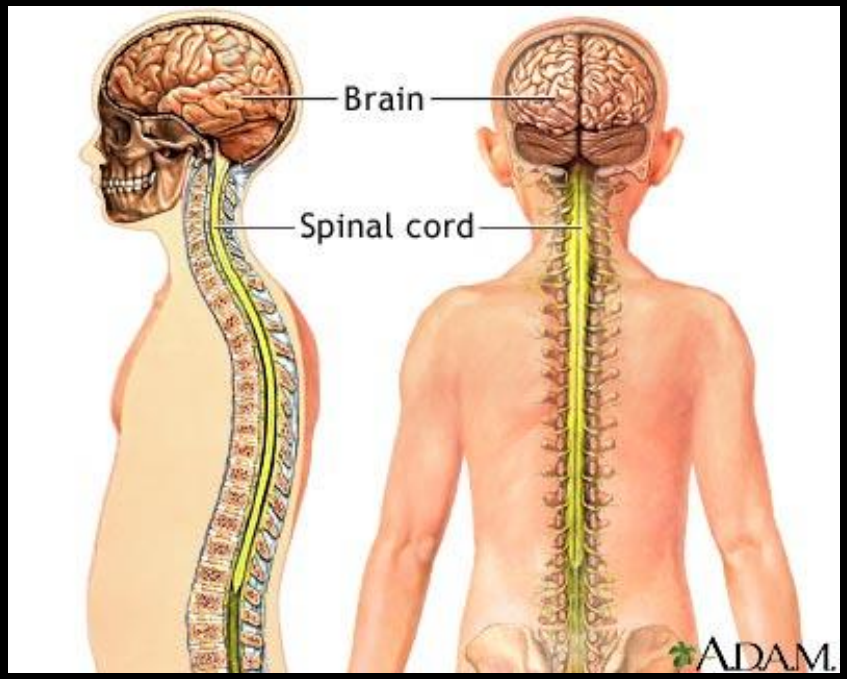
A nerve cell that is specialized to receive and conduct electrical impulses



Adapted from Holt Biology 2008

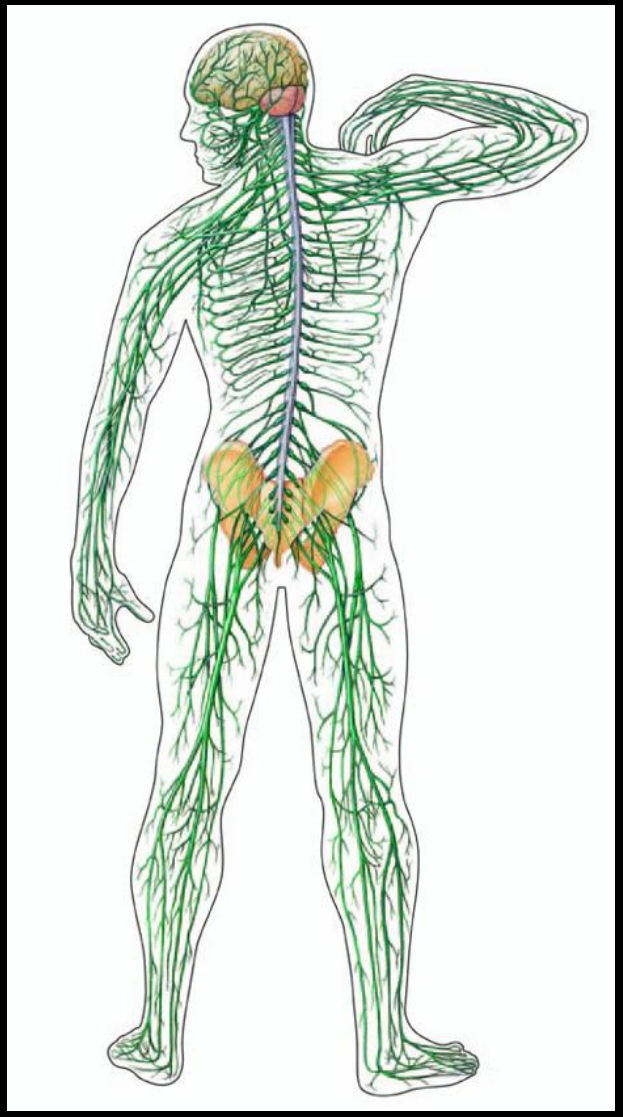
Central Nervous System (CNS)

The brain and the spinal cord; its main function is to control the flow of information in the body



Peripheral Nervous System (PNS)

All of the parts of the nervous system except for the brain and the spinal cord (the central nervous system); includes the cranial nerves and nerves of the neck, chest, lower back, and pelvis

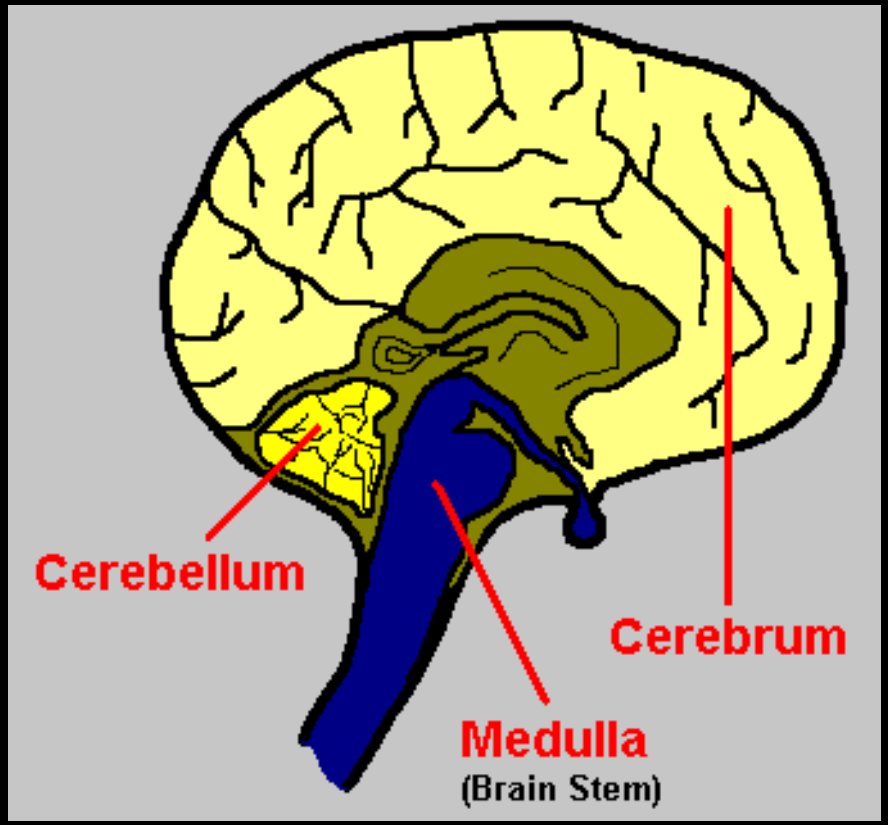


Brain

The mass of nerve tissue that is the main control center of the nervous system

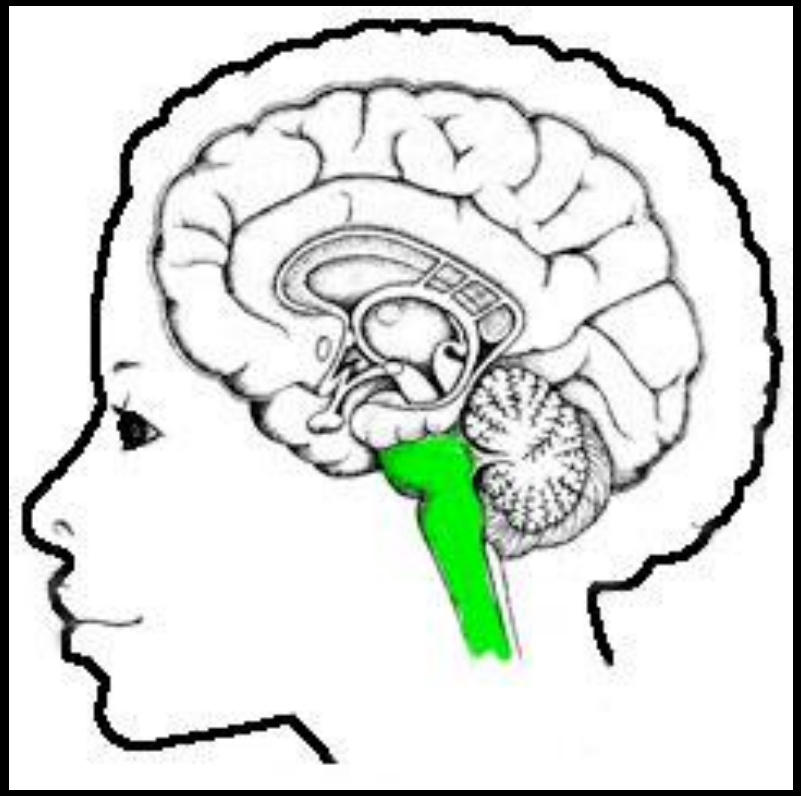
Cerebrum

The upper part of the brain that receives sensation and controls movement



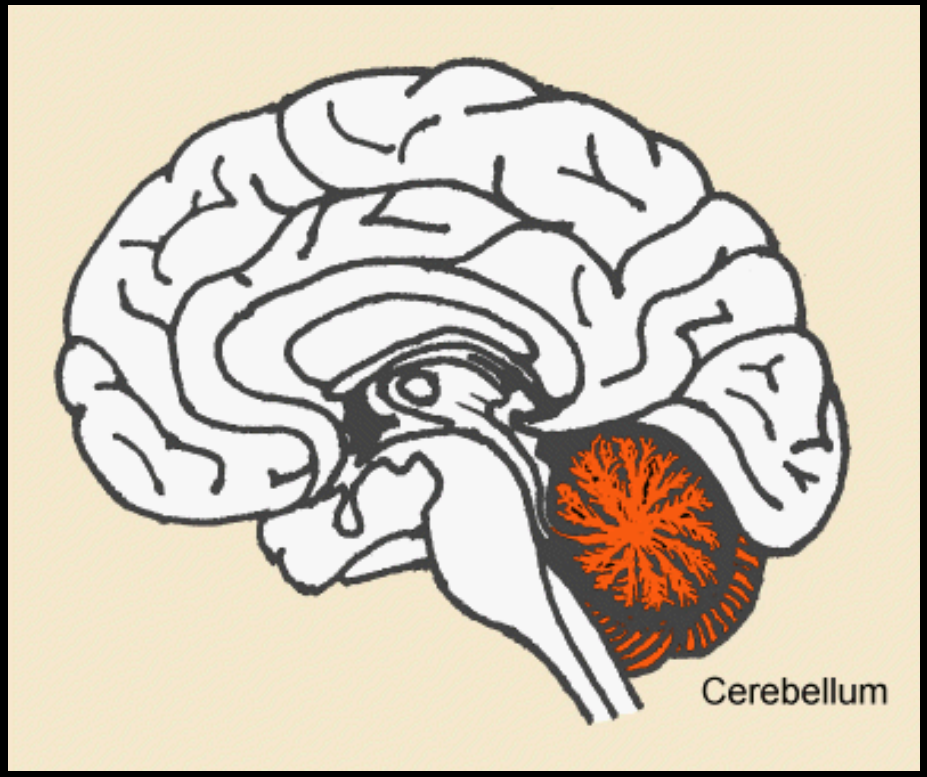
Brainstem

The stem like portion of the brain that connects the cerebral hemispheres with the spinal cord and that maintains the necessary functions of the body, such as breathing and circulation



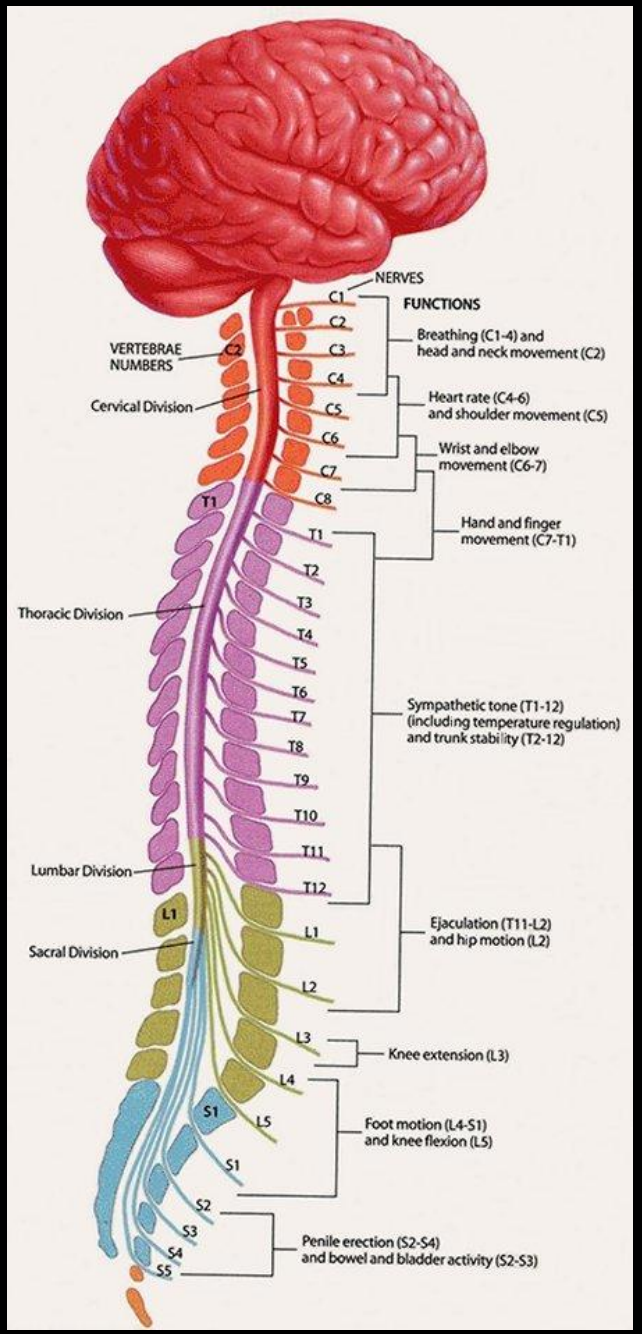
Cerebellum

A posterior portion of the brain that coordinates muscle movement and controls subconscious activities and some balance functions



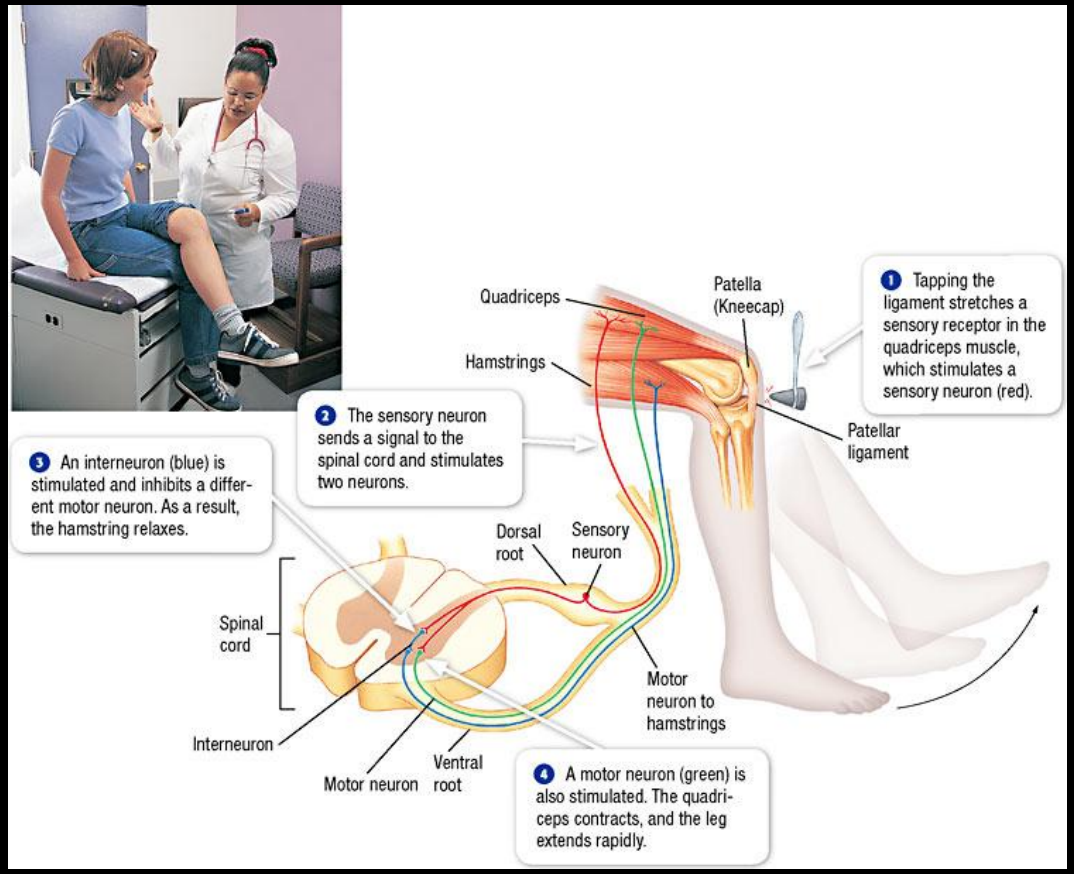
Spinal Cord

A column of nerve tissue running from the base of the brain through the vertebral column



Reflex

An involuntary and almost immediate movement in response to a stimulus



Content Objectives
Write these down!

I will be able to identify:

- The function of the central nervous system.
- The two components of the peripheral nervous system.
- How a spinal reflex is generated.

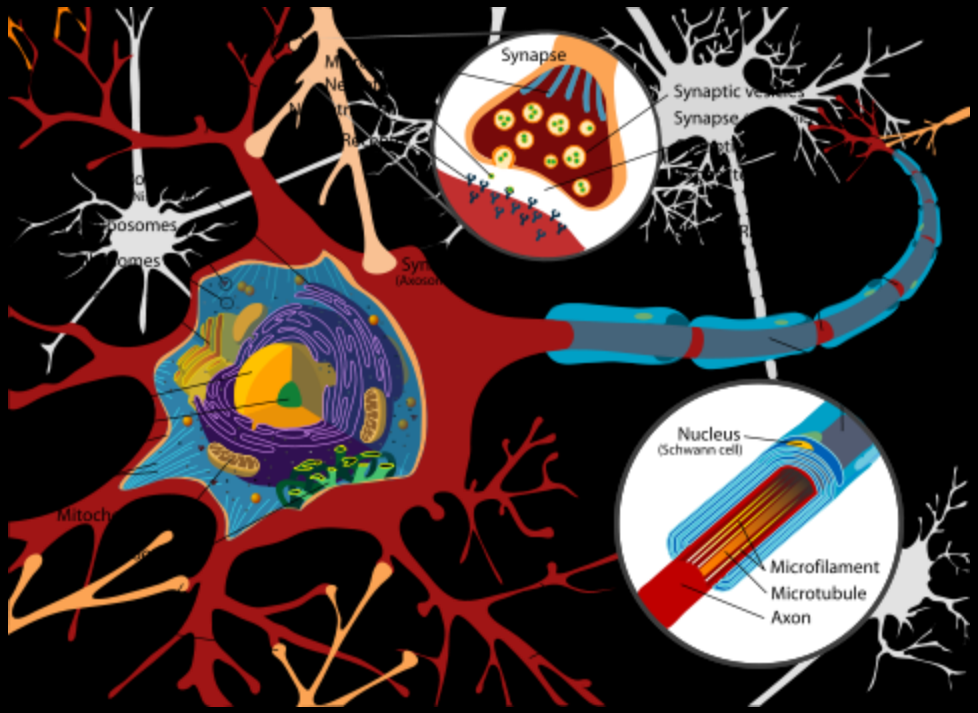
Chapter 38 - Section 1: Structures of the Nervous System

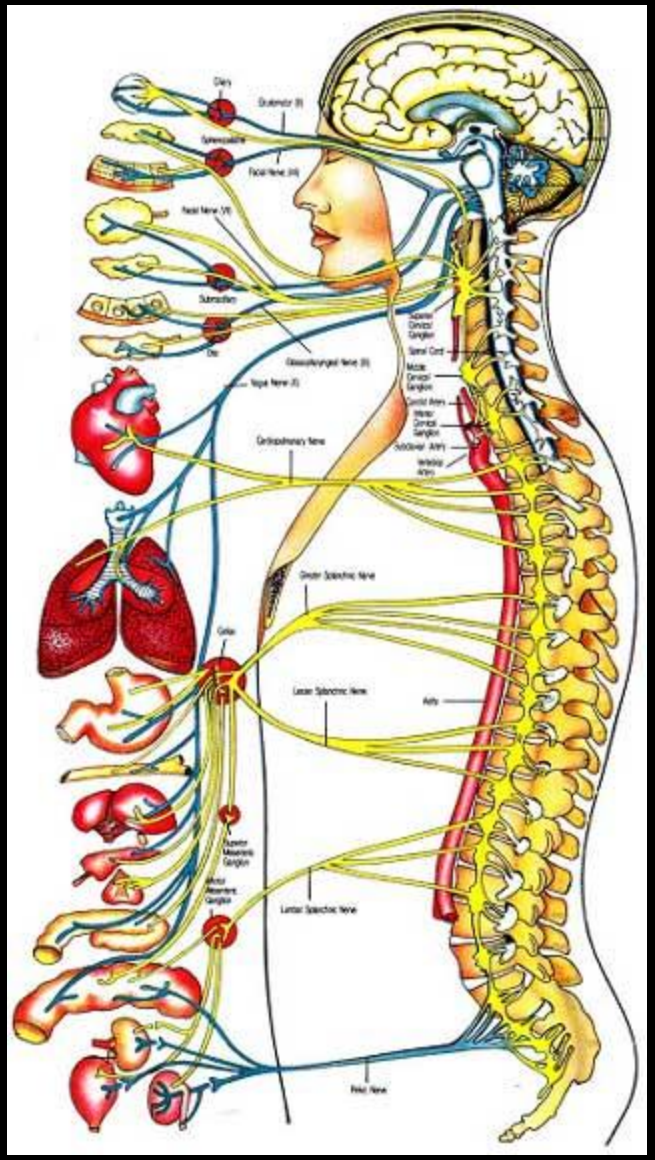
Notes

Adapted from Holt Biology 2008

The Nervous System

Neuron: specialized cell of the nervous system that carries messages (signaling cell)



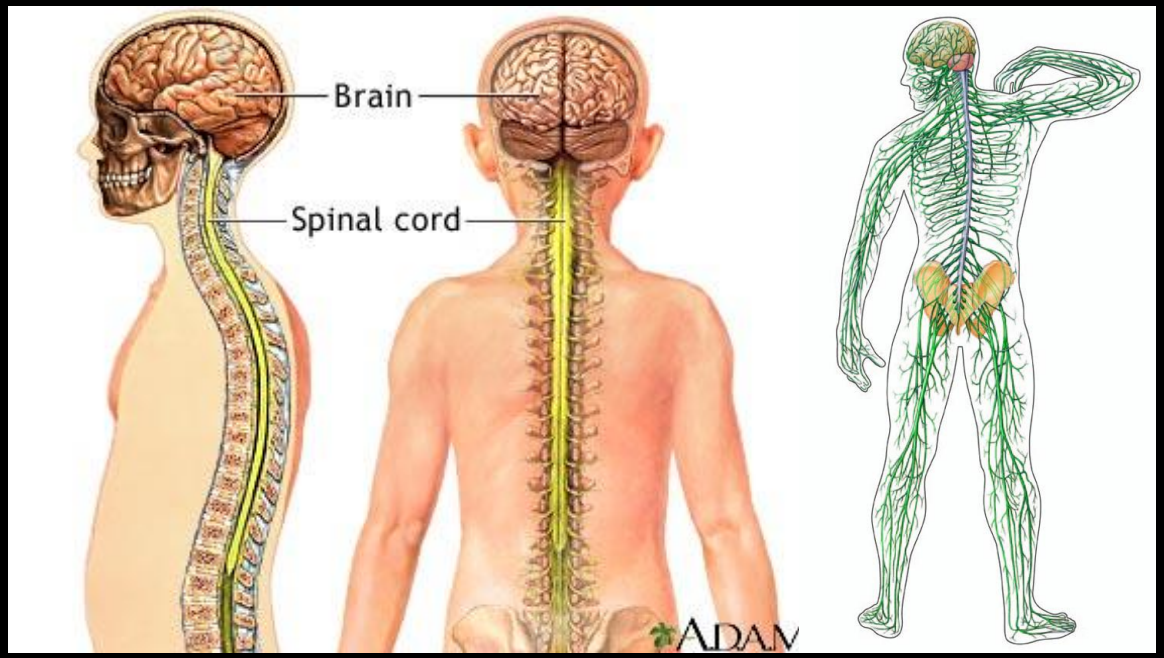


The Nervous System

Key point: *The nervous system controls and coordinates functions throughout the body and responds to internal and external changes.*

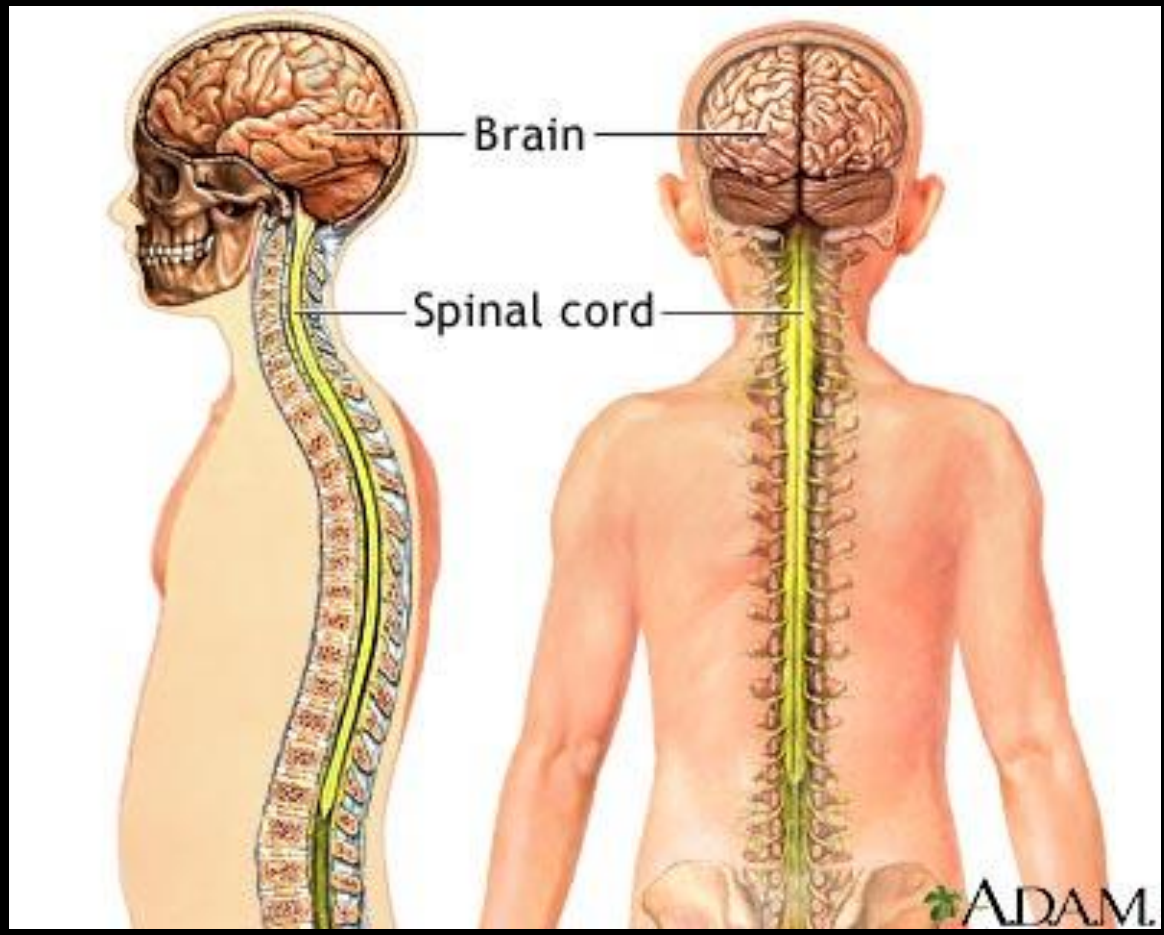
Divisions of the nervous system

1. Central Nervous System (CNS)
2. Peripheral Nervous System (PNS)



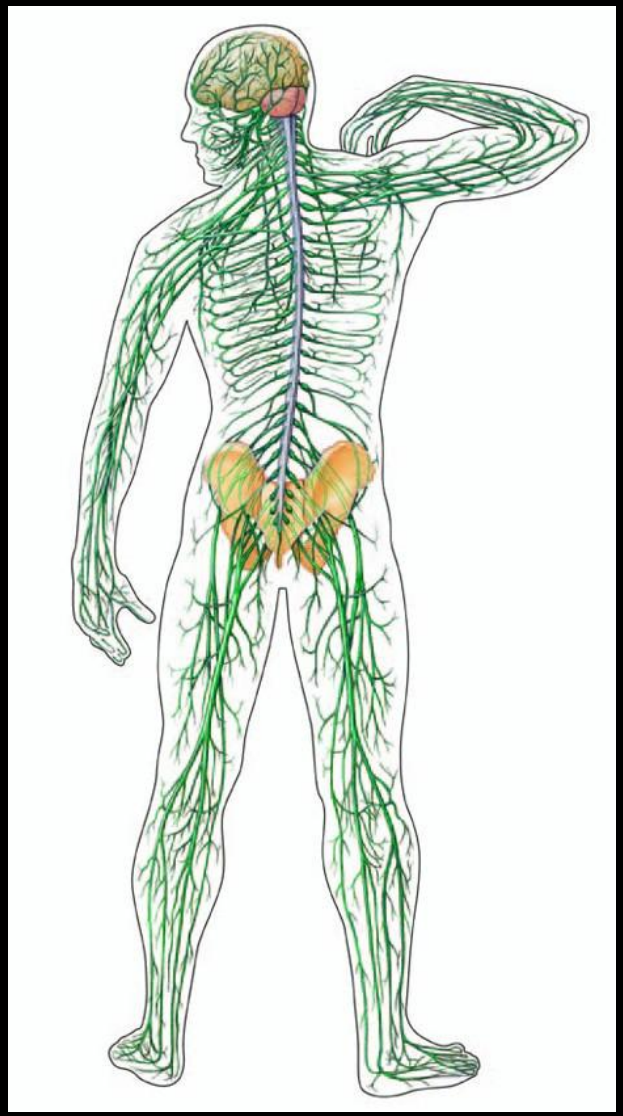
Central Nervous System (CNS)

a. Brain
b. Spinal cord

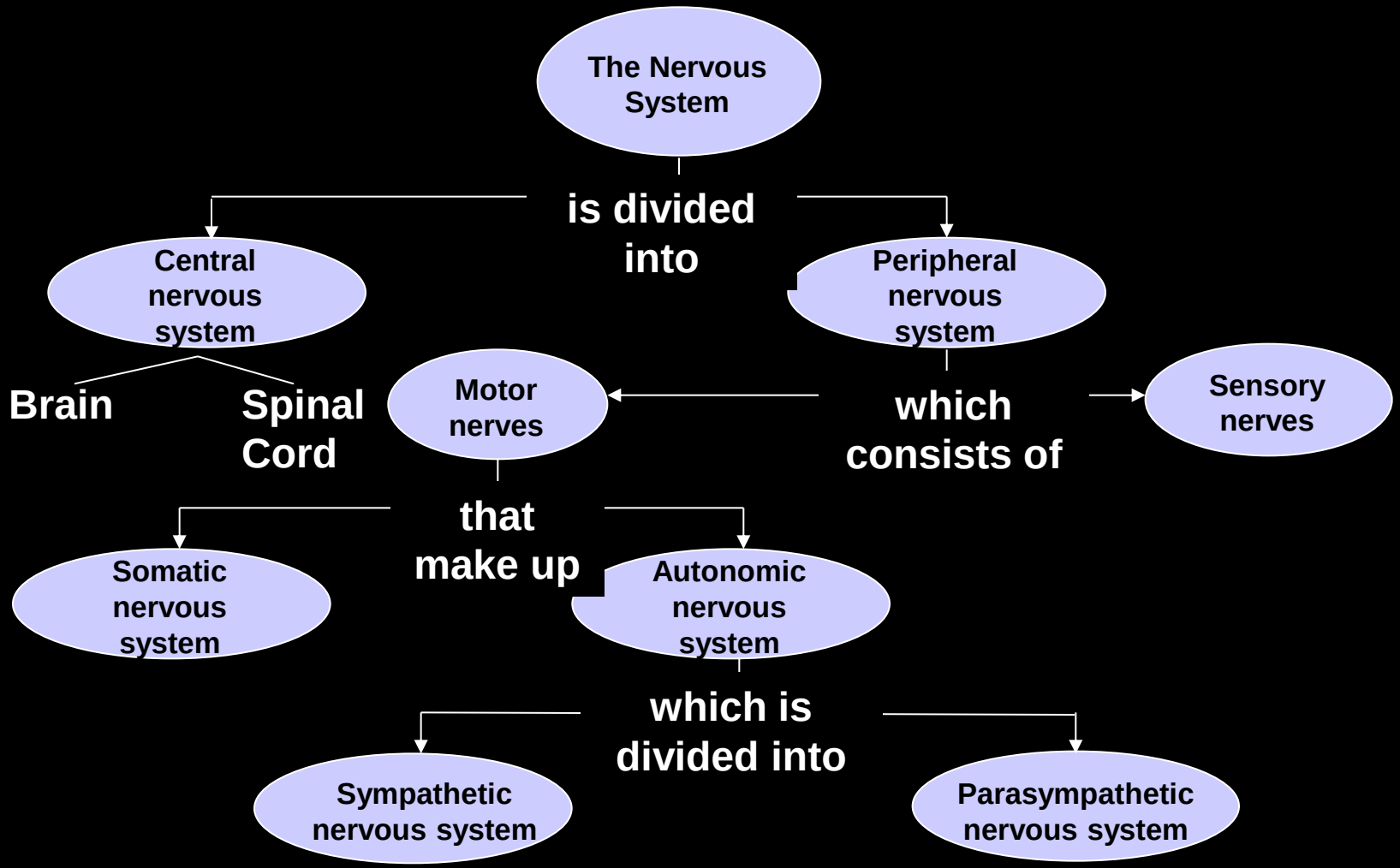


Peripheral Nervous System (PNS)

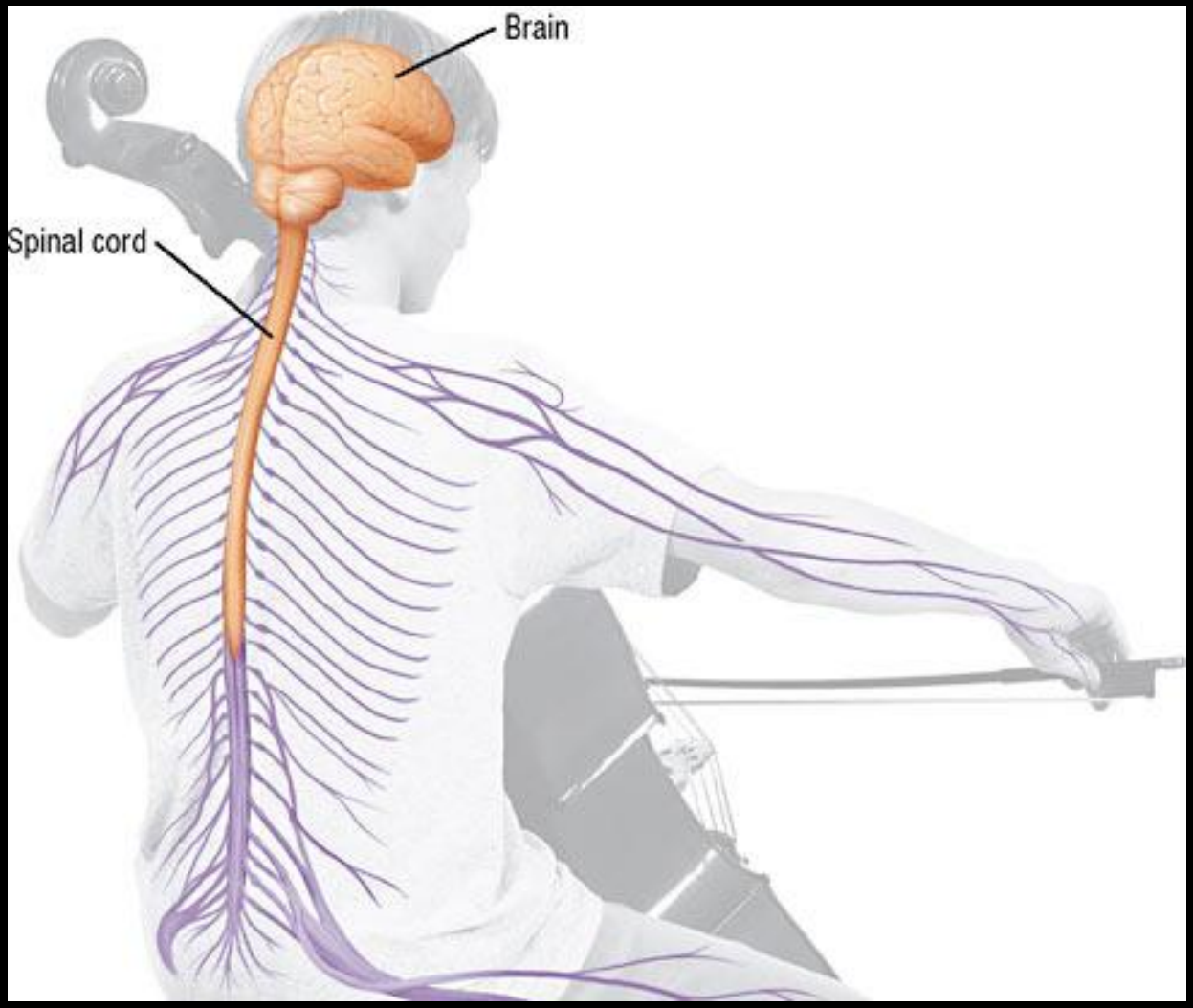
a. Sensory
b. Motor



Divisions of the Nervous System



Structures of the Nervous System



Think, Share, Write #1

What is a neuron?

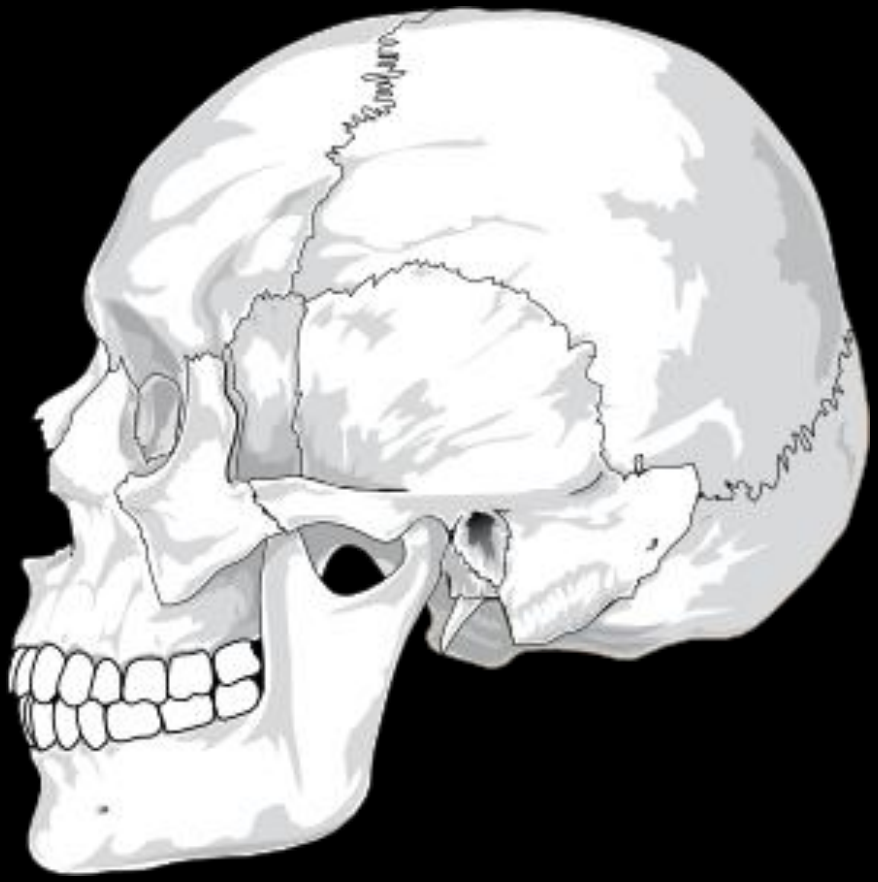
Think, Share, Write #1

What is a neuron?

A neuron is a specialized cell in the nervous system, a nerve cell.

The Brain

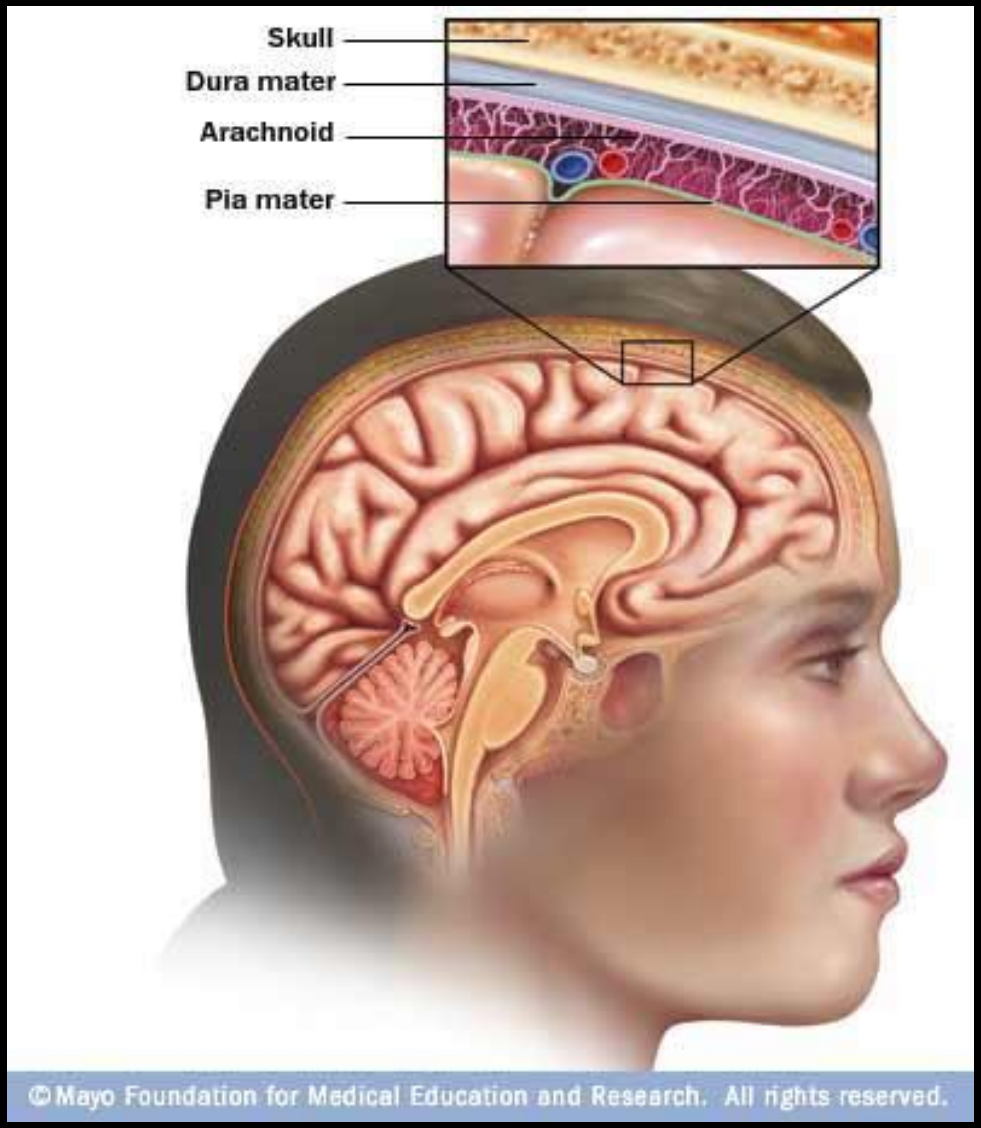
1. The Brain is protected by:
   a. skull: hard bone mass



1. The Brain is protected by:

b. meninges:

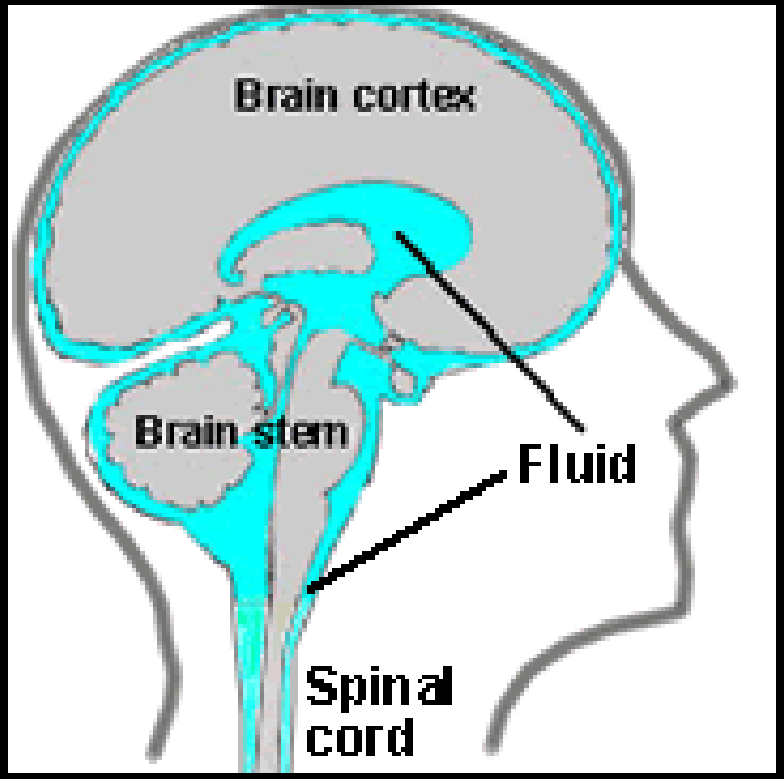
3 layers of tissue covering the brain



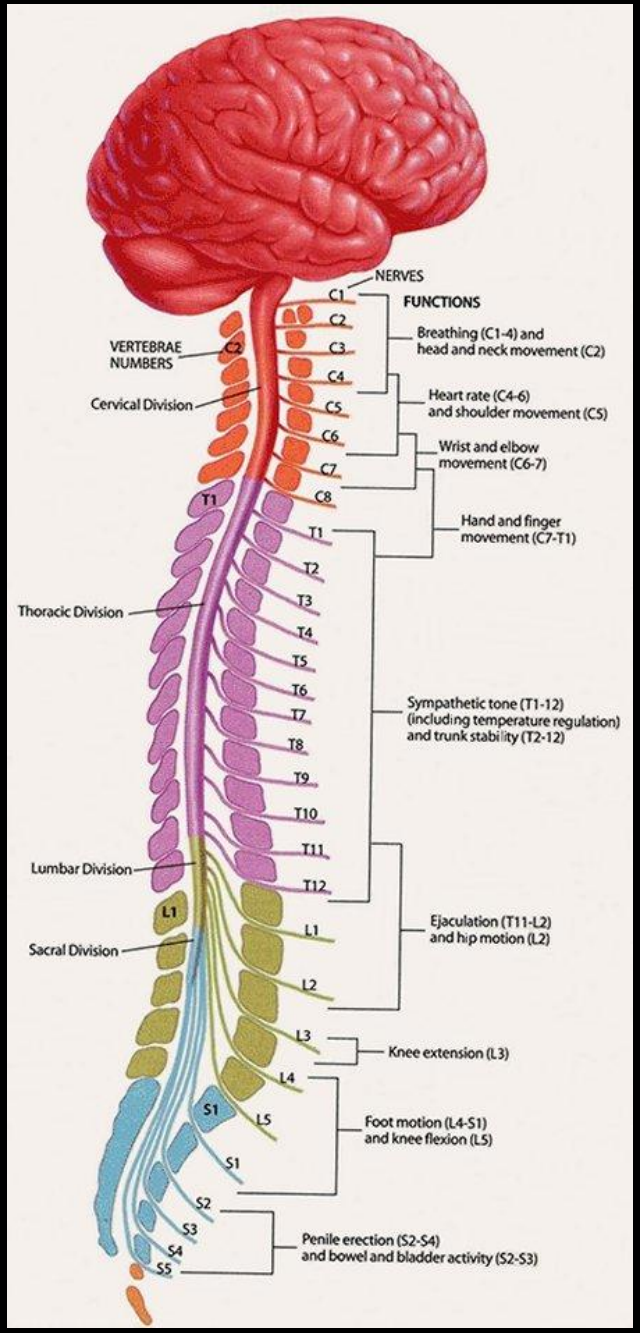
1. The Brain is protected by:

c. cerebrospinal fluid:

surrounds and absorbs shock

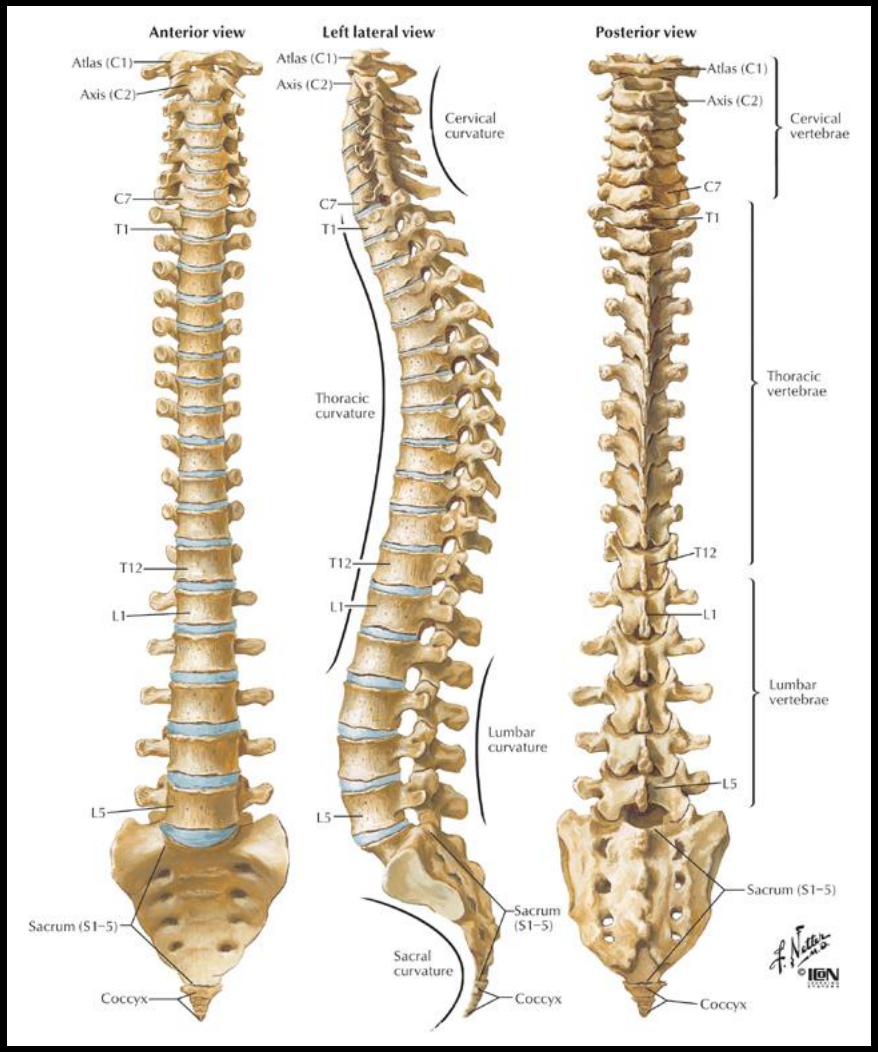


2. Spinal Cord



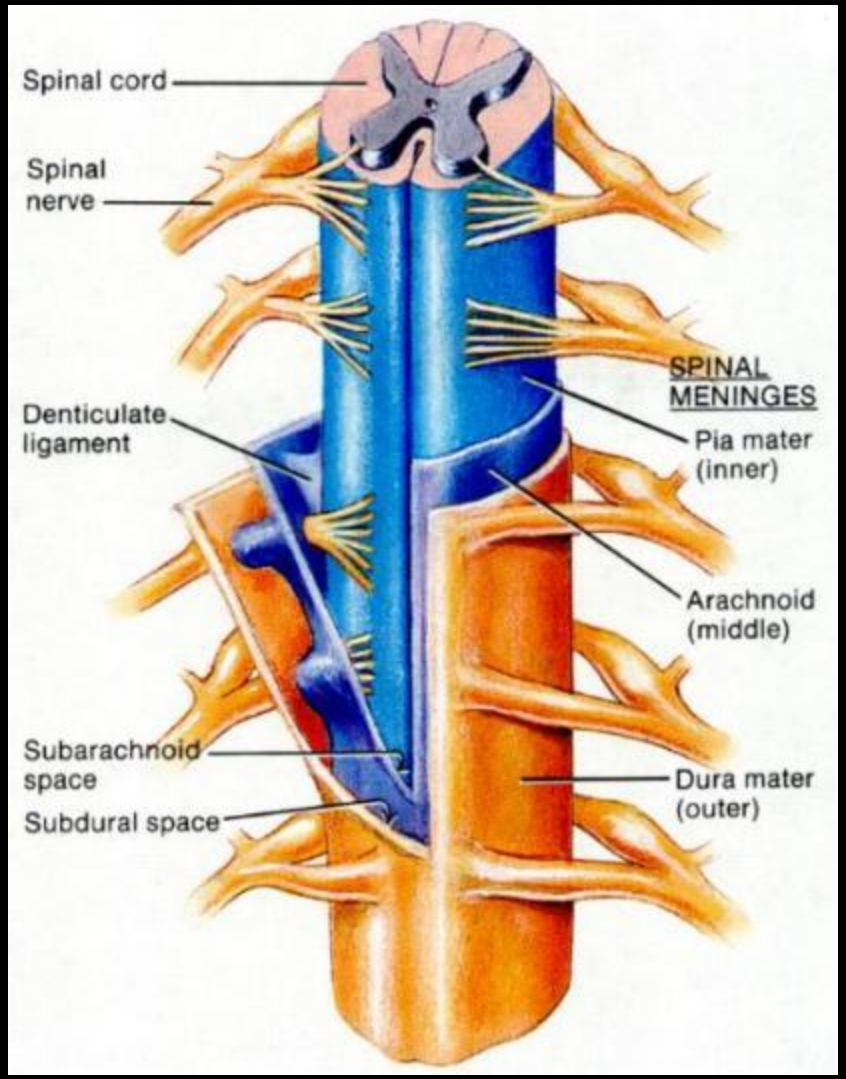
2. Spinal Cord Protected by:

a. vertebrae: bone



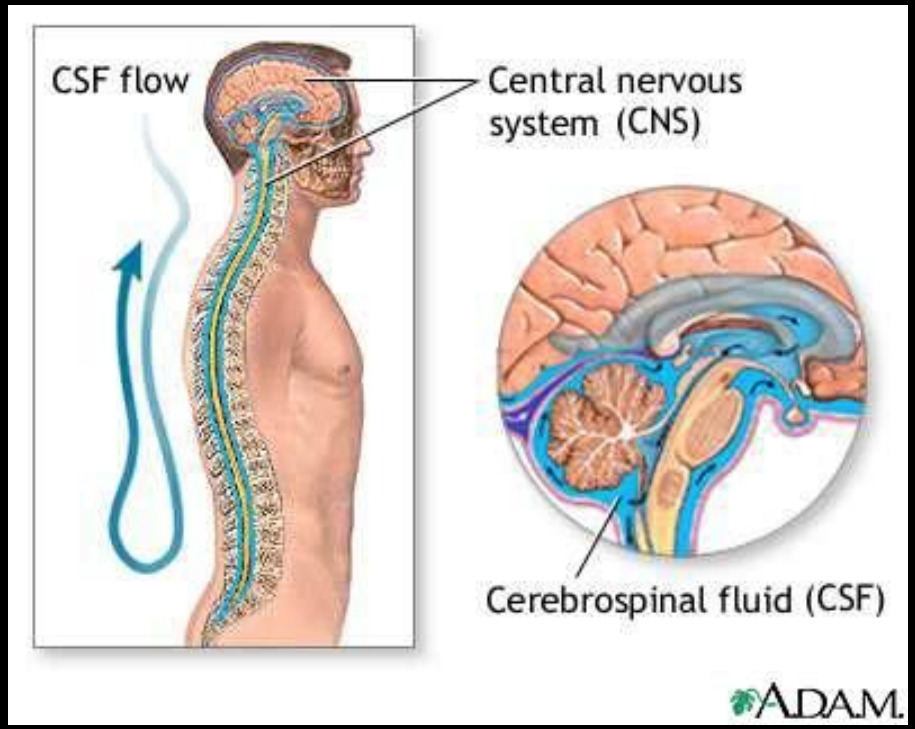
2. Spinal Cord Protected by:

b. meninges:
3 layers of tissue



2. Spinal Cord Protected by:

c. cerebrospinal fluid: wraps around, shock absorber



YOUR TURN

- With a partner, read the Chapter 38 Section 1 Active Reading – Structures of the Nervous System
- 1st - Take turns reading the questions aloud to each other, alternating questions.
- 2nd - Take turns reading the selection aloud to each other, alternating sentences or paragraphs.

YOUR TURN

- As you read discuss the content.
- Reread and discuss each question. Write down the best answer to the question using full descriptive sentences.
- Be prepared to share with the class.

Content Objectives

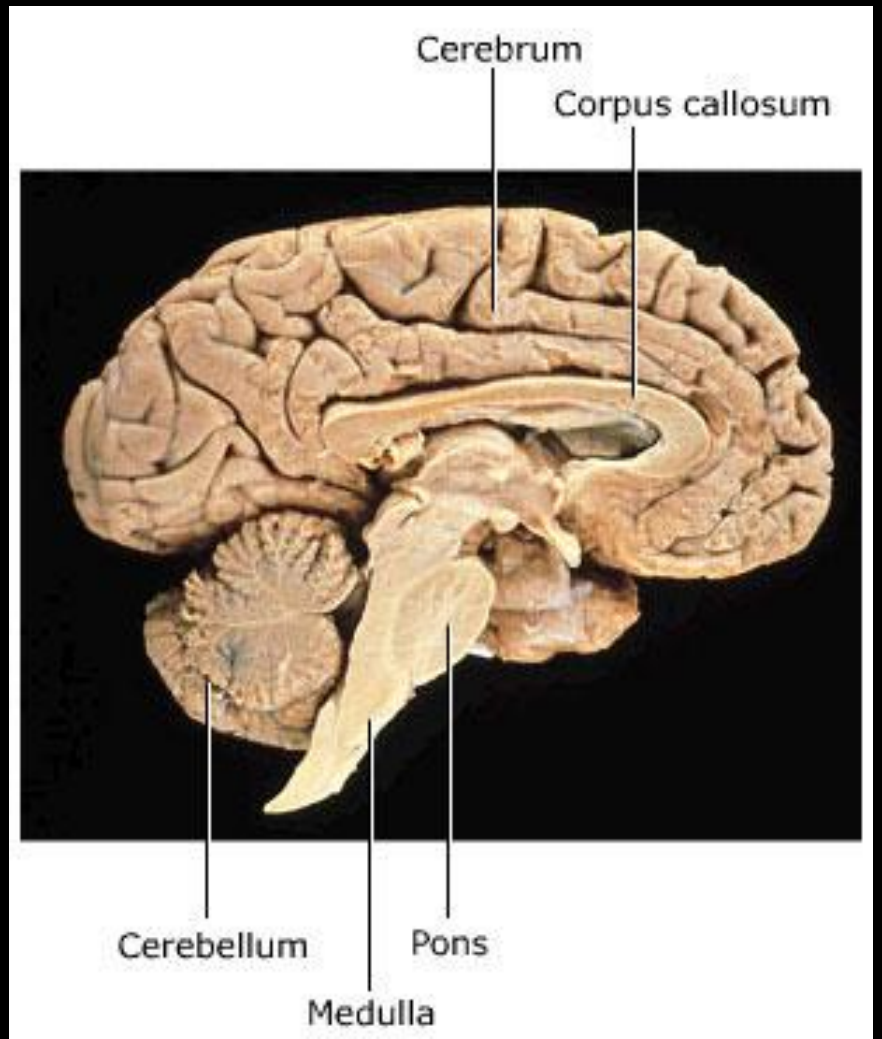
Write these down!

I will be able to identify:

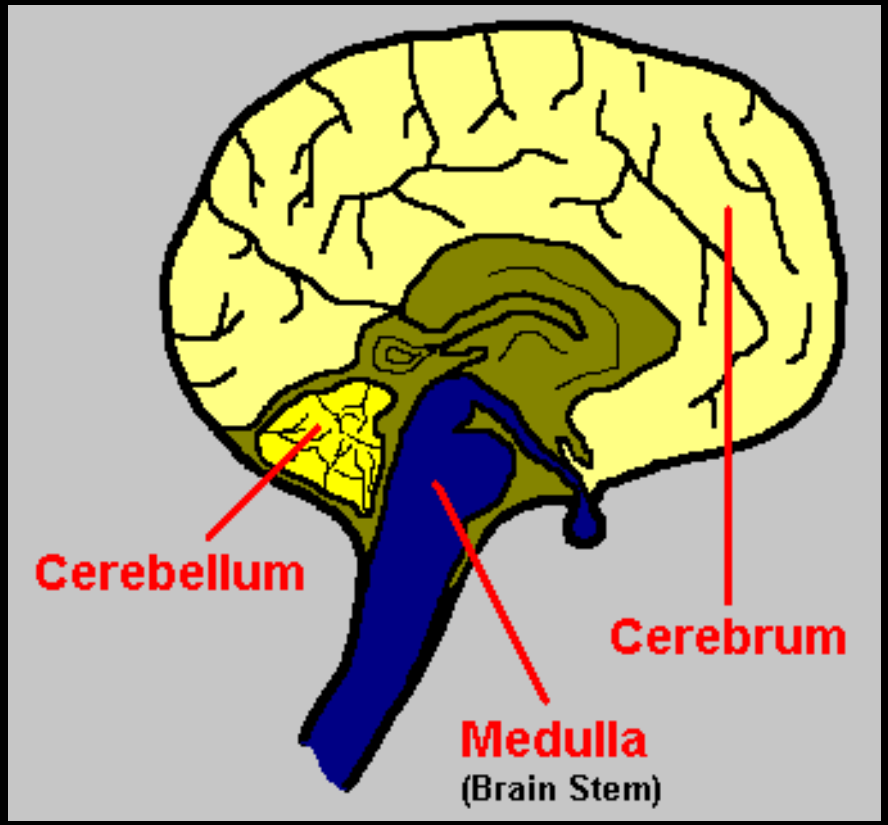
- The function of the central nervous system.
- The two components of the peripheral nervous system.
- How a spinal reflex is generated.

Four Main Areas of the Brain:

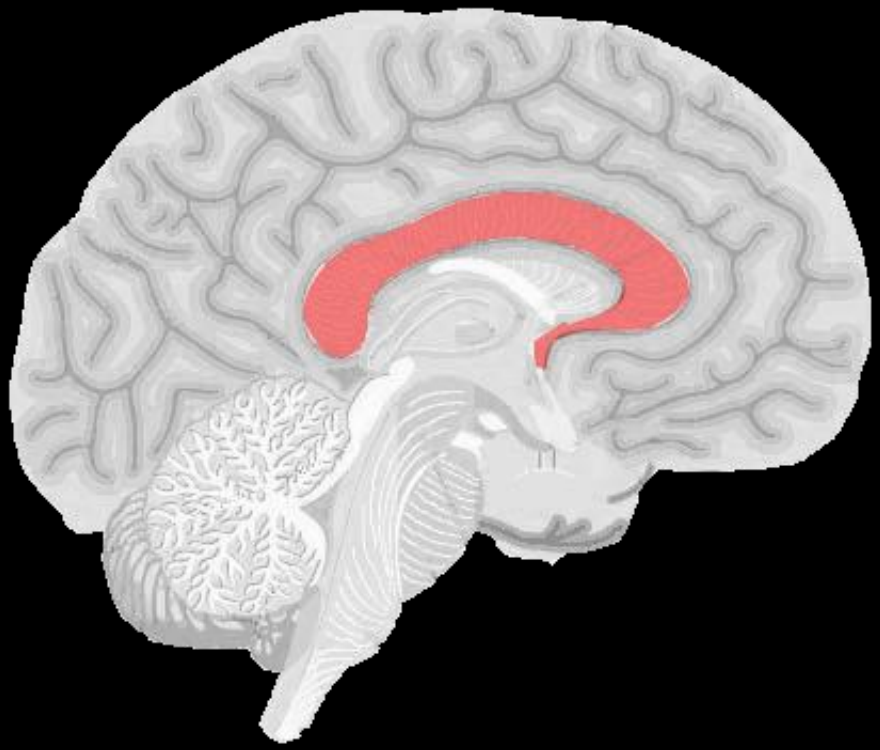
1. *Cerebrum*
2. Cerebellum
3. Pons
4. Medulla



1.*Cerebrum:* largest, most prominent part, voluntary activities of the body, intelligence, learning, judgment

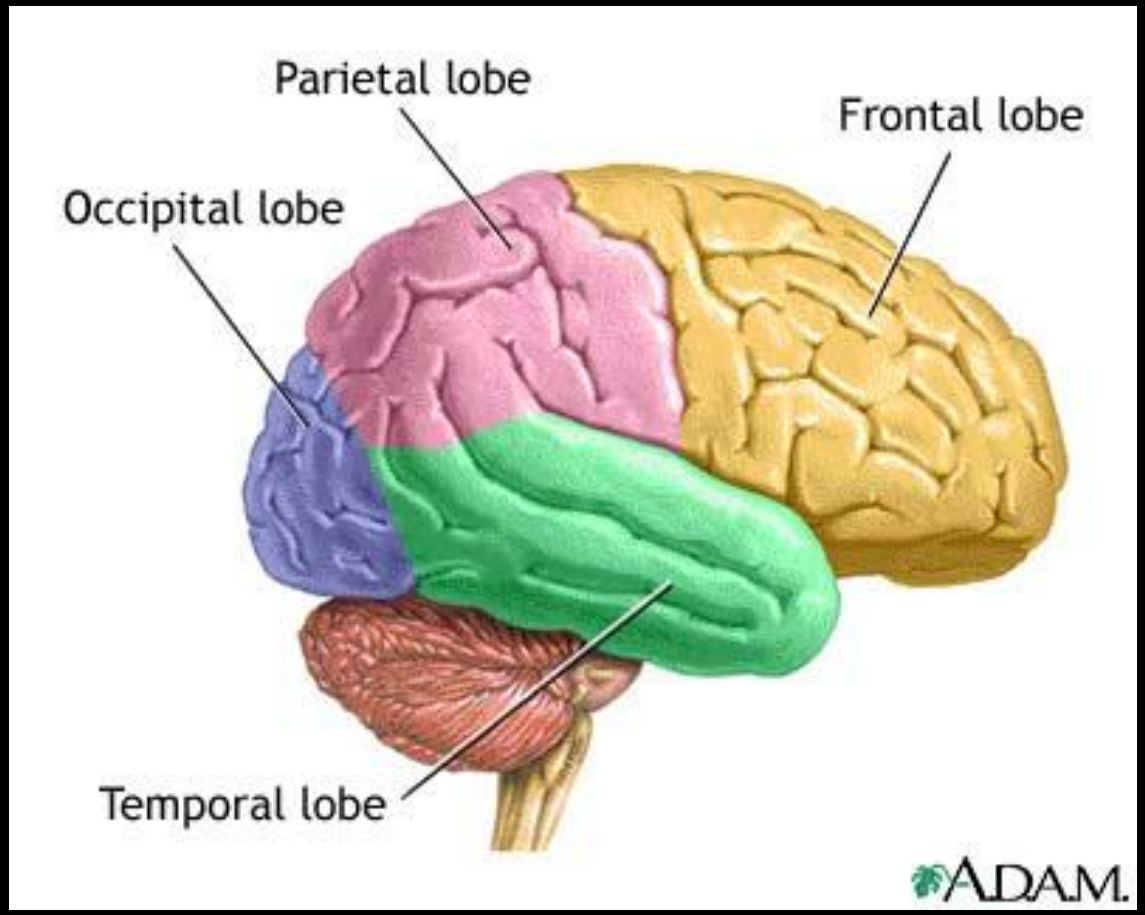


Two sections connected by the corpus callosum



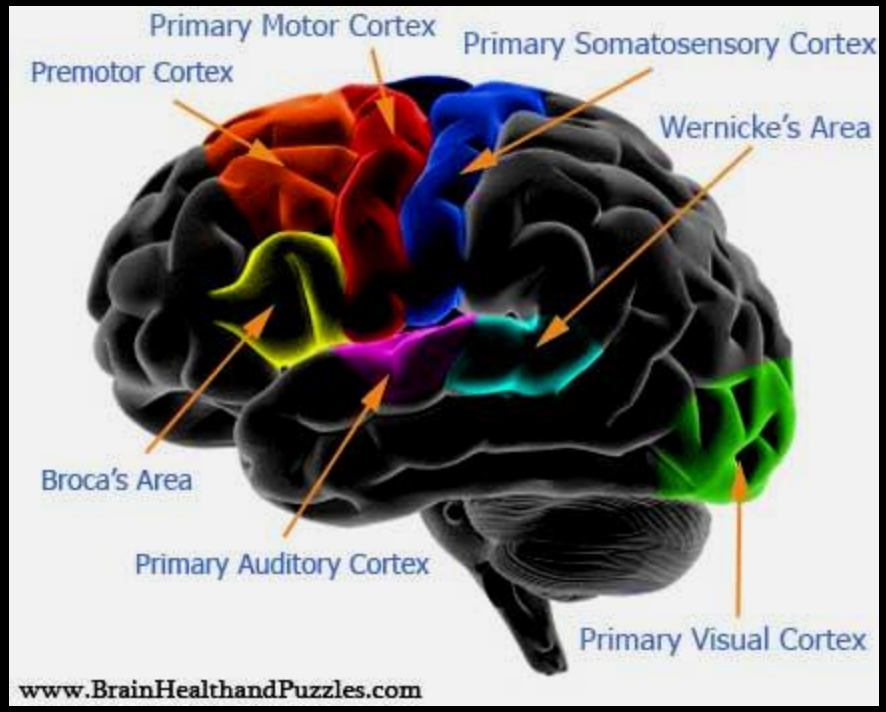
Main Lobes of the *Cerebrum* :

Frontal
Parietal
Temporal
Occipital



Surfaces of the Brain:

1. Cortex : outer surface - gray matter;
Process information from senses &
Controls body movement



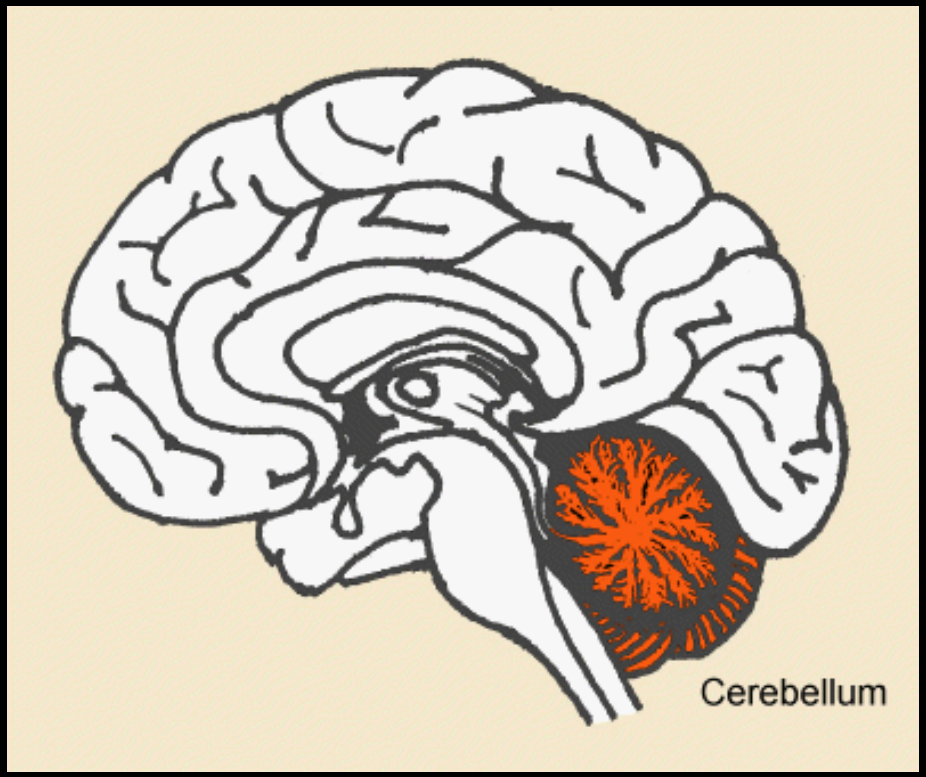
Surfaces of the Brain:

2. Medulla: center, white matter; Bundles of myelinated axons

Four Main Areas of the Brain cont. :

2. *Cerebellum:*

2nd largest area, coordinates and balances actions of muscles that move the body



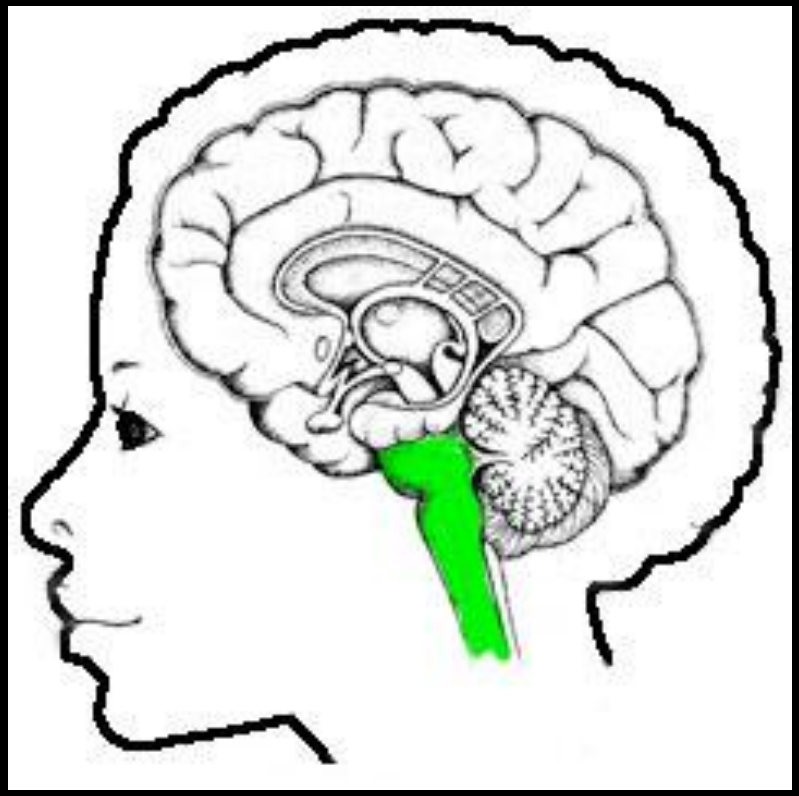
Four Main Areas of the Brain cont. :

3. *Brain Stem:*

Medulla and Pons

Connects brain to spinal cord,

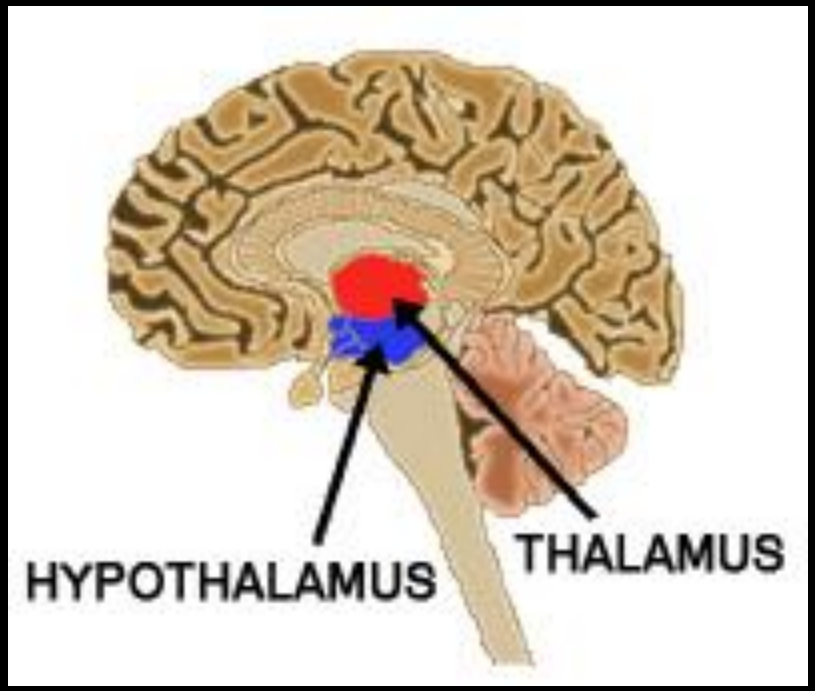
regulates flow of information between brain and body and controls blood pressure, heart rate, breathing, swallowing etc.



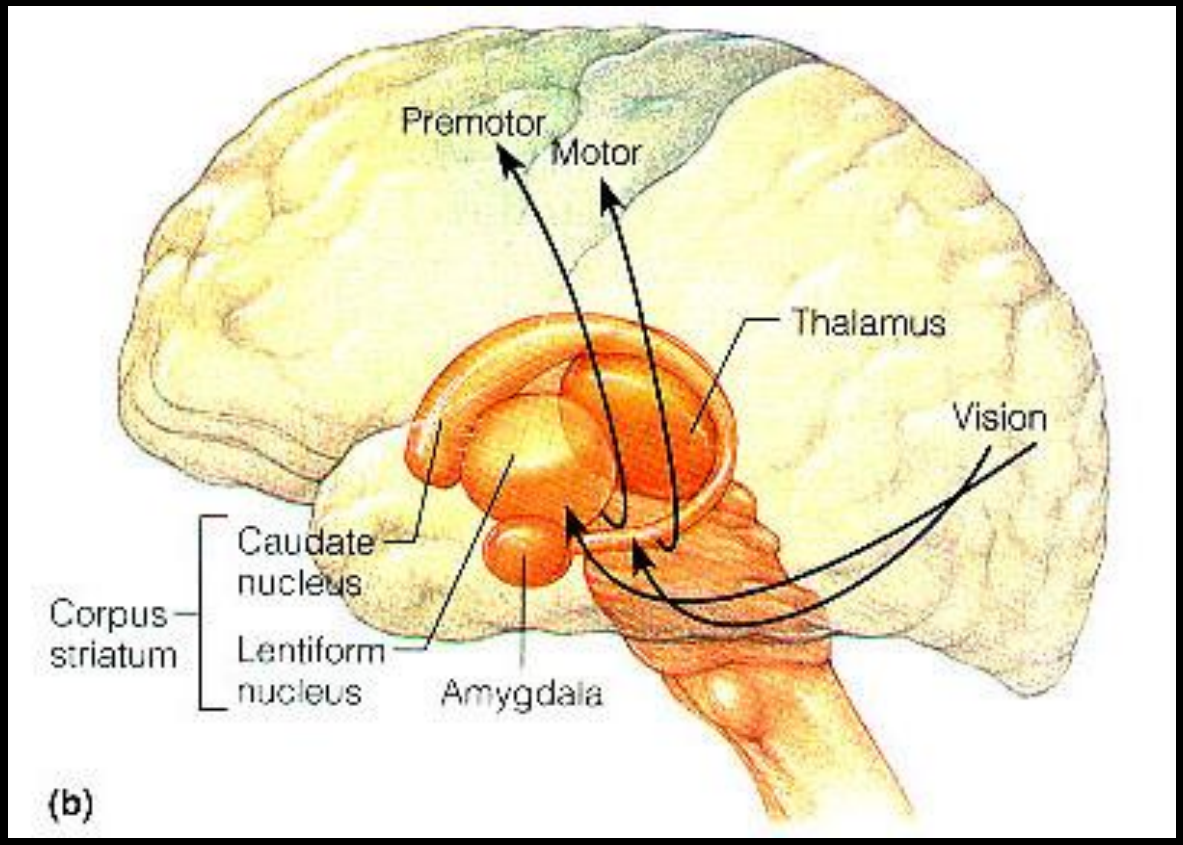
Four Main Areas of the Brain cont. :

4. *Thalamus and Hypothalamus*

Between brain and brain stem

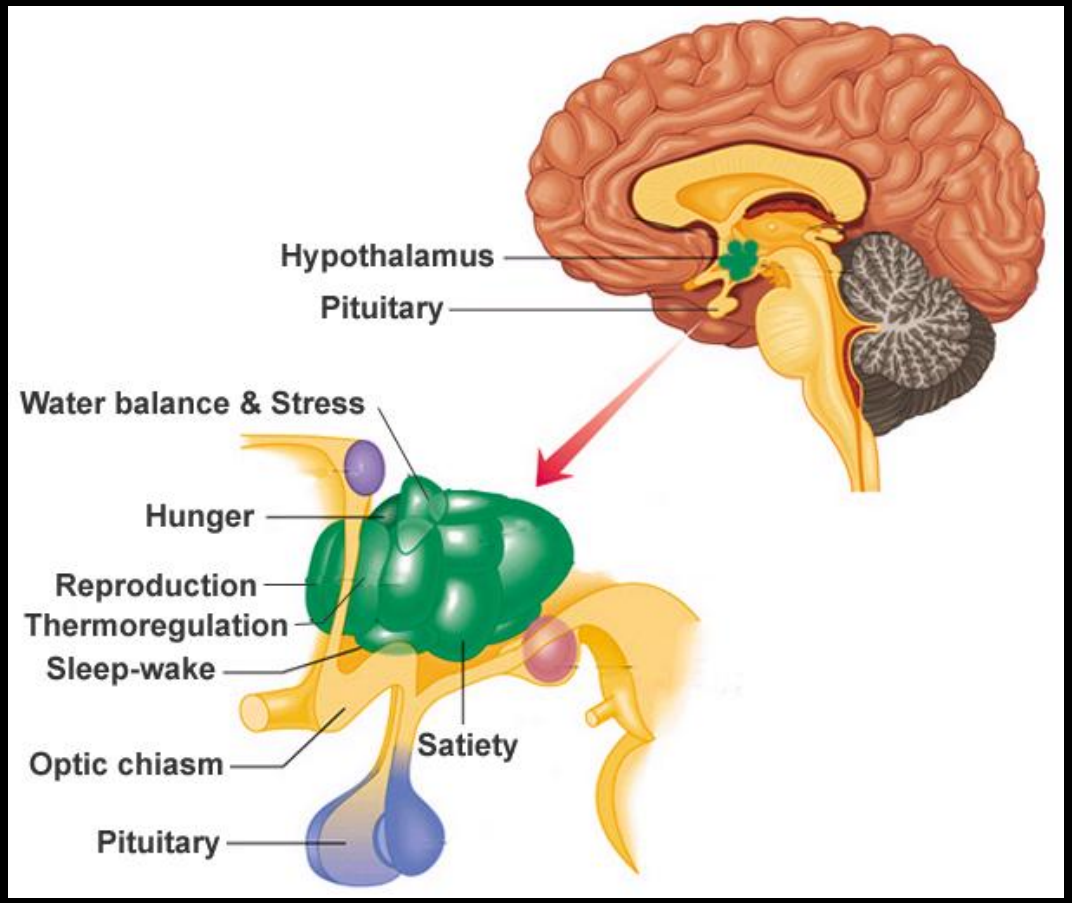


Thalamus – receives information from sense organs and relays to correct area of cerebrum

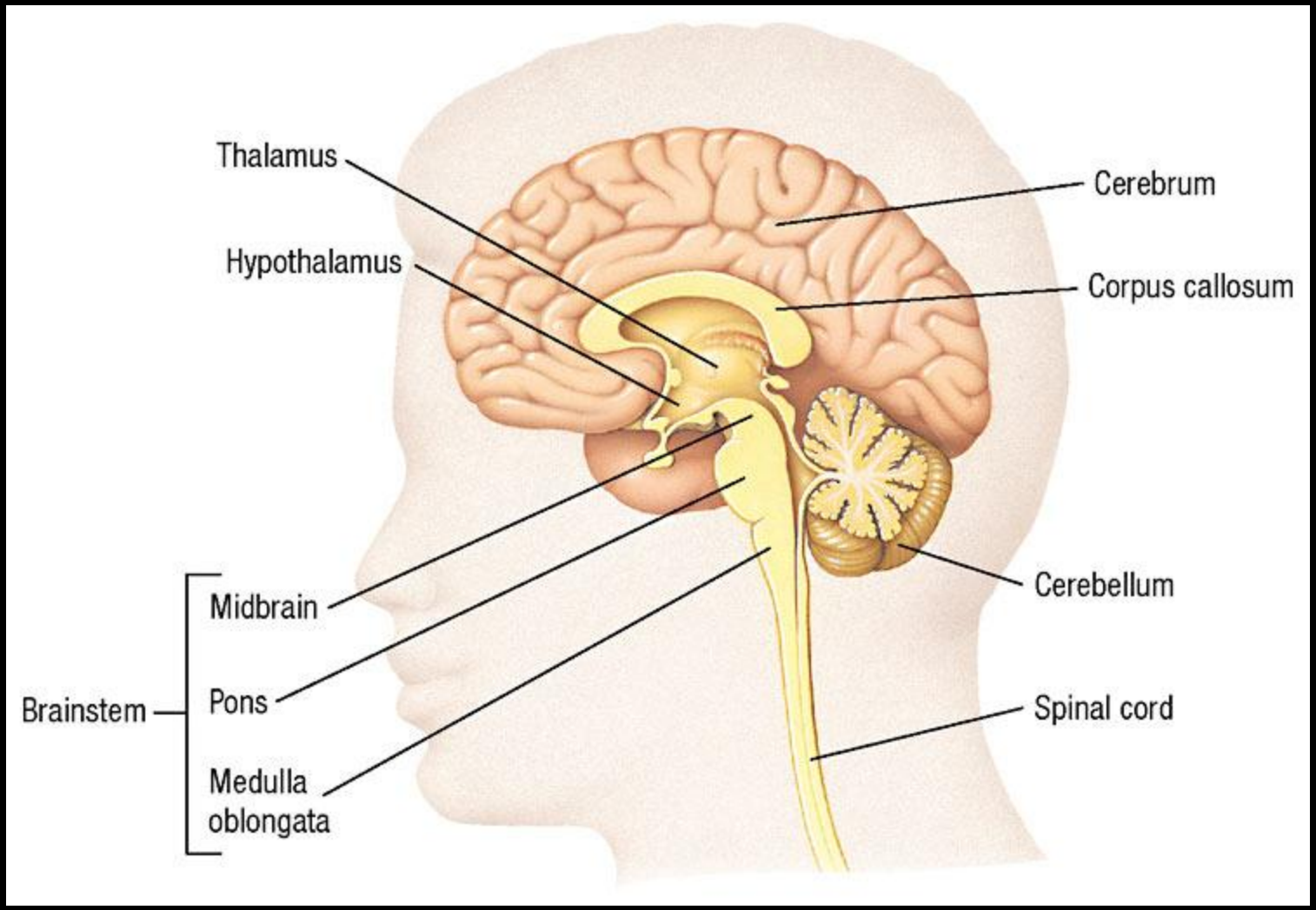


Hypothalamus

Control center for thirst, fatigue, anger and body temperature



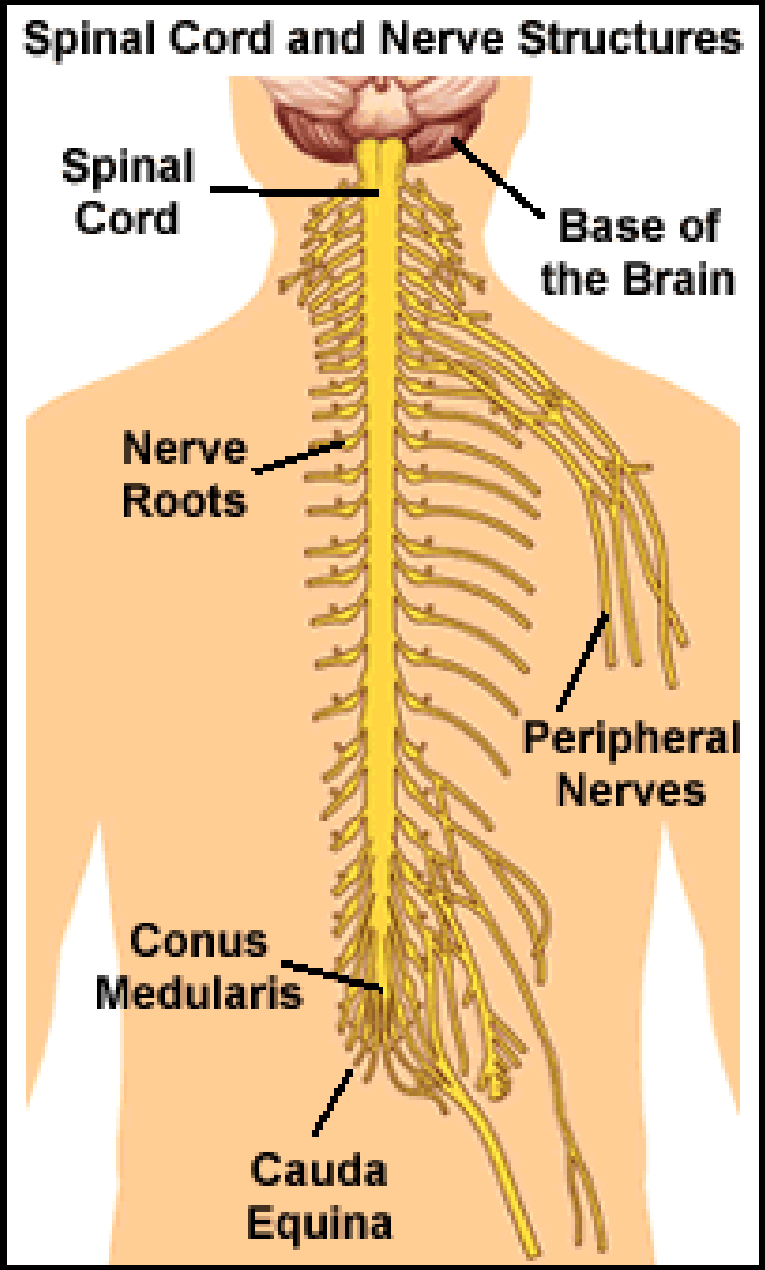
The Brain


Thalamus
Hypothalamus
Midbrain
Brainstem
Pons
Medulla oblongata
Cerebrum
Corpus callosum
Cerebellum
Spinal cord

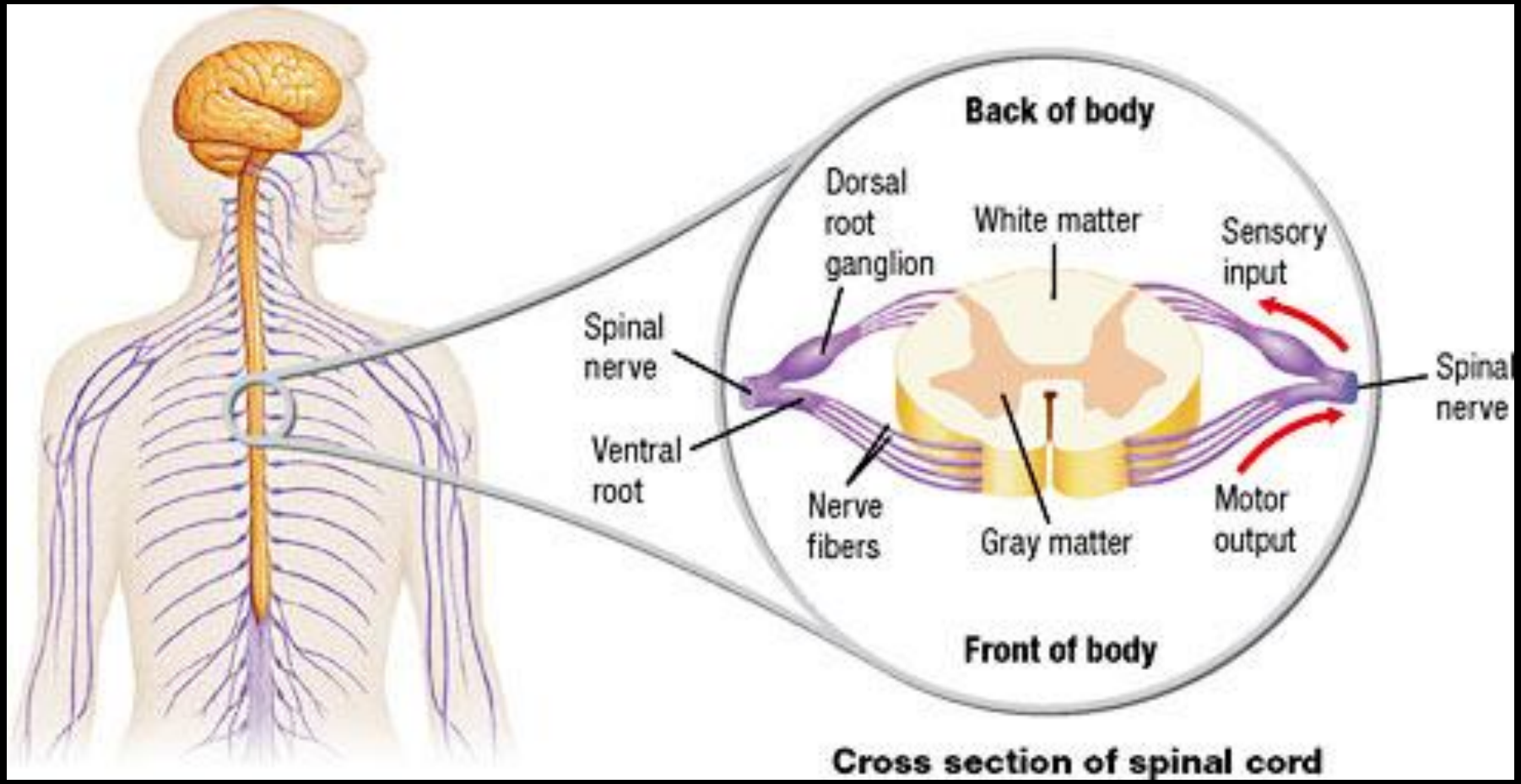
The Spinal Cord

Main communication link between brain and rest of the body.

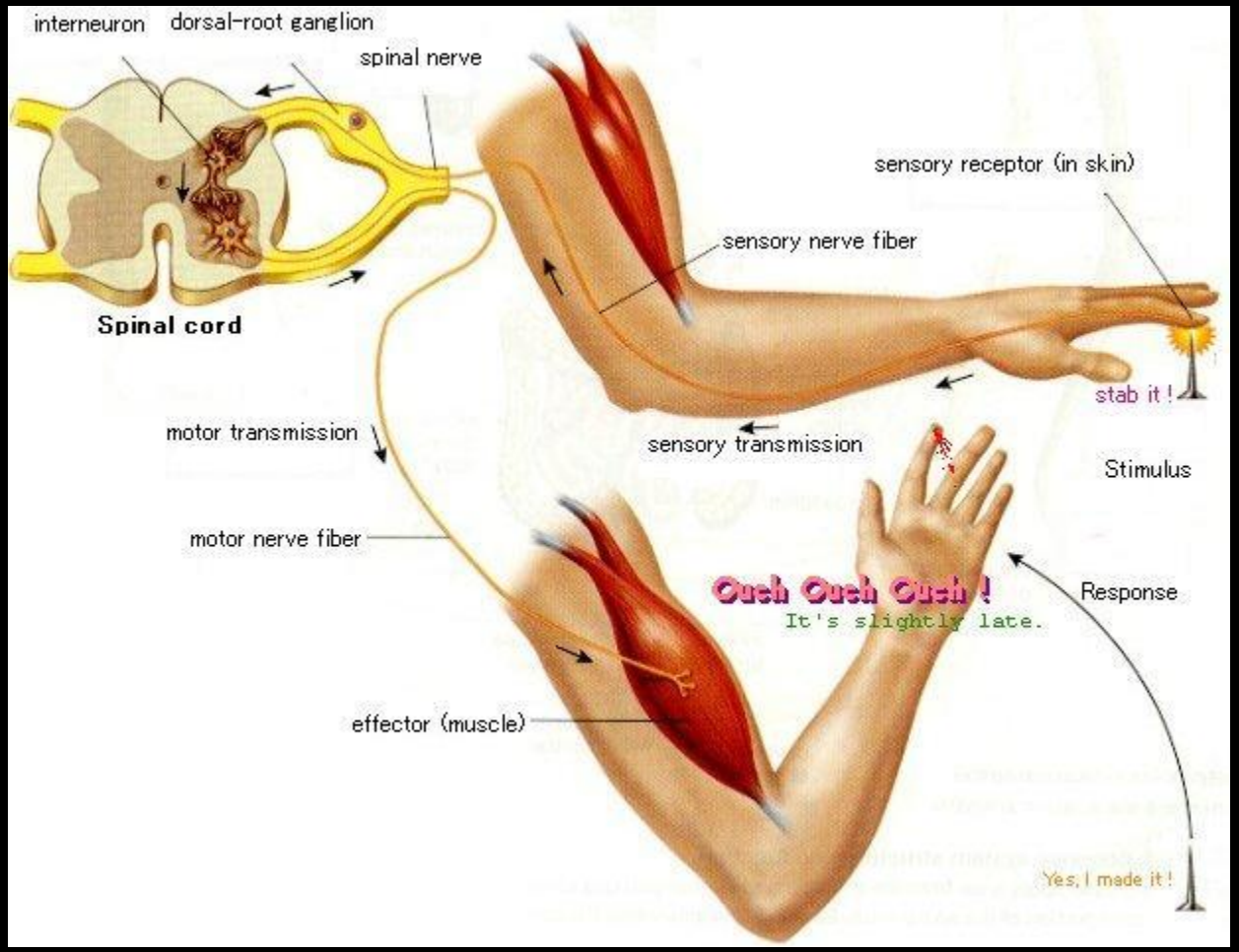
31 pairs of nerves out from the spinal cord and lead to the rest of the body.



The Spinal Cord

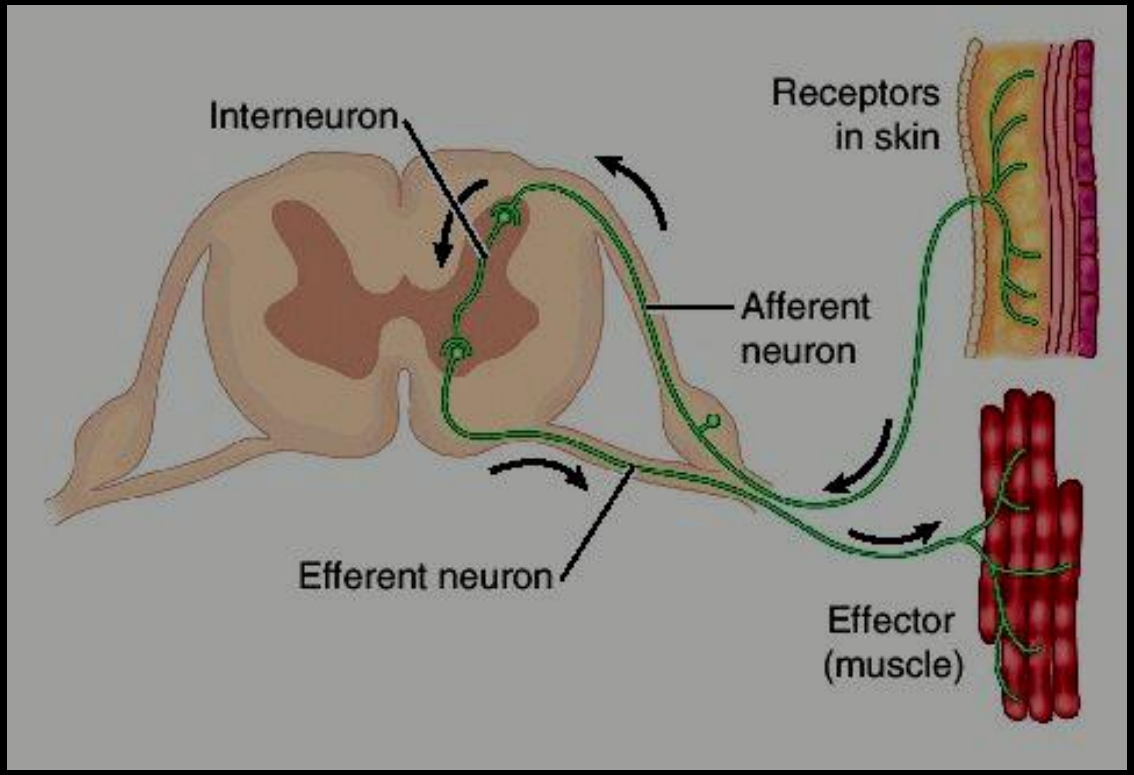


Reflex: automatic response to a stimulus - It is usually a reaction to protect body

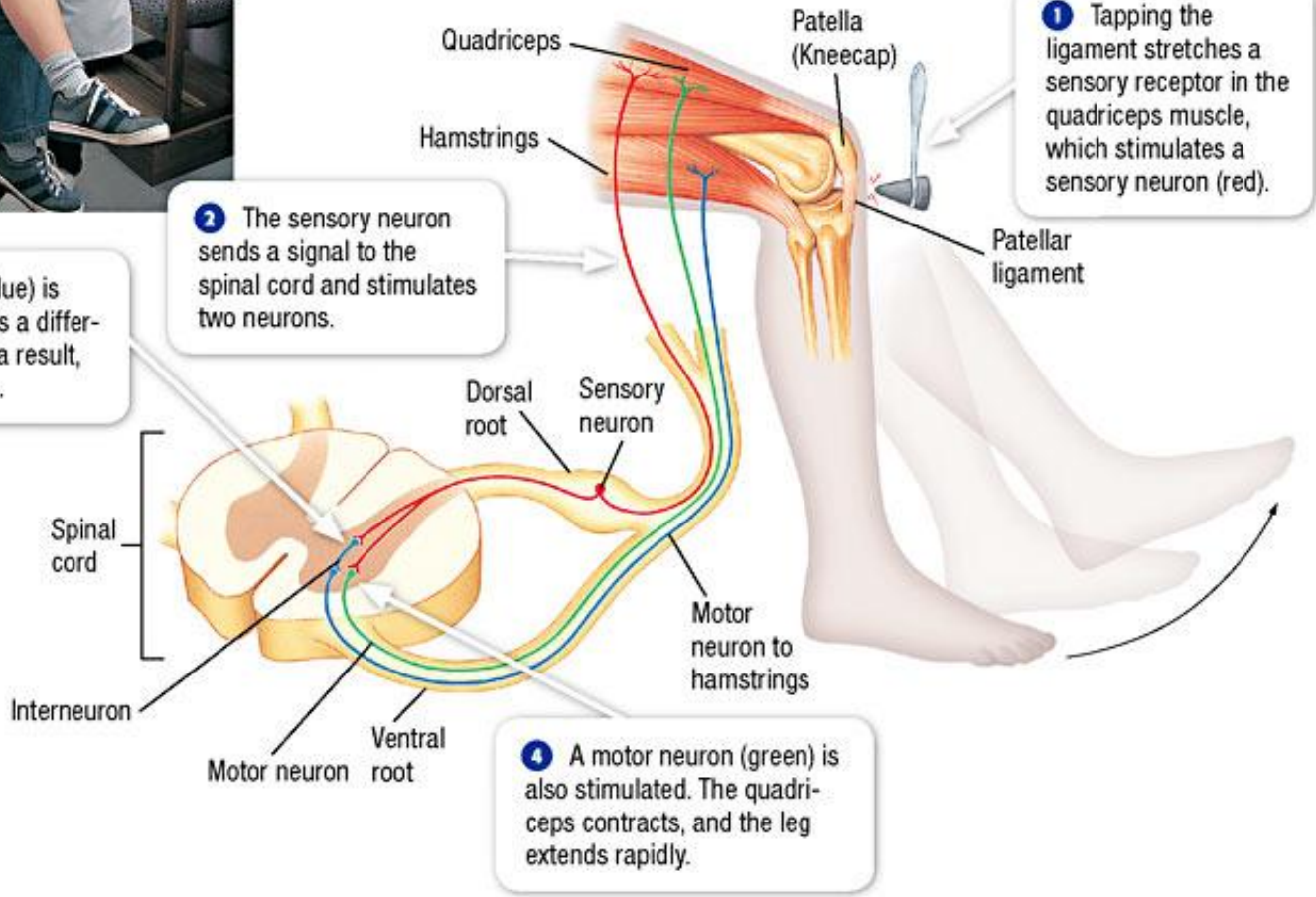


Reflex arc – The nerve pathway -

1. sensory receptor,
2. spinal cord,
3. muscle or gland (effector)



Reflex


Quadriceps
Patella (Kneecap)
Hamstrings
Patellar ligament
1 Tapping the ligament stretches a sensory receptor in the quadriceps muscle, which stimulates a sensory neuron (red).
2 The sensory neuron sends a signal to the spinal cord and stimulates two neurons.
3 An interneuron (blue) is stimulated and inhibits a different motor neuron. As a result, the hamstring relaxes.
Dorsal root
Sensory neuron
Spinal cord
Motor neuron to hamstrings
Interneuron
Motor neuron
Ventral root
4 A motor neuron (green) is also stimulated. The quadriceps contracts, and the leg extends rapidly.

Think, Share, Write #2

What neurons are involved in a spinal reflex?

Think, Share, Write #2

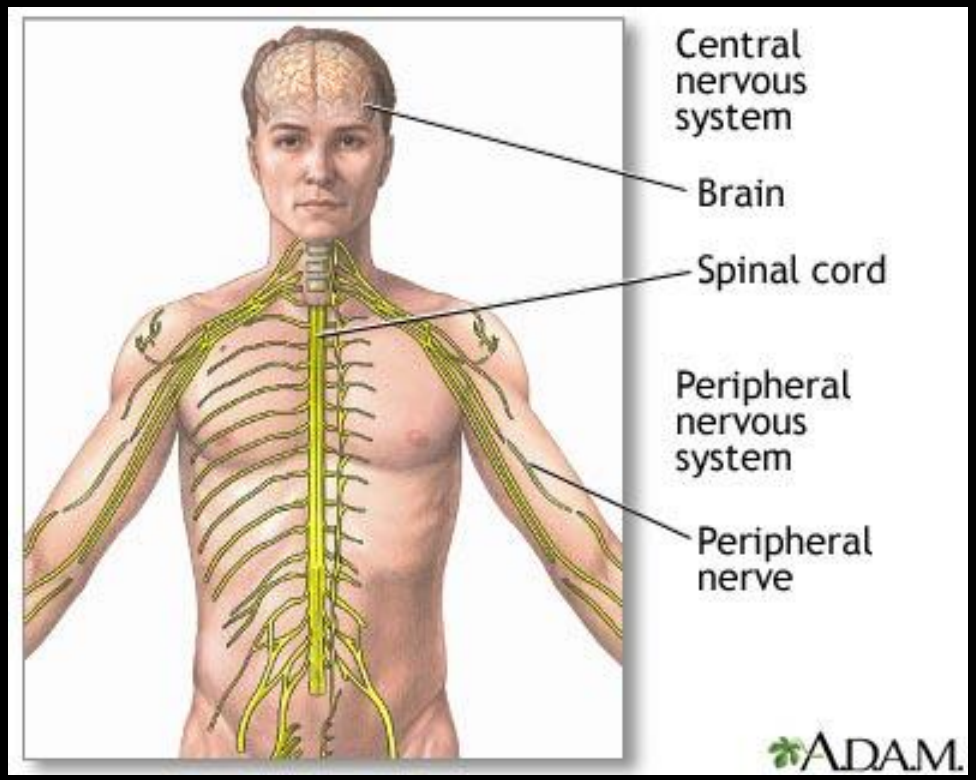
What neurons are involved in a spinal reflex?

Sensory neurons, motor neurons, and interneurons are involved in a spinal reflex?

Peripheral Nervous System

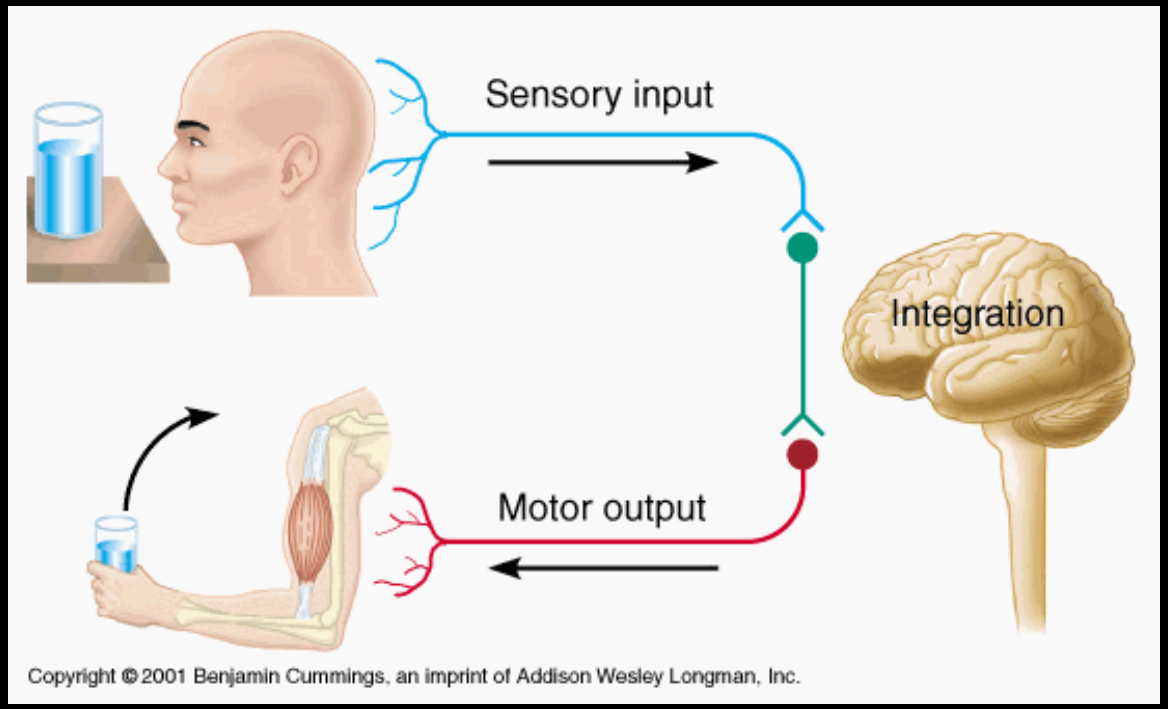
Outside the Central Nervous System

Transmits from sense organs to CNS and back to muscles or glands.

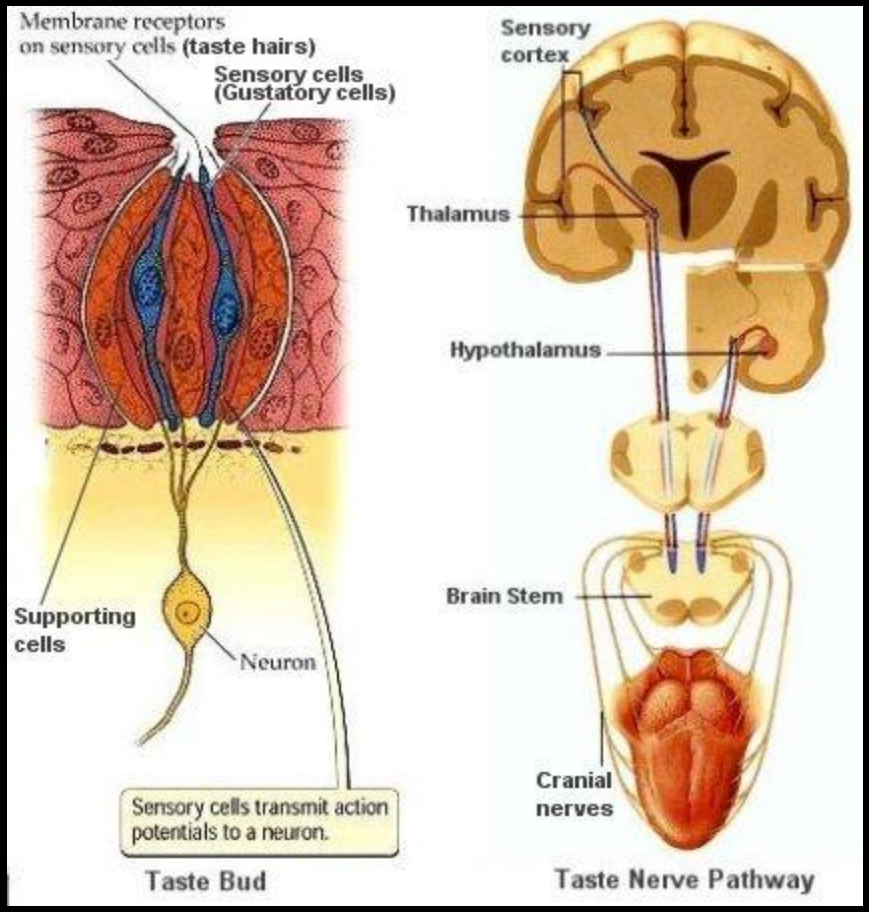


Peripheral Nervous System

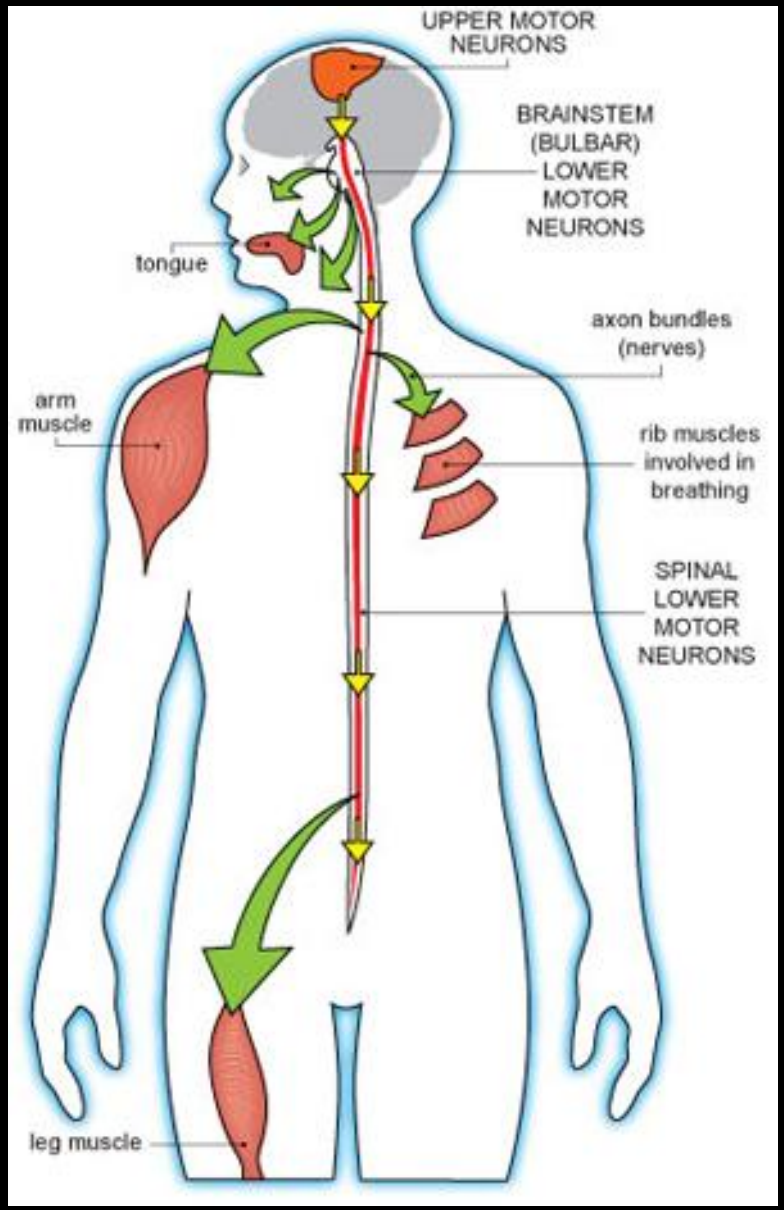
Two Divisions: Sensory and Motor



*The sensory division transmits impulses **from** sense organs - such as the ears and taste buds - **to** the CNS.*

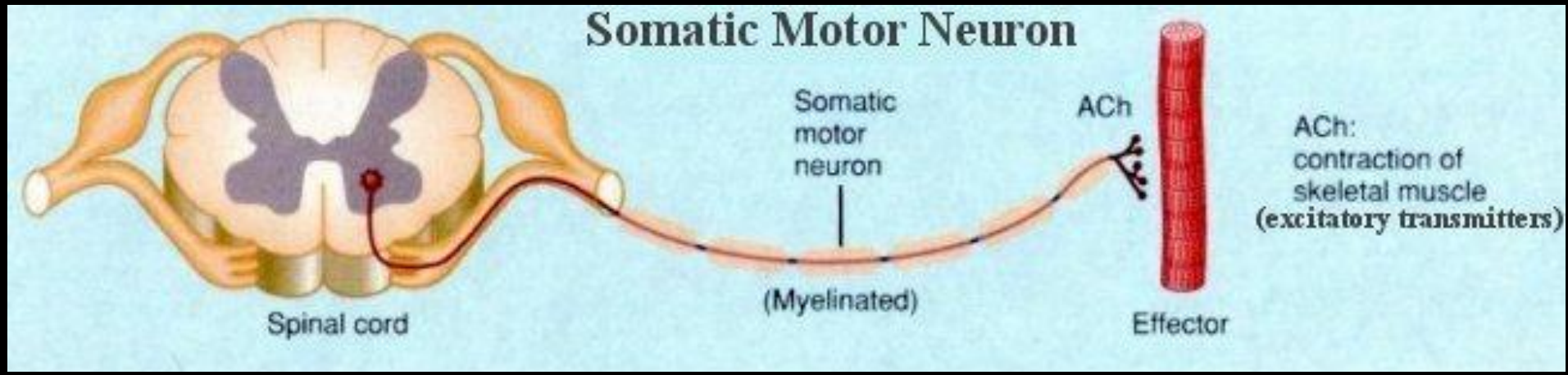


*The motor division transmits impulses **from** the CNS system **to** the muscles or glands*.

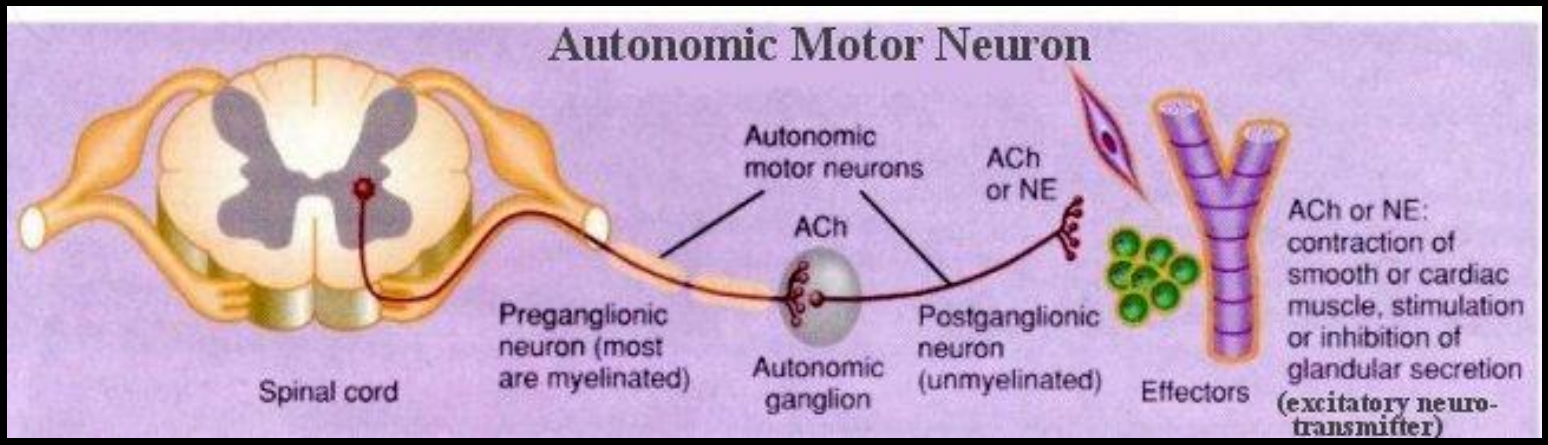


Somatic Nervous System

Regulates activities under **conscious** control -skeletal muscles also controls reflexes



Autonomic Nervous System



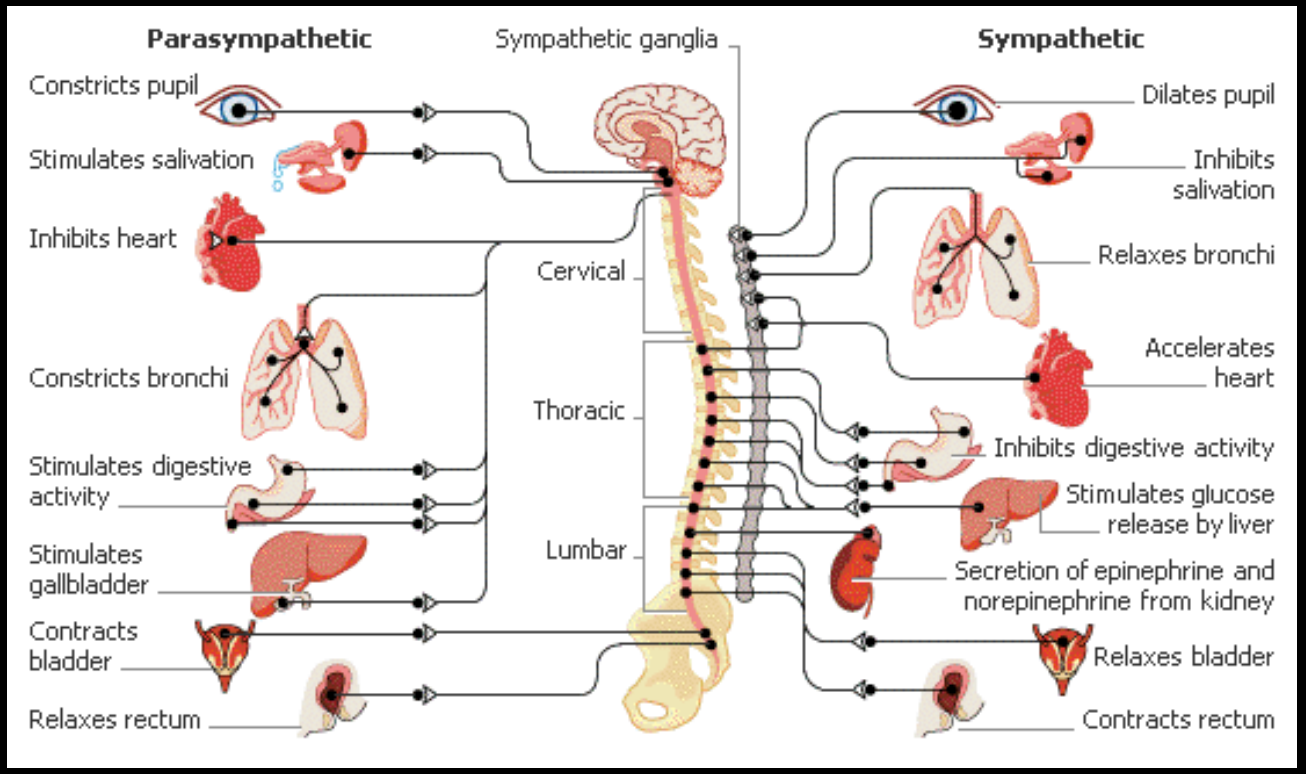
Regulates activities that are

automatic – involuntary

Examples:

- **heartbeat**
- **contraction of smooth muscles in the digestive system**

Two Parts: Autonomic Nervous System

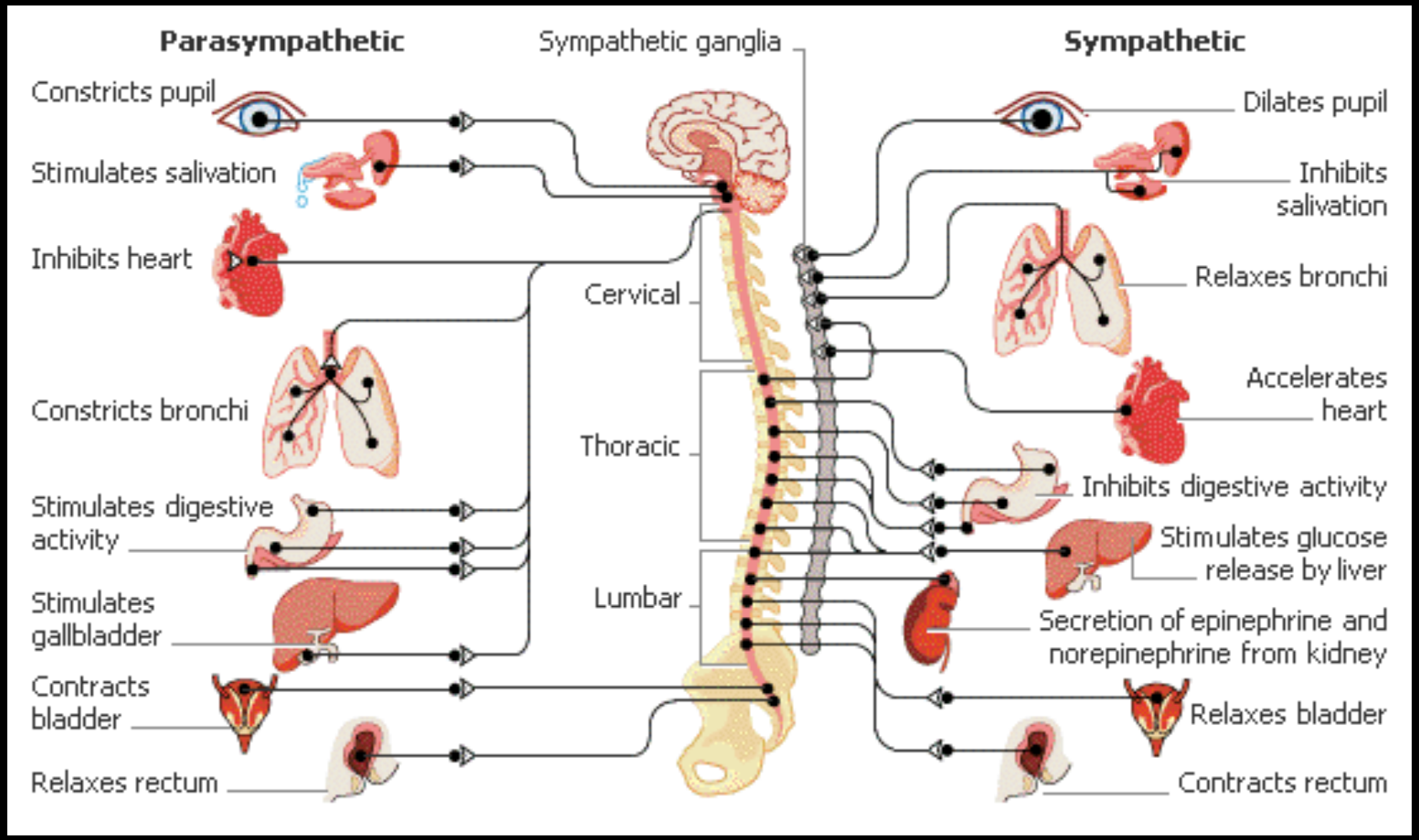


Sympathetic - **fight or flight**

Parasympathetic – **rest and digest**

Two Parts: Sympathetic & Parasympathetic

Most organs are controlled by both. Why?



Content Objectives
Write these down!

I will be able to identify:

- How the body conducts electricity.
- How a neuron's structure allows the neuron to send electrical signals.
- How a nerve impulse is generated
- How neurons communicate with each other.

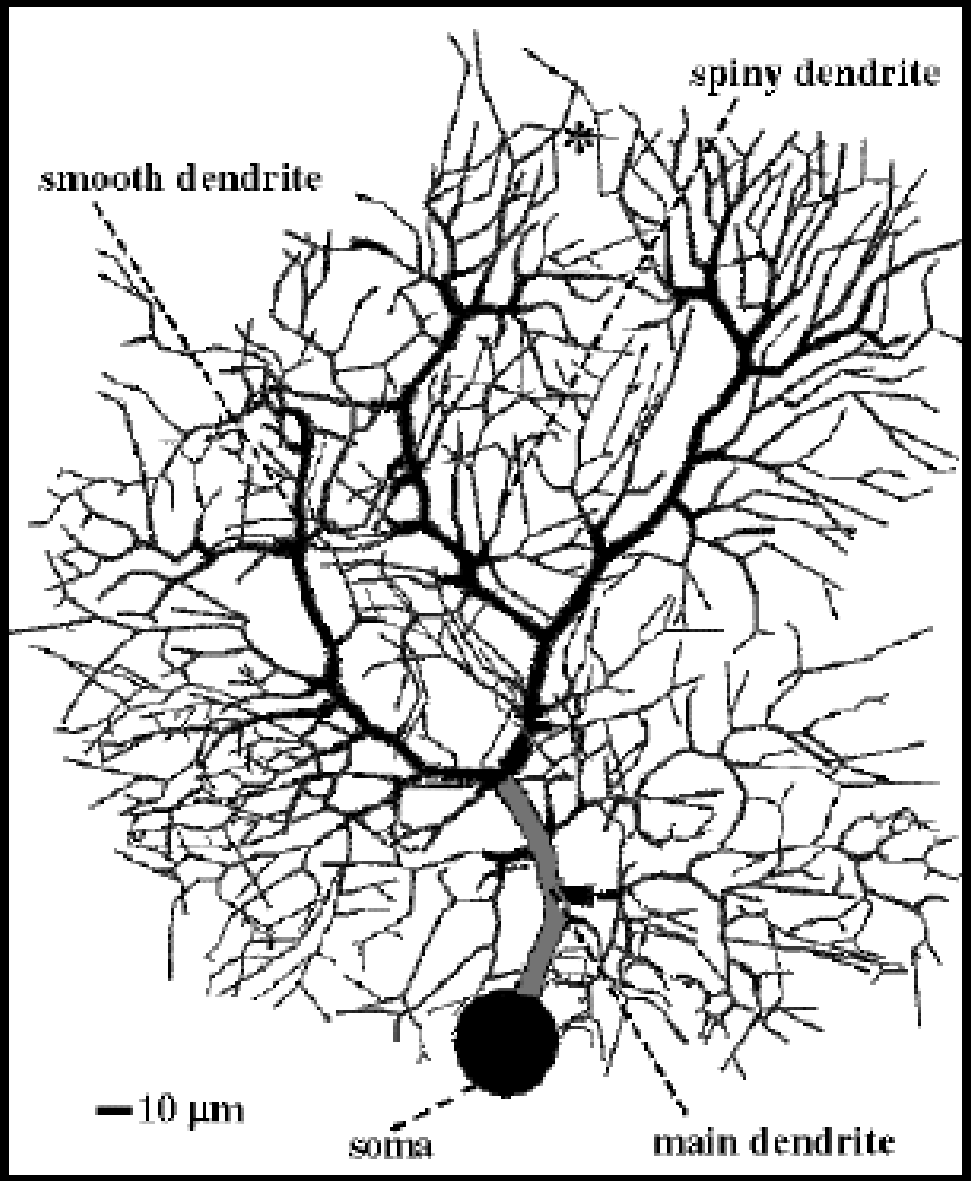
Chapter 38 Section 2: Neurons and the Nerve Impulse

Key Vocabulary Terms

Adapted from Holt Biology 2008

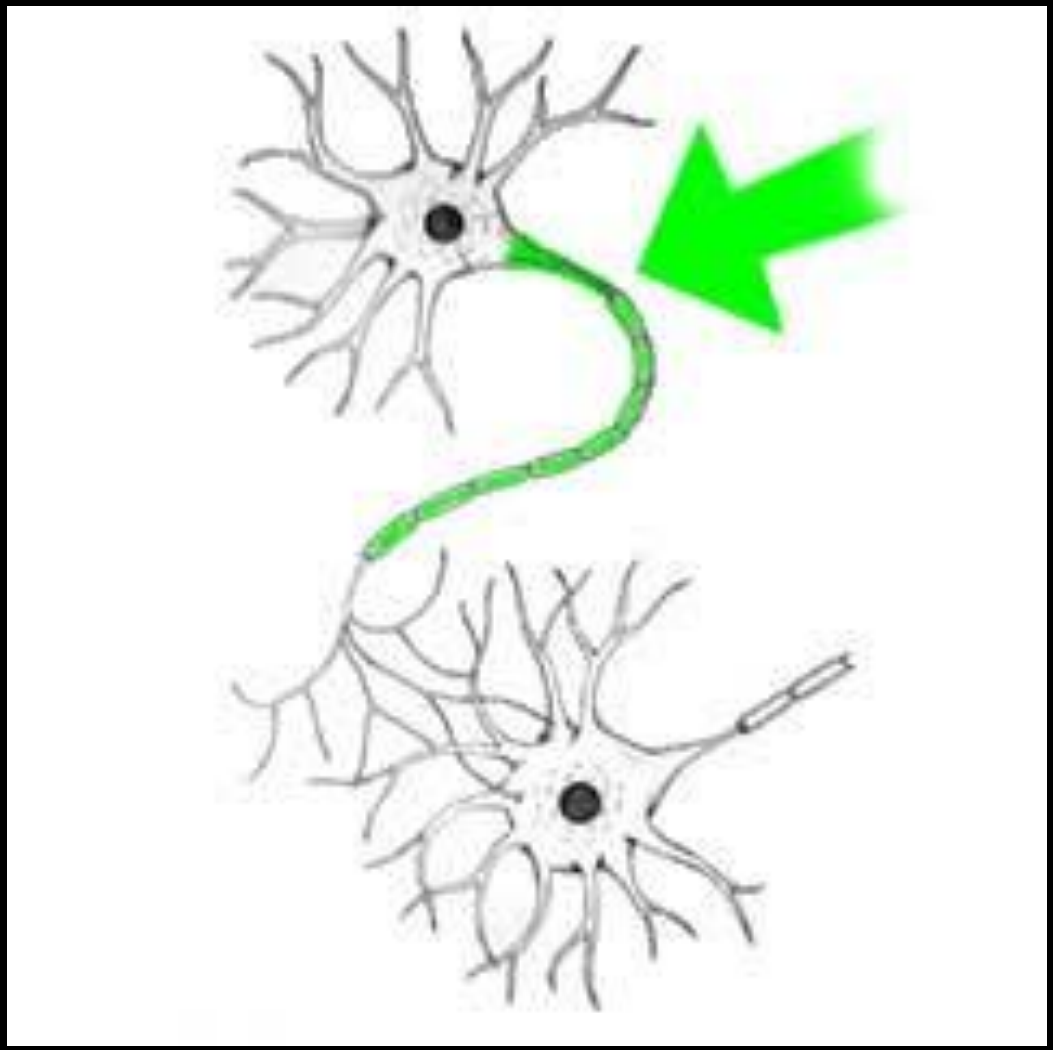
Dendrite

A cytoplasmic extension of a neuron that receives stimuli



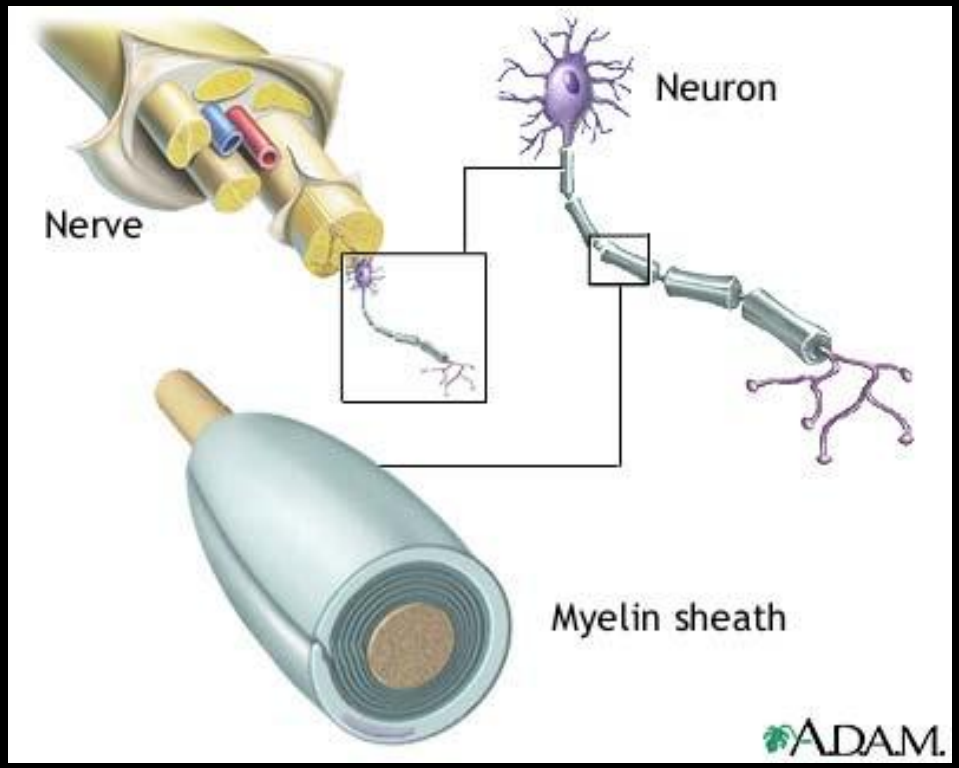
Axon

An elongated extension of a neuron that carries impulses away from the cell body



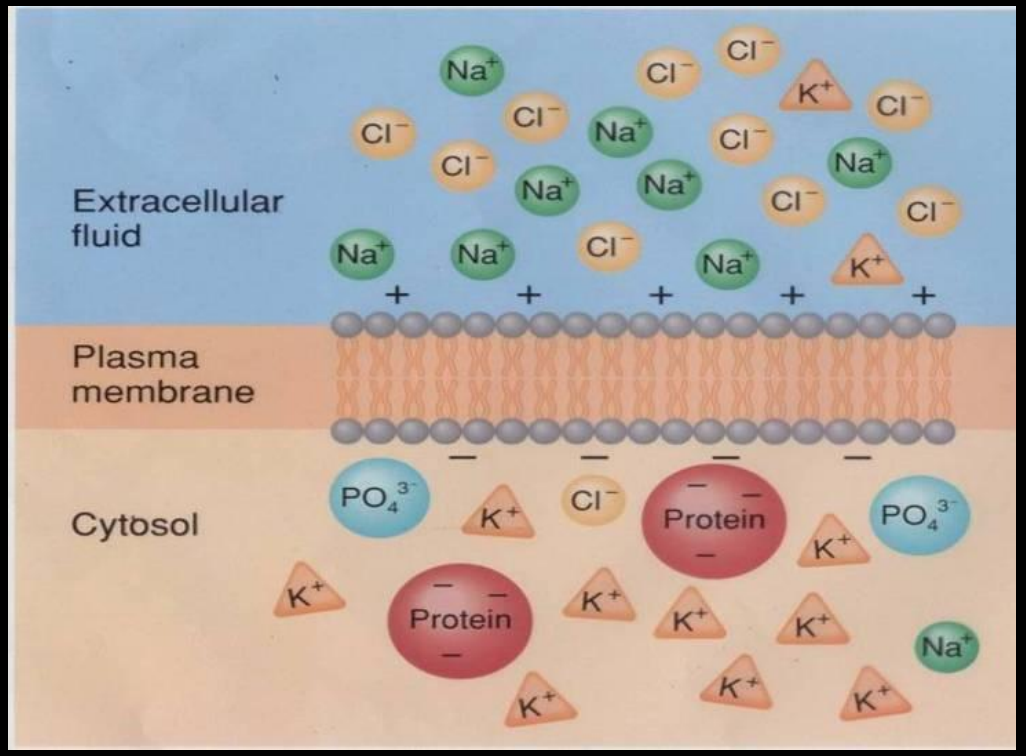
Nerve

A collection of nerve fibers through which impulses travel between the central nervous system and other parts of the body



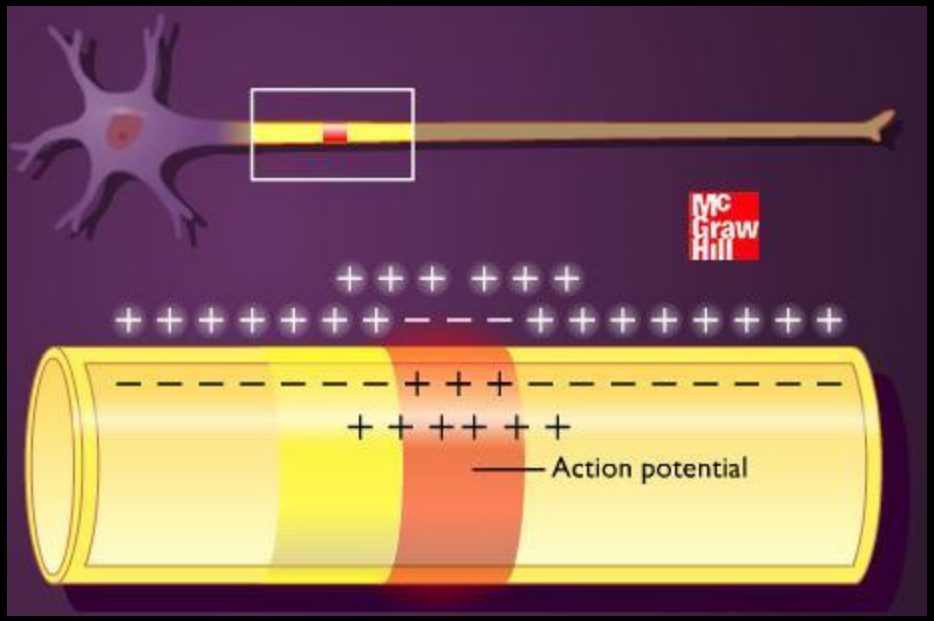
Membrane Potential

The difference in electric potential between the two sides of a cell membrane



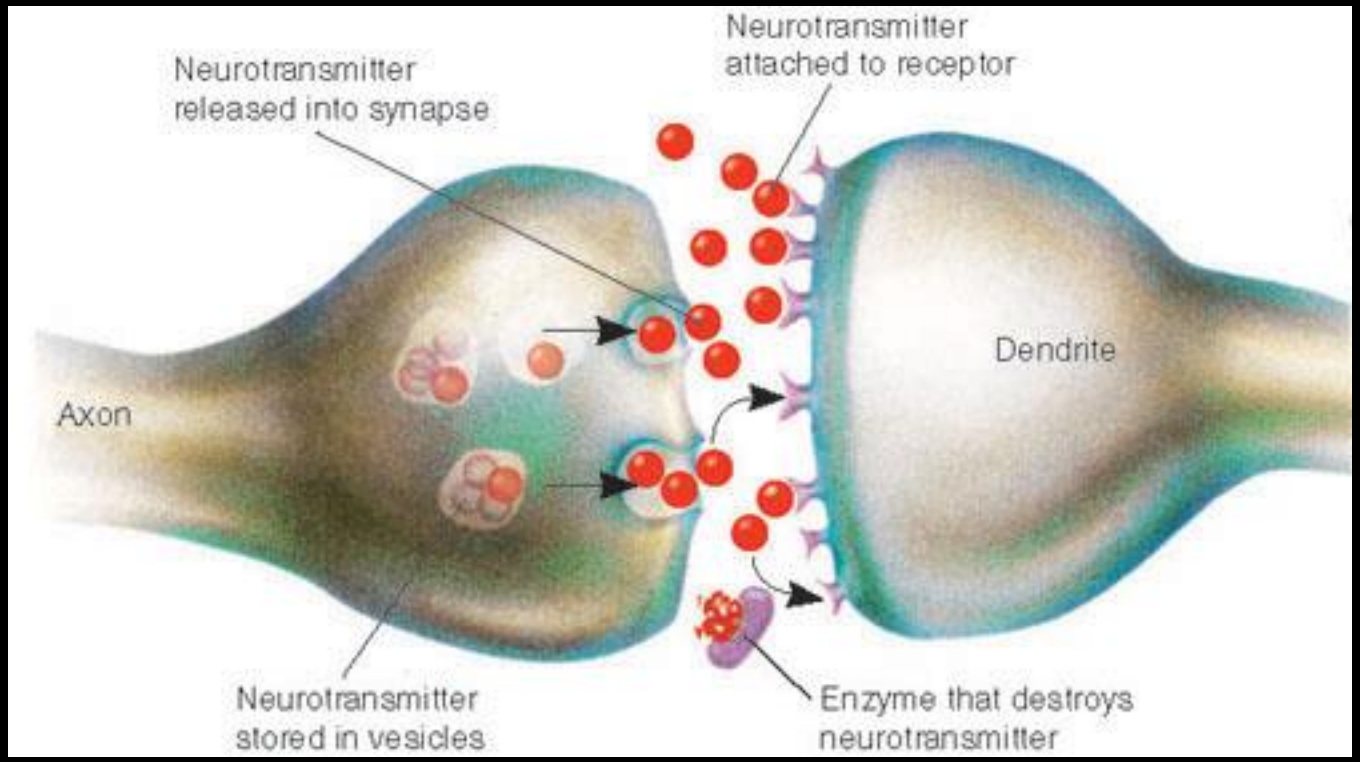
Action Potential

A sudden change in the polarity of the membrane of a neuron, gland cell, or muscle fiber that facilitates the transmission of electrical impulses



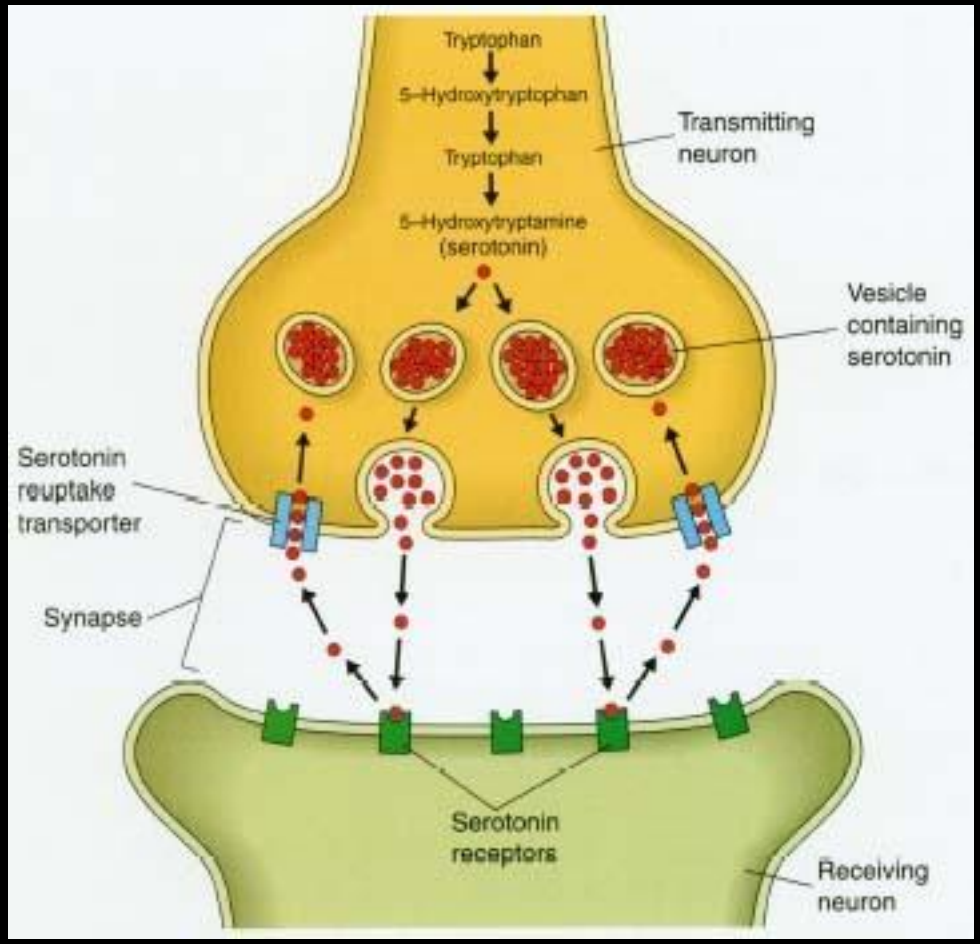
Synapse

The junction at which the end of the axon of a neuron meets the end of a dendrite or the cell body of another neuron or meets another cell



Neurotransmitter

A chemical substance that transmits nerve impulses across a synapse



Think, Share, Write #3

What part of the cell sends electrical signals?

Think, Share, Write #3

What part of the cell sends electrical signals?

The part of the cell that sends electrical signals is the axon.

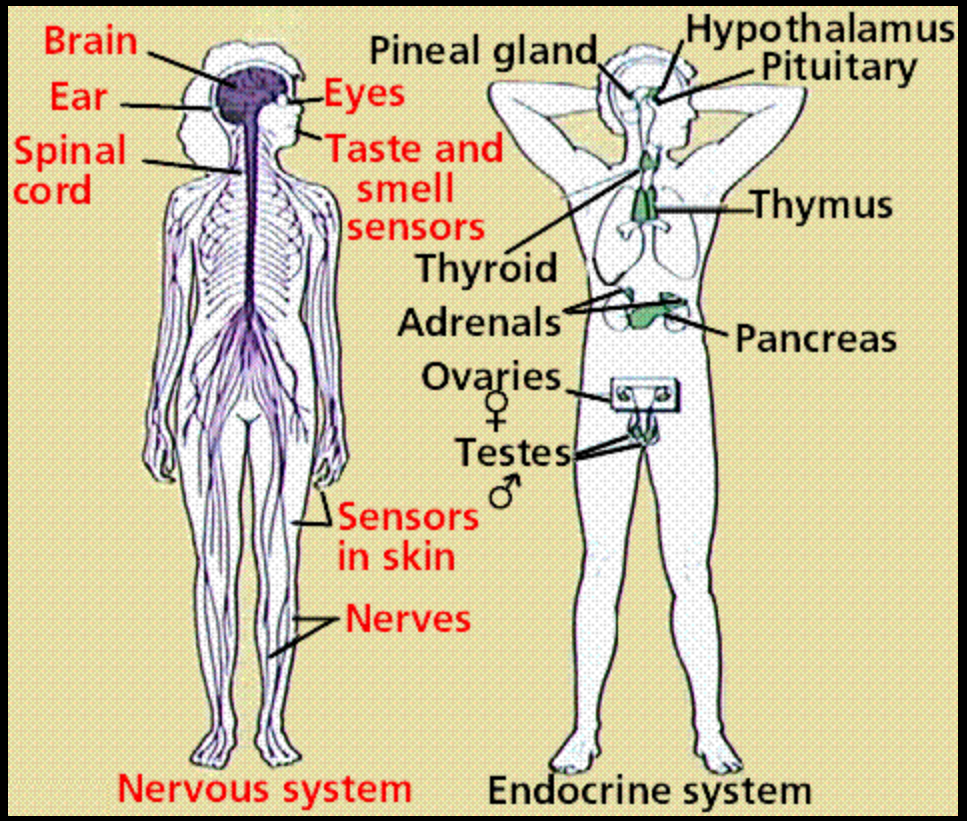
Chapter 38 - Section 2: Neurons and the Nerve Impulse

Notes

Adapted from Holt Biology 2008

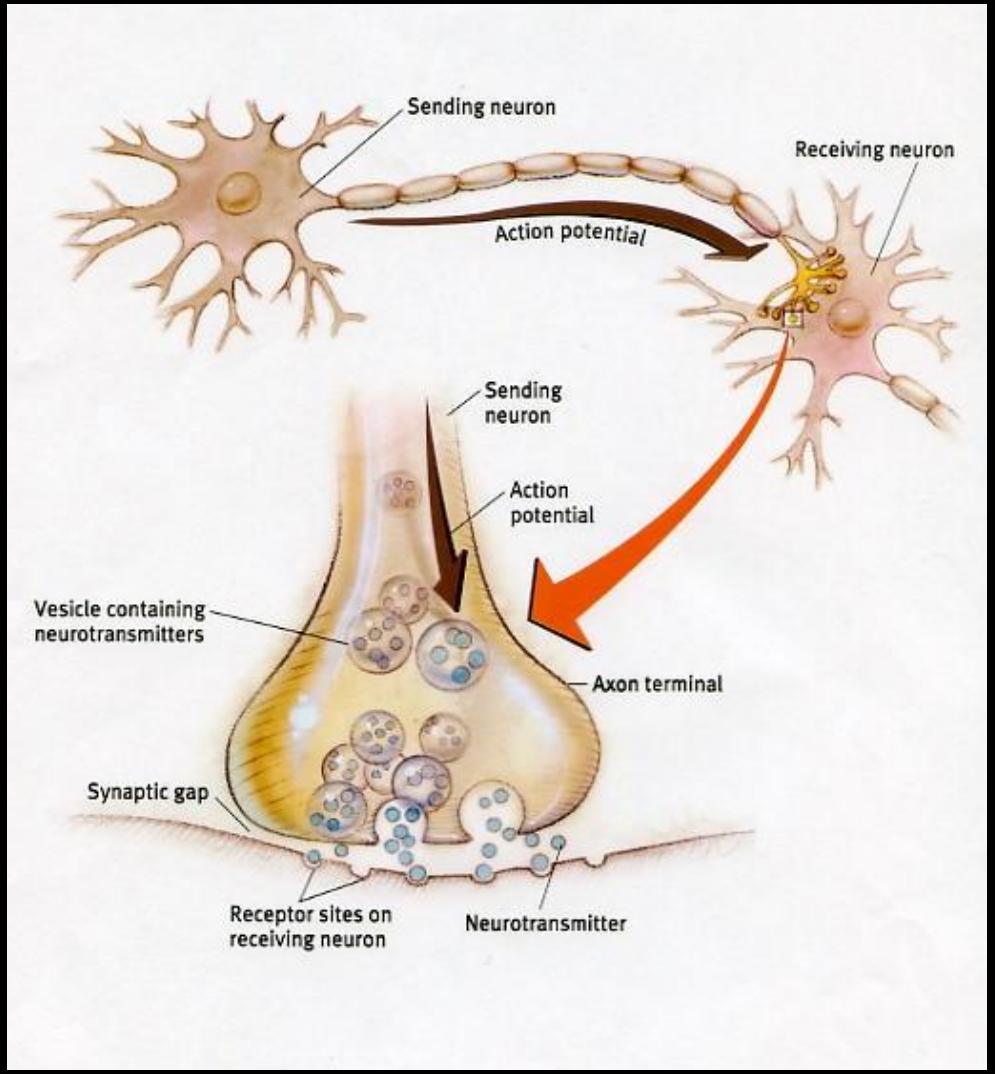
Neurons and the Nerve Impulse

Key Point: The nervous and endocrine systems help the body maintain homeostasis by responding to change.

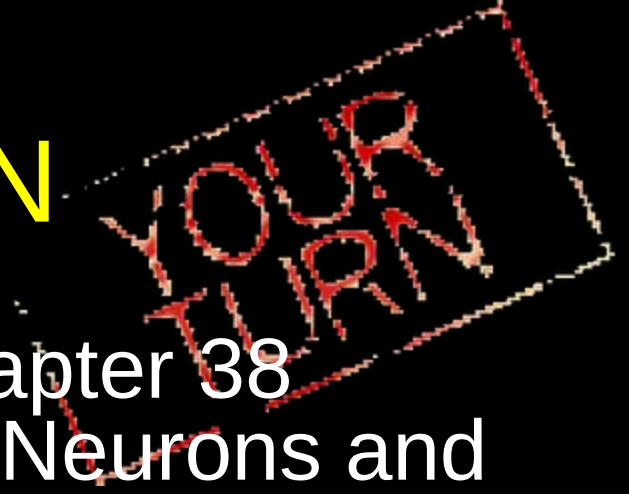


Neurons and the Nerve Impulse

Impulses in the nervous system are electrical and chemical. The electrical signals are caused by the movement of ions across the cell membrane of neurons.



YOUR TURN

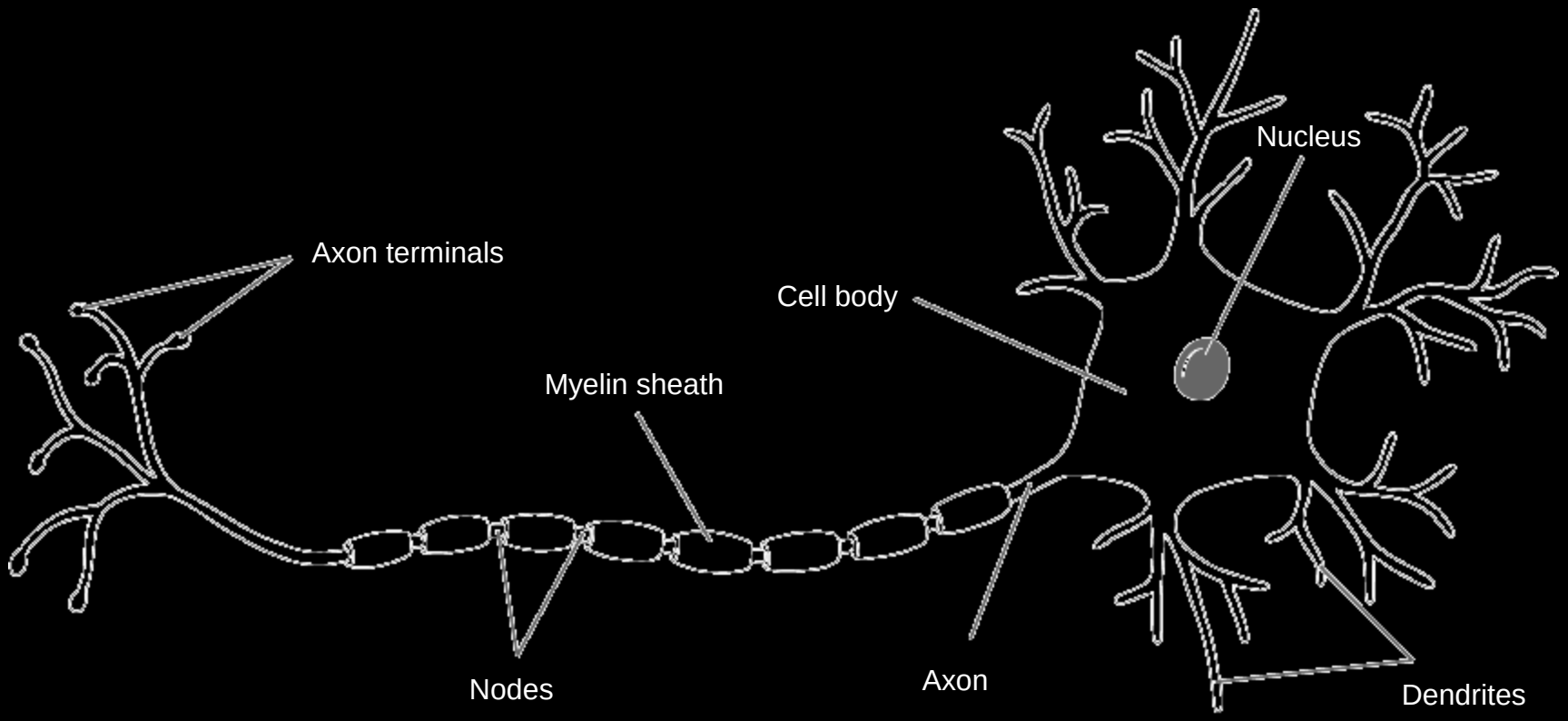


- With a partner, read the Chapter 38 Section 2 Active Reading – Neurons and Nerve Impulses
- 1st - Take turns reading the questions aloud to each other, alternating questions.
- 2nd - Take turns reading the selection aloud to each other, alternating sentences or paragraphs.

YOUR TURN

- As you read discuss the content.
- Reread and discuss each question. Write down the best answer to the question using full descriptive sentences.
- Be prepared to share with the class.

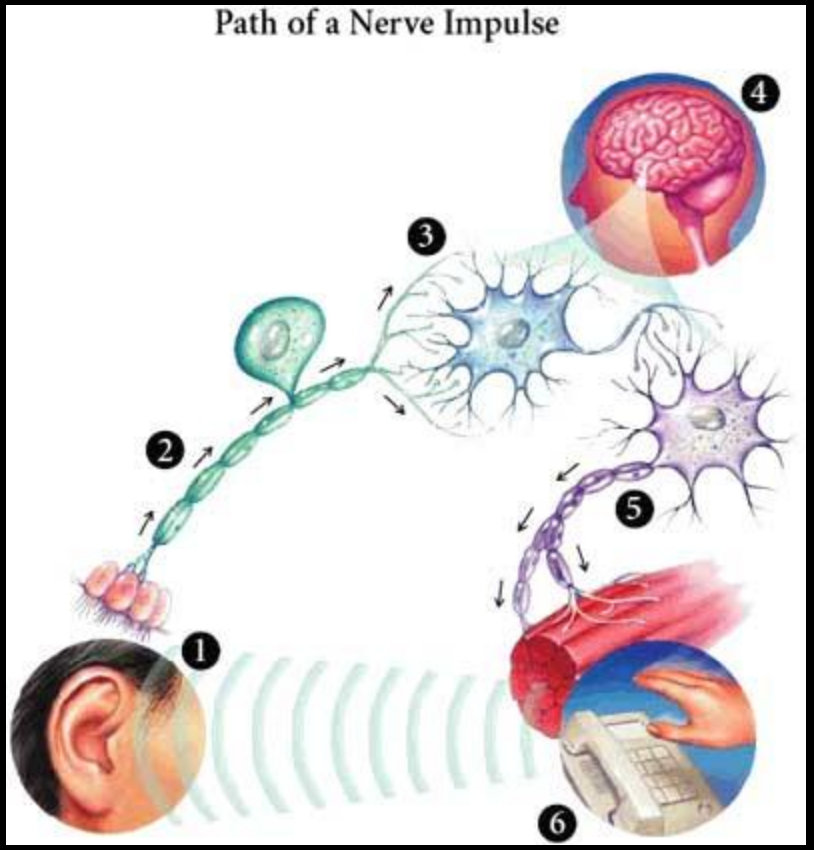
The Neuron


Nucleus
Axon terminals
Cell body
Myelin sheath
Nodes
Axon
Dendrites

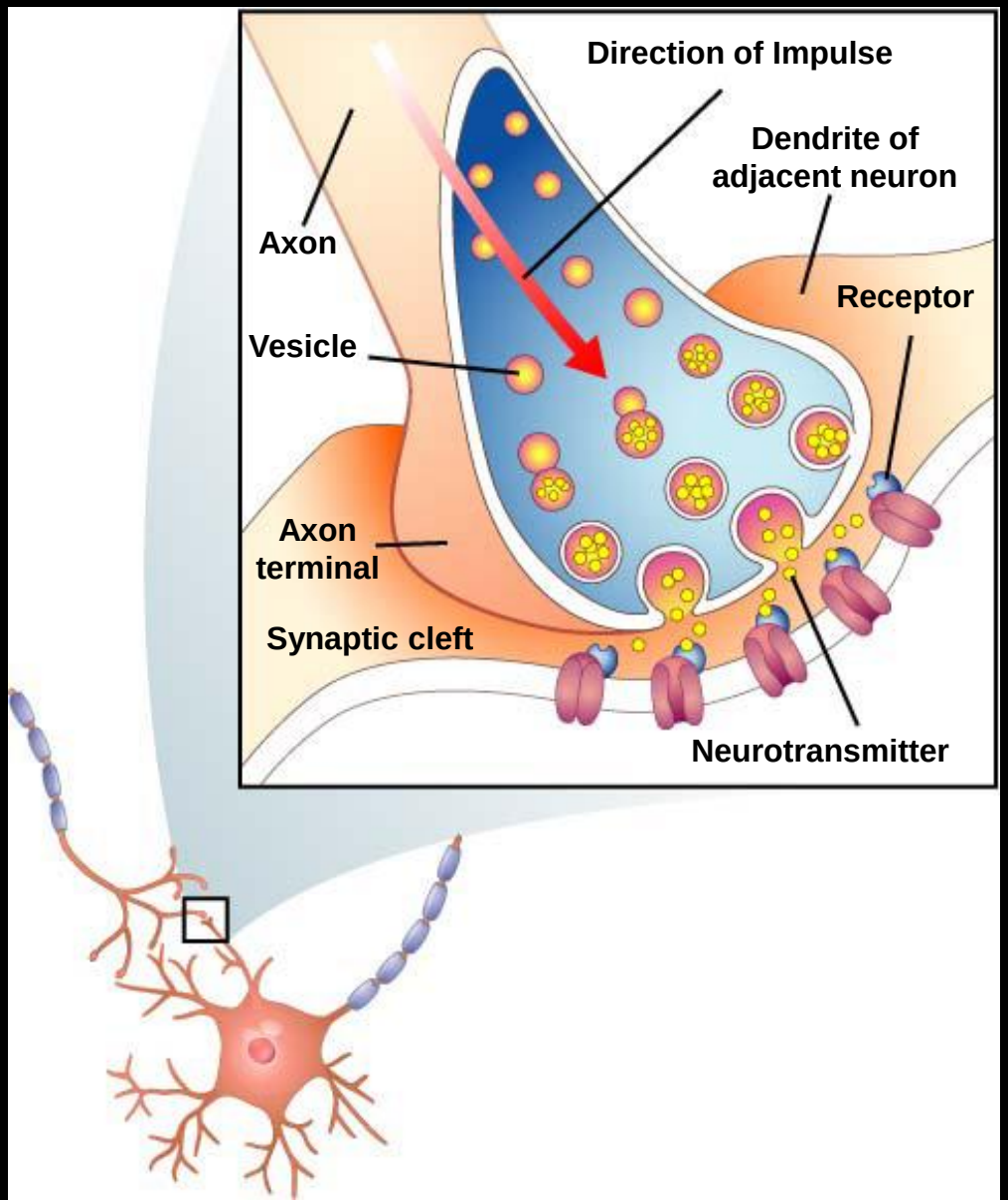
The Nerve Impulse

Key Point: An impulse begins when a neuron is stimulated by another neuron or by a stimulus in its environment

Click picture

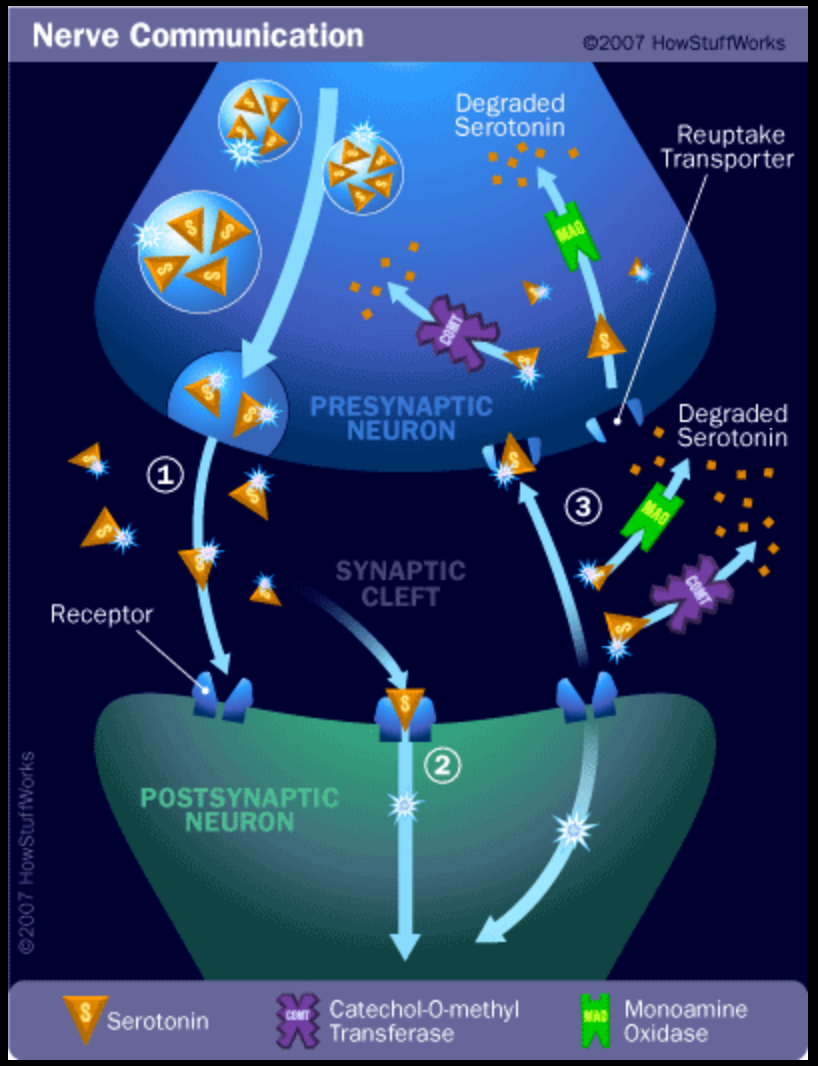


The Synapse

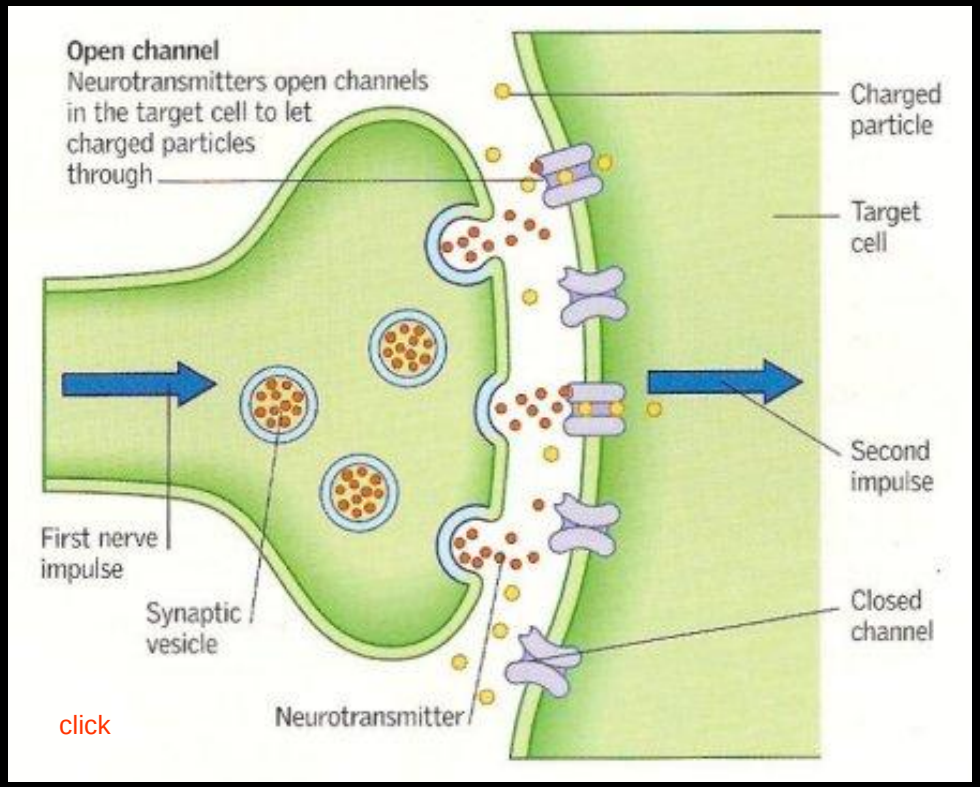


Space between two neurons or neuron and muscle or gland.

Impulse - message - crosses the synapse with the aid of a *chemical* called a *neurotransmitter*



Neurotransmitters change the permeability of the membrane of the next neuron, muscle or gland to allow moving impulse to go from one to the other



Think, Share, Write #4

How are neurotransmitters released?

Think, Share, Write #4

How are neurotransmitters released?

Neurotransmitters are released from synaptic vesicles at the presynaptic membrane by exocytosis.

Content Objectives
Write these down!

I will be able to identify:

- How sensory information is detected.
- The five (5) types of sensory receptors.
- Where the sites of sensory processing are in the brain.

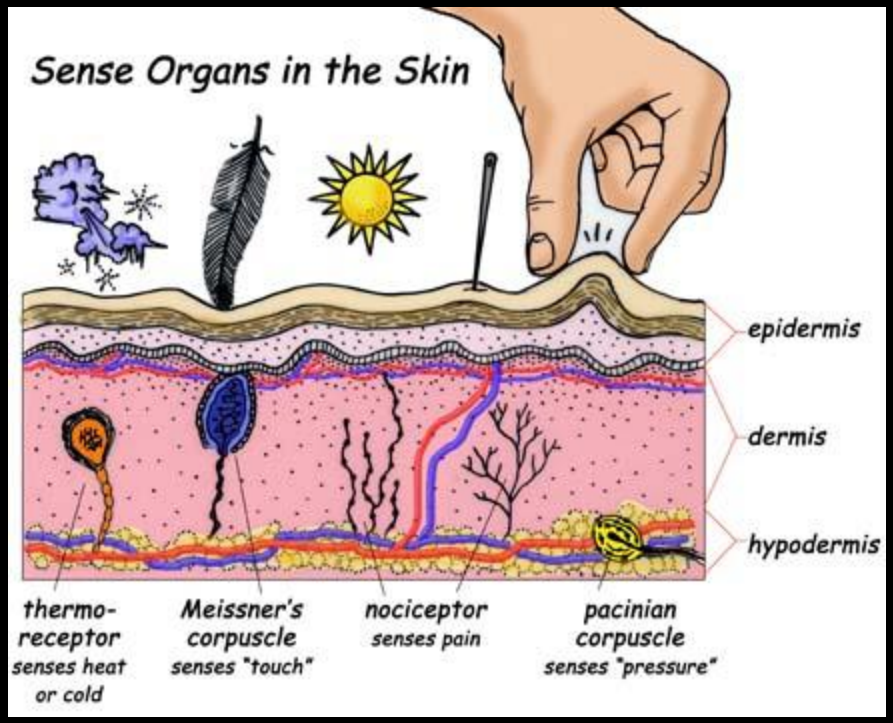
Chapter 38 Section 3: Sensory Systems

Key Vocabulary Terms

Adapted from Holt Biology 2008

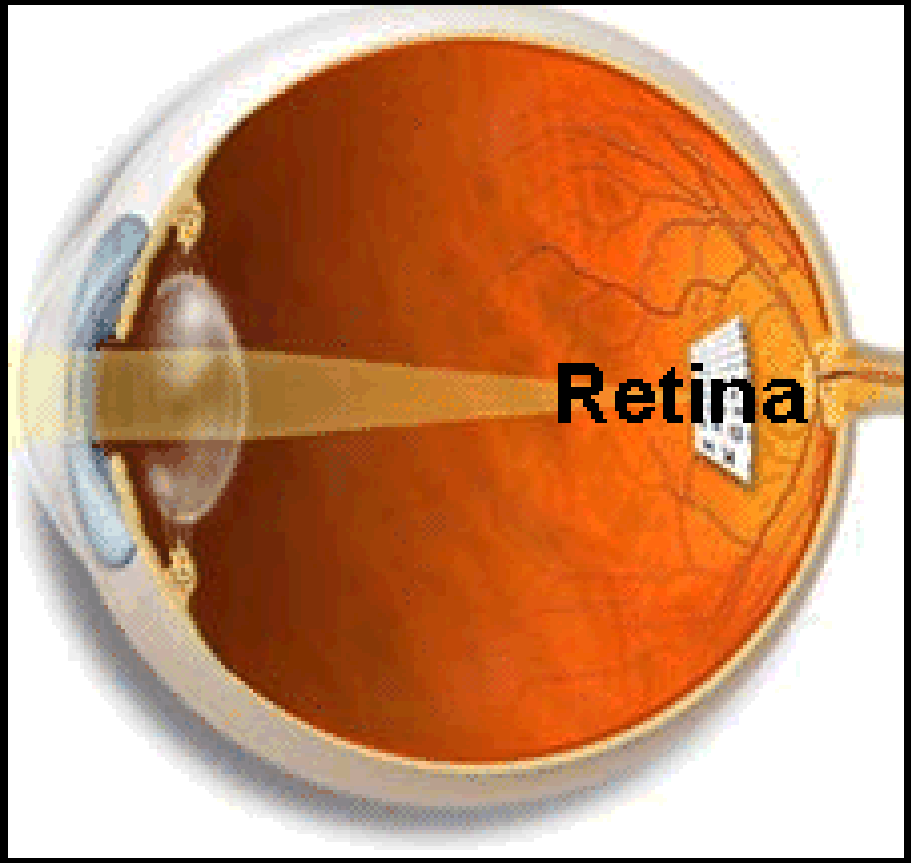
Sensory Receptor

A specialized structure that contains the ends of sensory neurons and that responds to specific types of stimuli



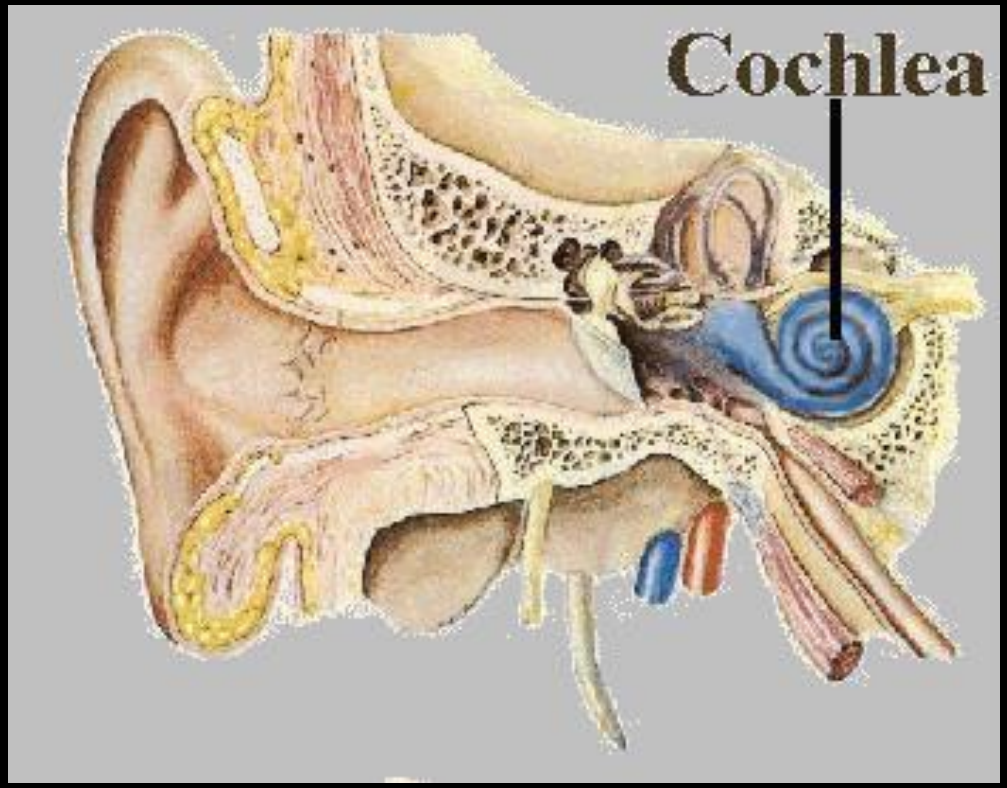
Retina

The light-sensitive inner layer of the eye, which receives images formed by the lens and transmits them through the optic nerve to the brain



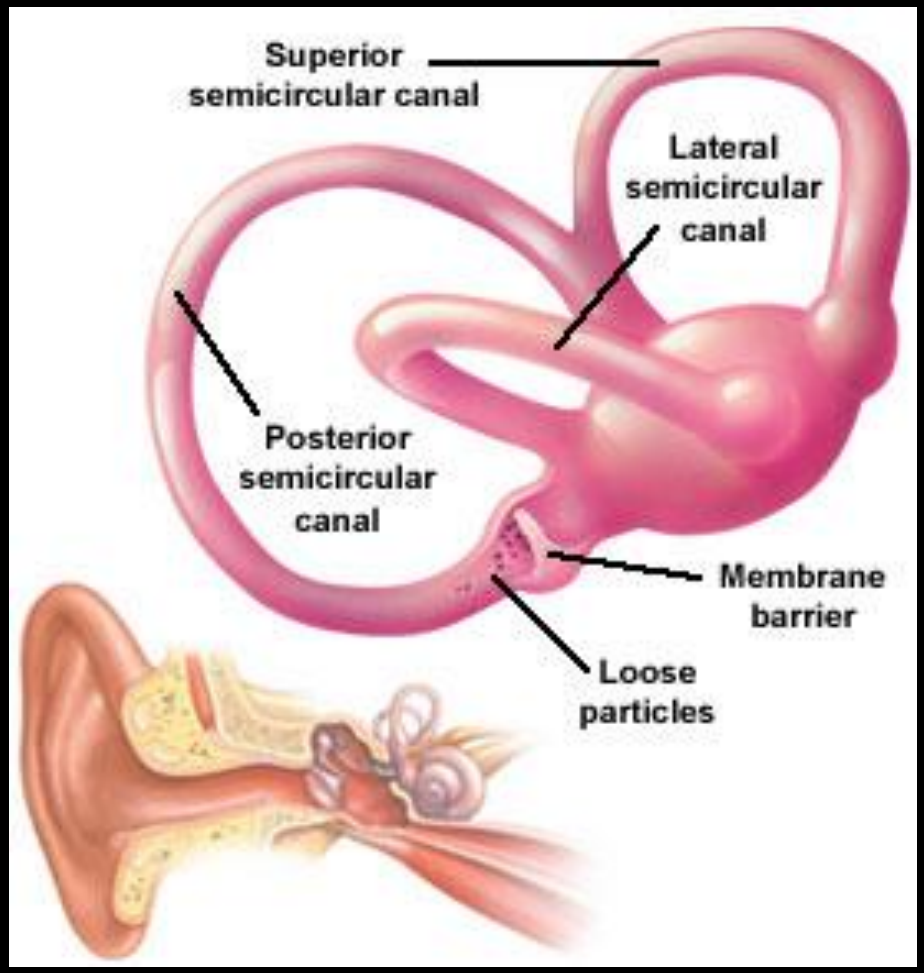
Cochlea

A coiled tube that is found in the inner ear and that is essential to hearing



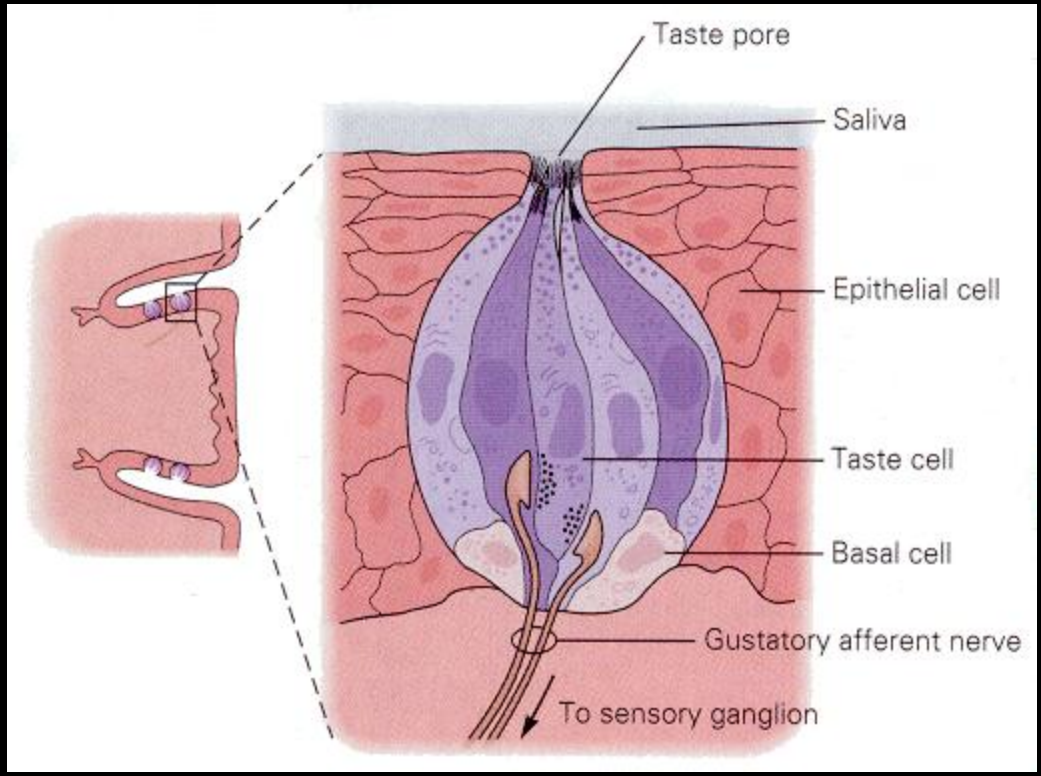
Semicircular Canal

The fluid-filled canal in the inner ear that helps maintain balance and coordinate movements



Taste Bud

One of many oval concentrations of sensory nerve endings on the tongue, palate, and pharynx



Think, Share, Write #5

What types of cells are sensory receptors?

Think, Share, Write #5

What types of cells are sensory receptors?

The types of cells that are sensory receptors are specialized neurons located in sensory organs.

.

Chapter 38 - Section 3: Sensory Systems

Notes

Adapted from Holt Biology 2008

Content Objectives
Write these down!

I will be able to identify:

- How sensory information is detected.
- The five (5) types of sensory receptors.
- Where the sites of sensory processing are in the brain.

The Senses

Sensory receptors: specialized neurons that react directly to environmental stimuli

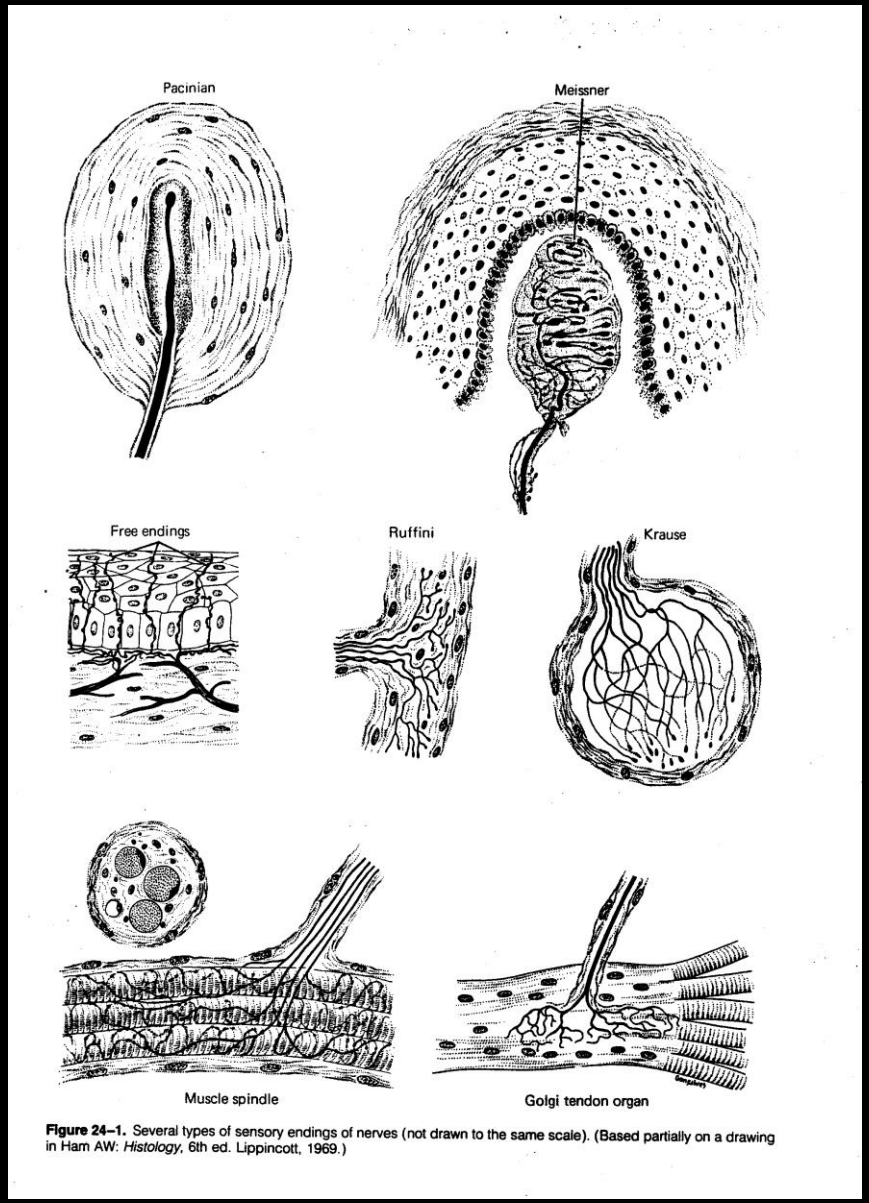
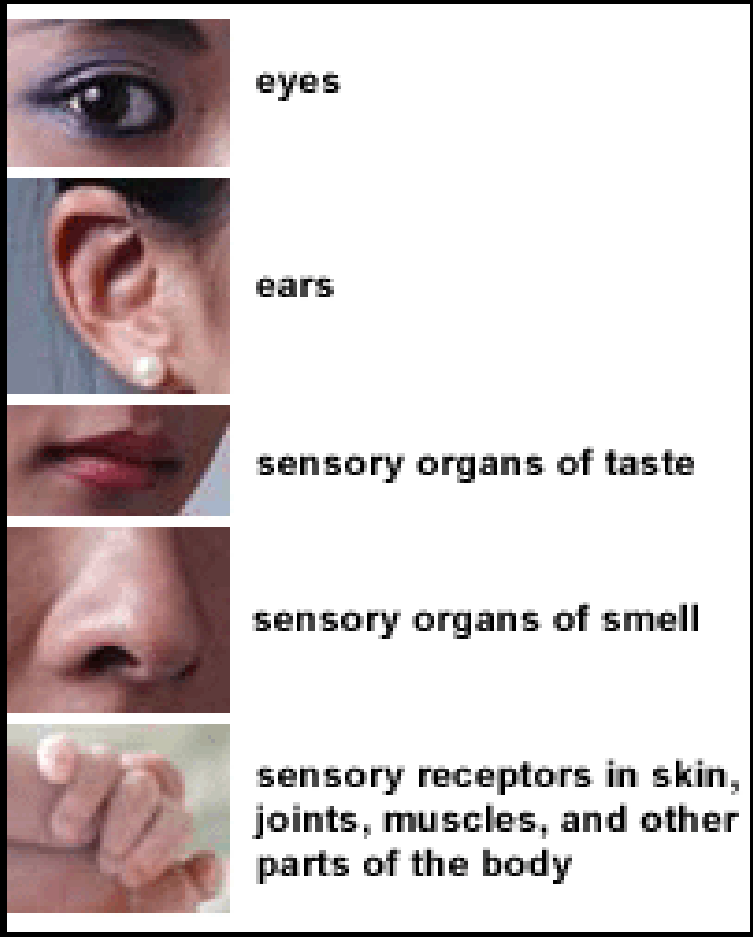


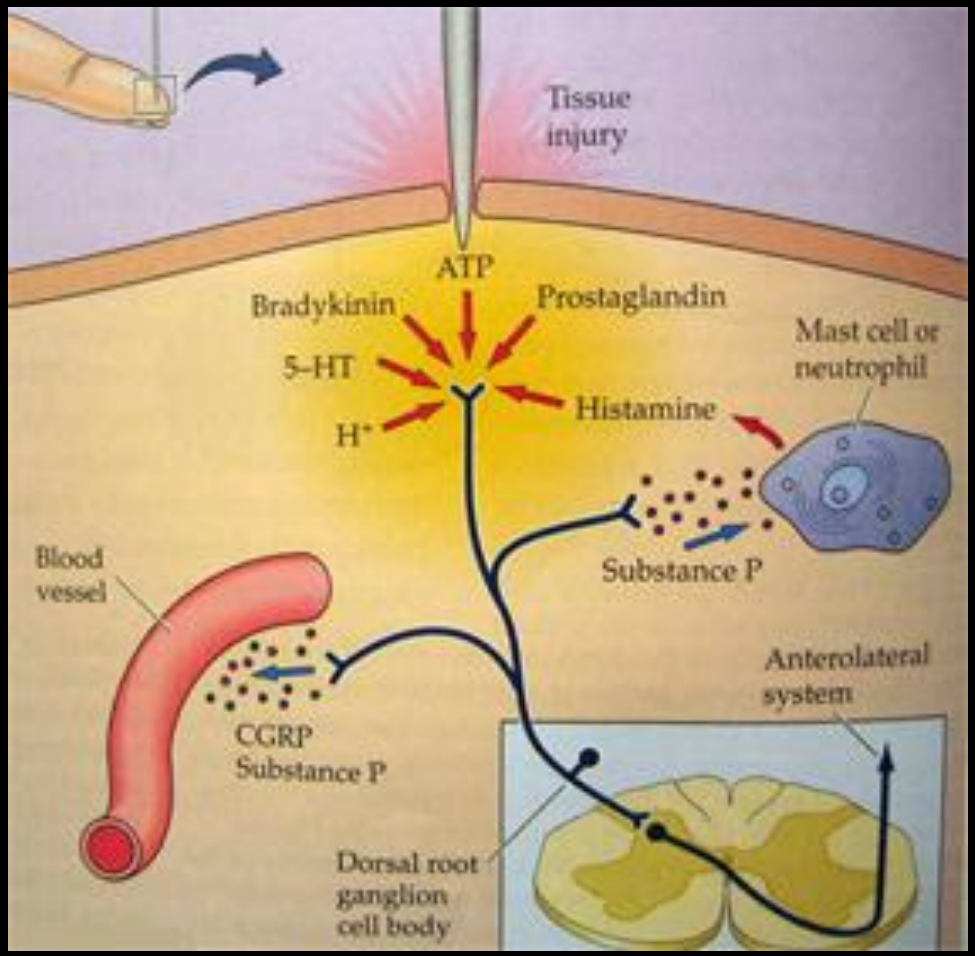
Figure 24–1. Several types of sensory endings of nerves (not drawn to the same scale). (Based partially on a drawing in Ham AW: *Histology*, 6th ed. Lippincott, 1969.)

Key point: *There are five general categories of sensory receptors:*

pain receptors
thermoreceptors
mechanoreceptors
chemoreceptors
photoreceptors



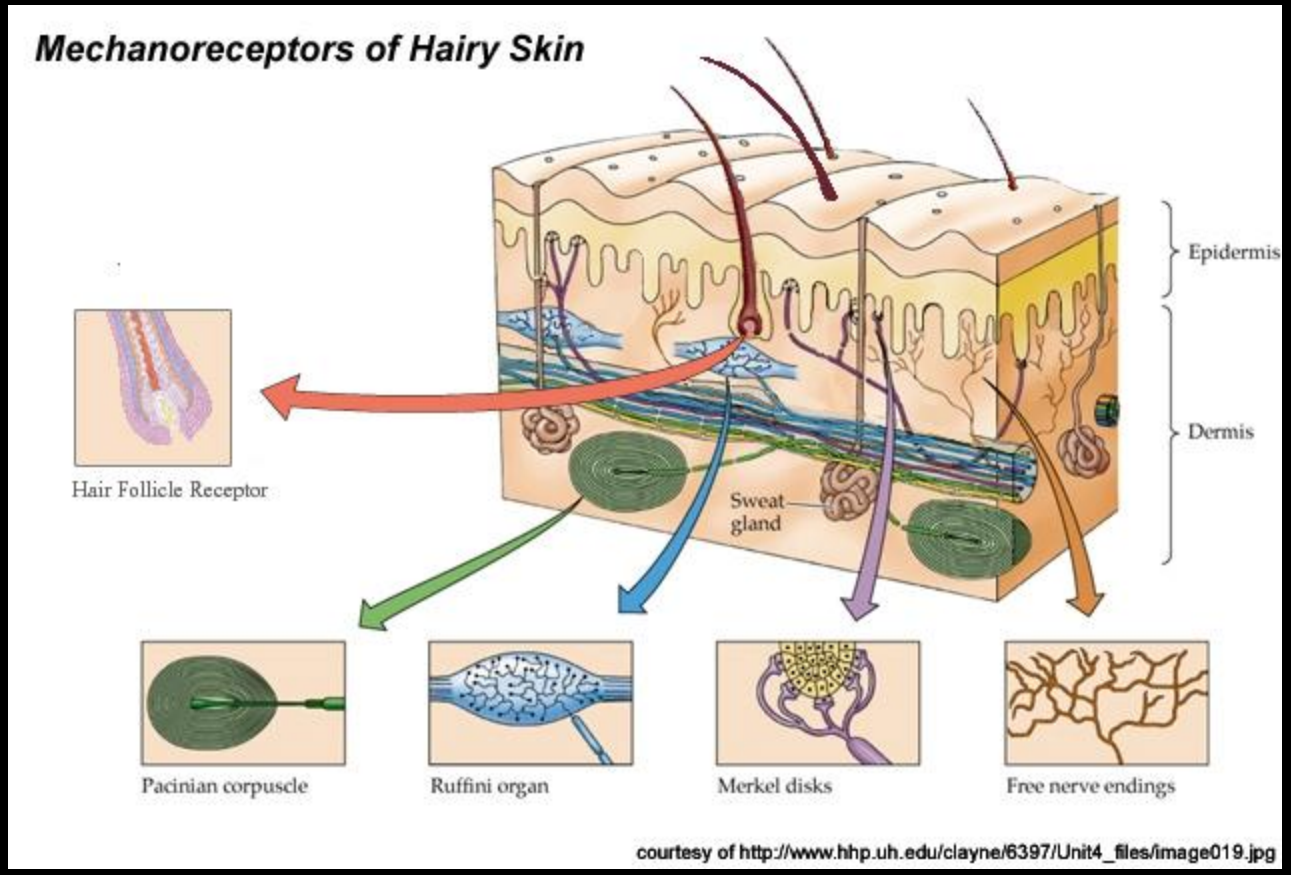
Pain receptors
Respond to tissue damage



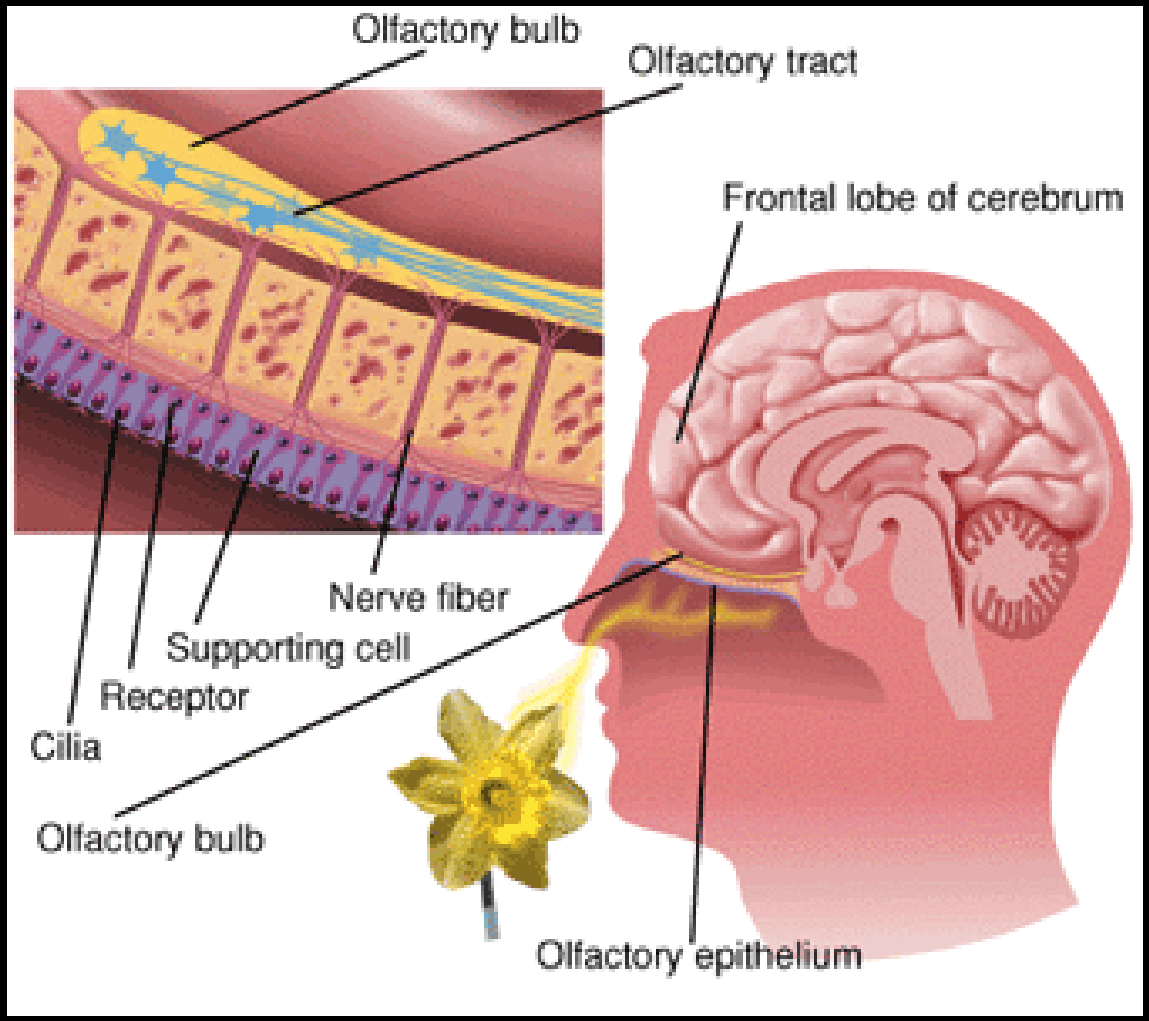
Thermoreceptors

Respond to mild heat and cold

Mechanoreceptors
Respond to pressure



Chemoreceptors
Respond to chemicals



Photoreceptors
Respond to light

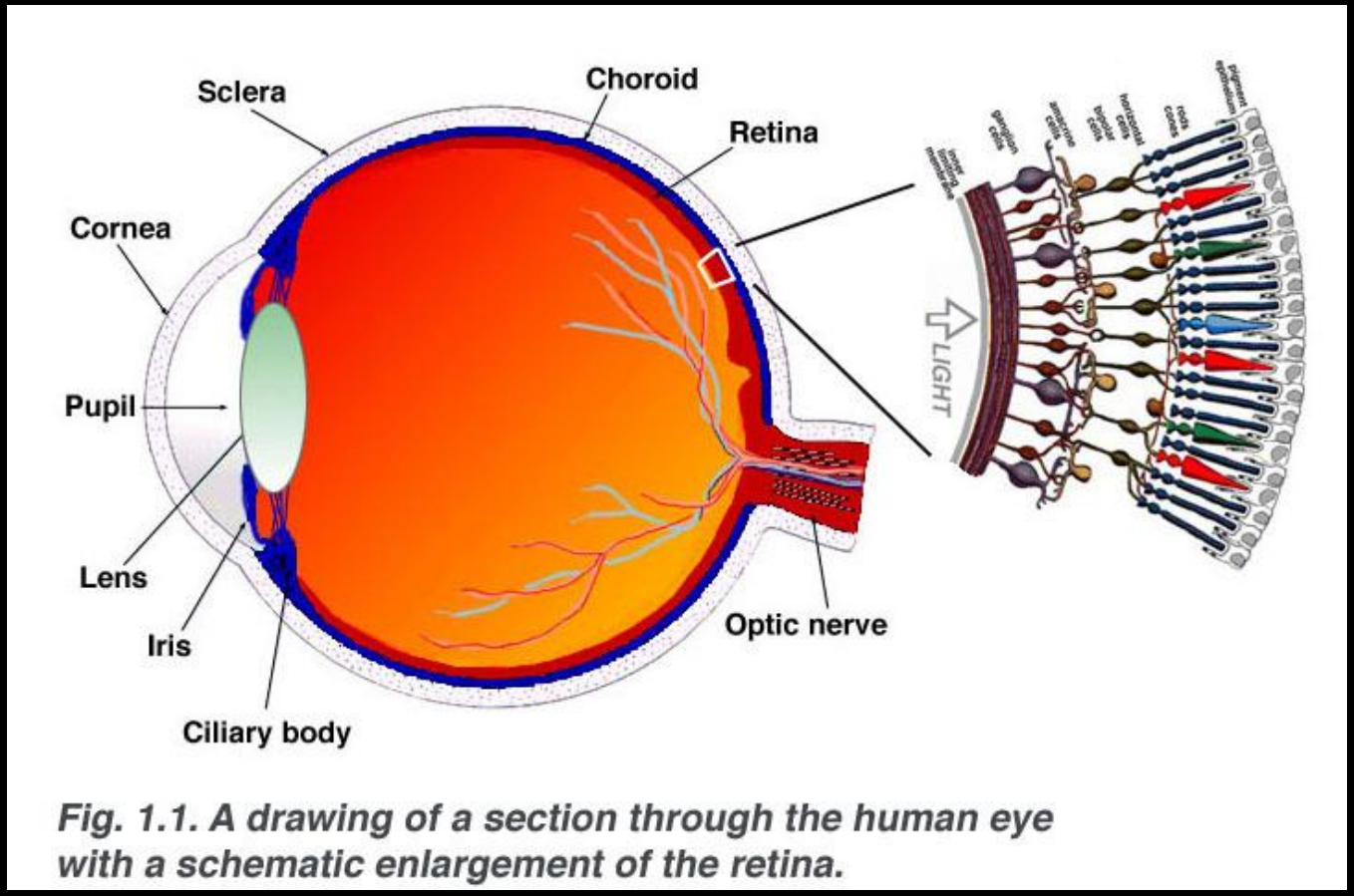
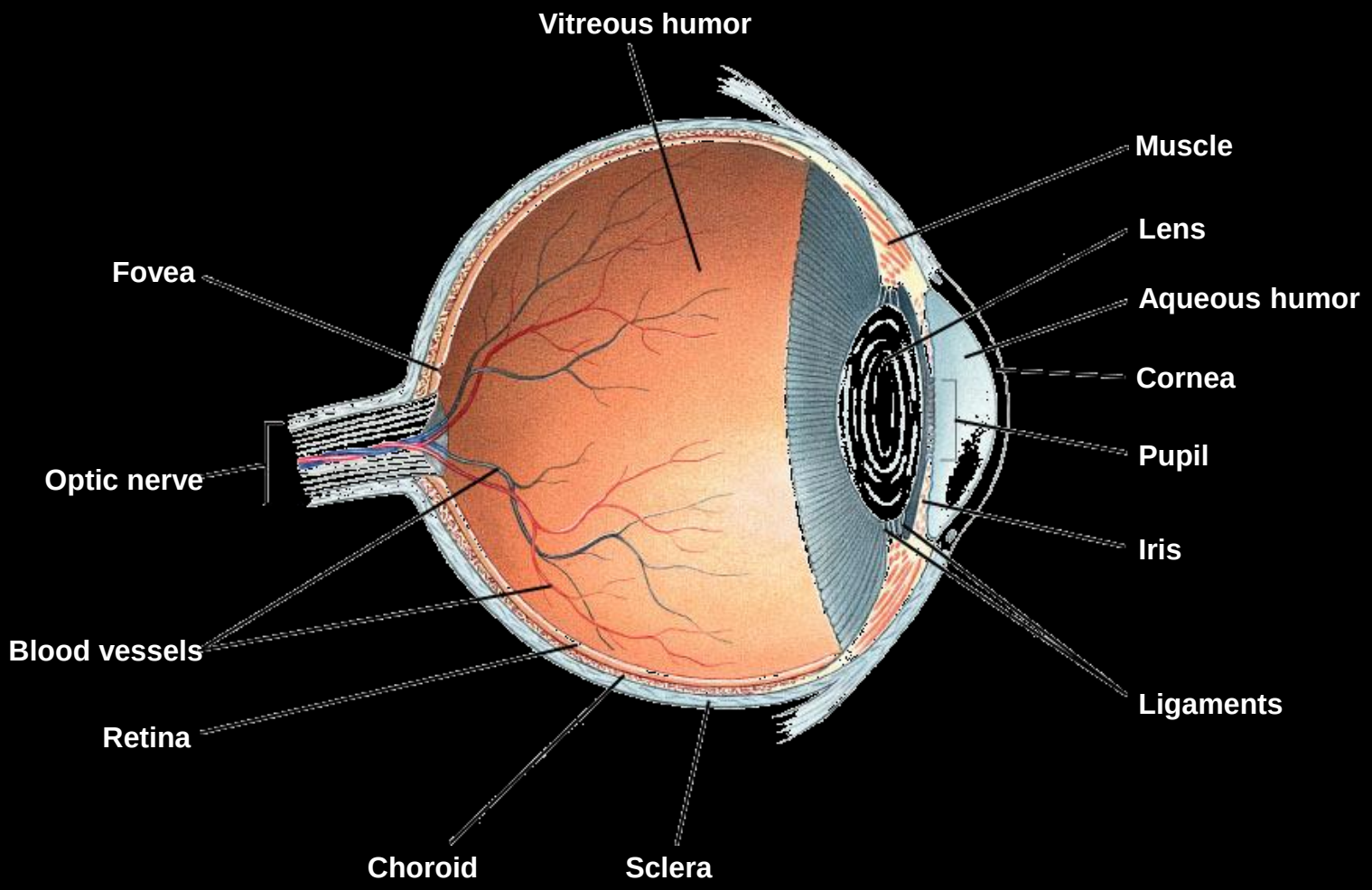
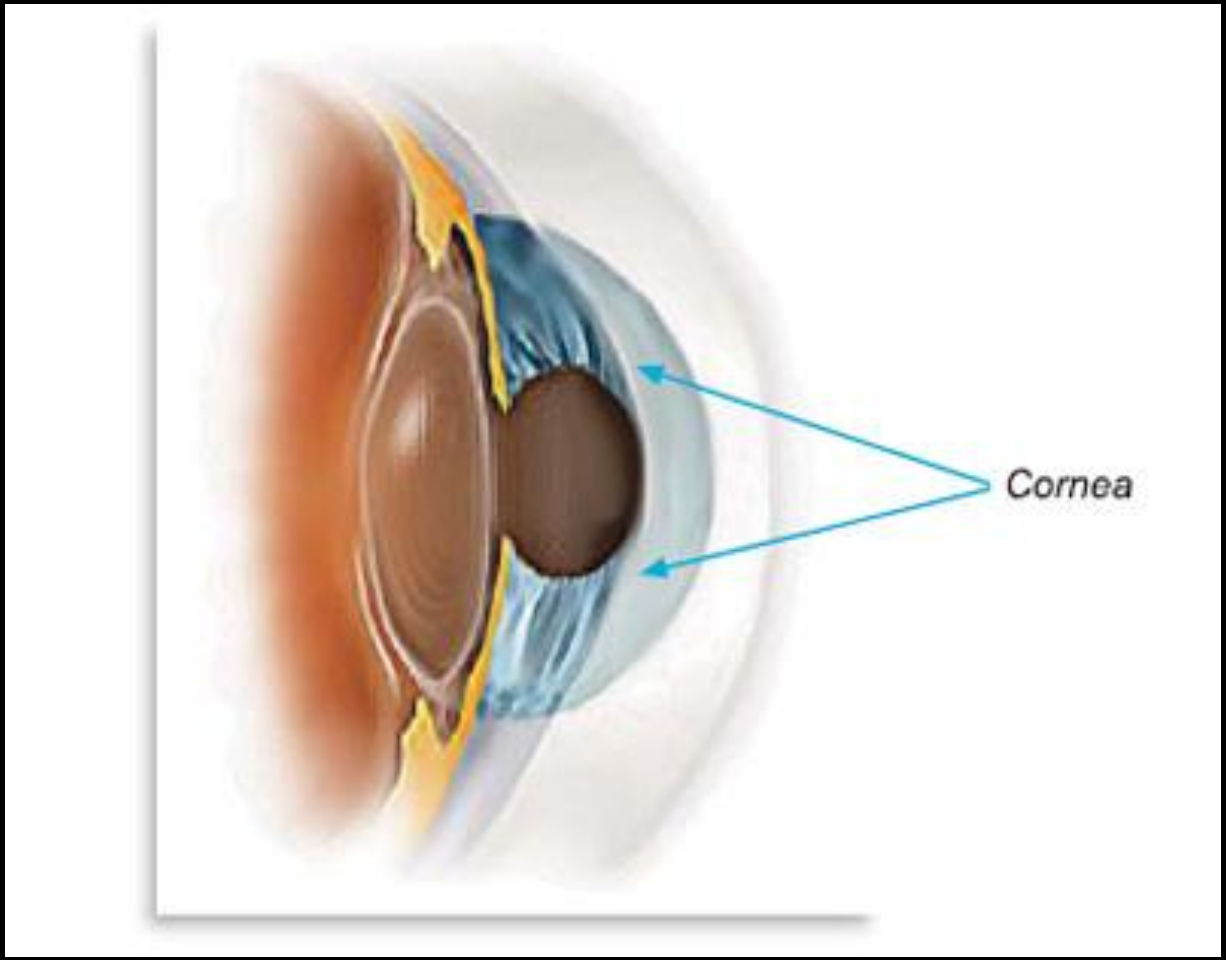


Fig. 1.1. A drawing of a section through the human eye with a schematic enlargement of the retina.

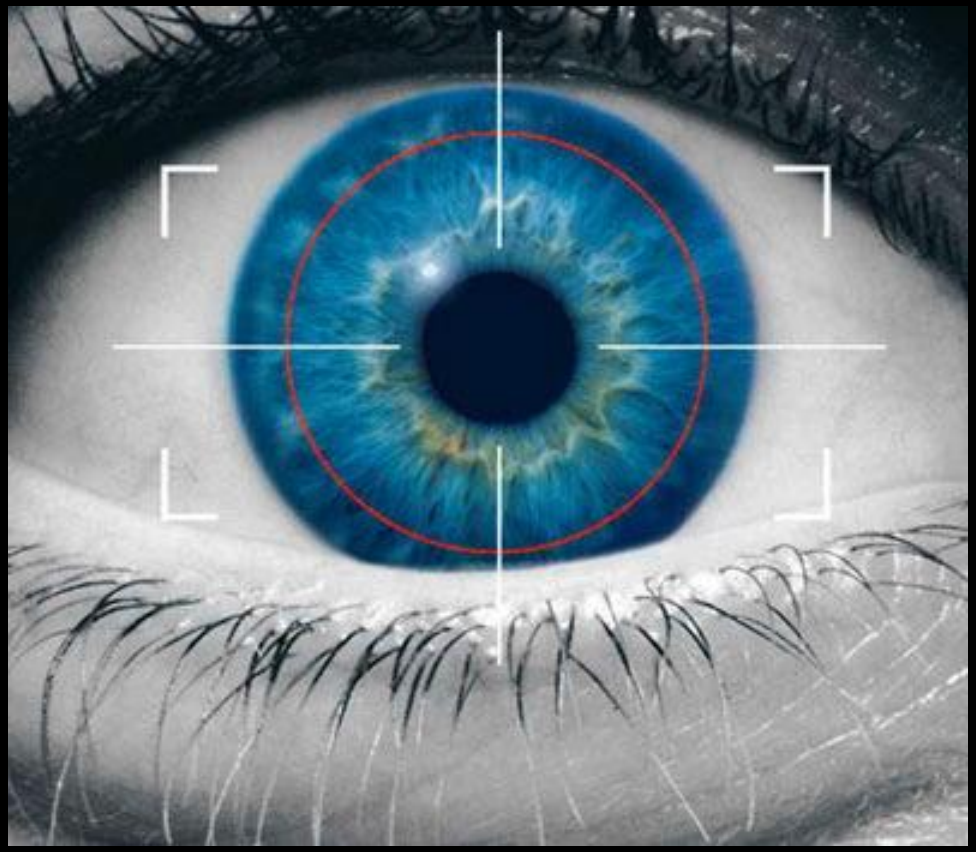
Four Senses - Vision - The Eye



Cornea - *focuses light*

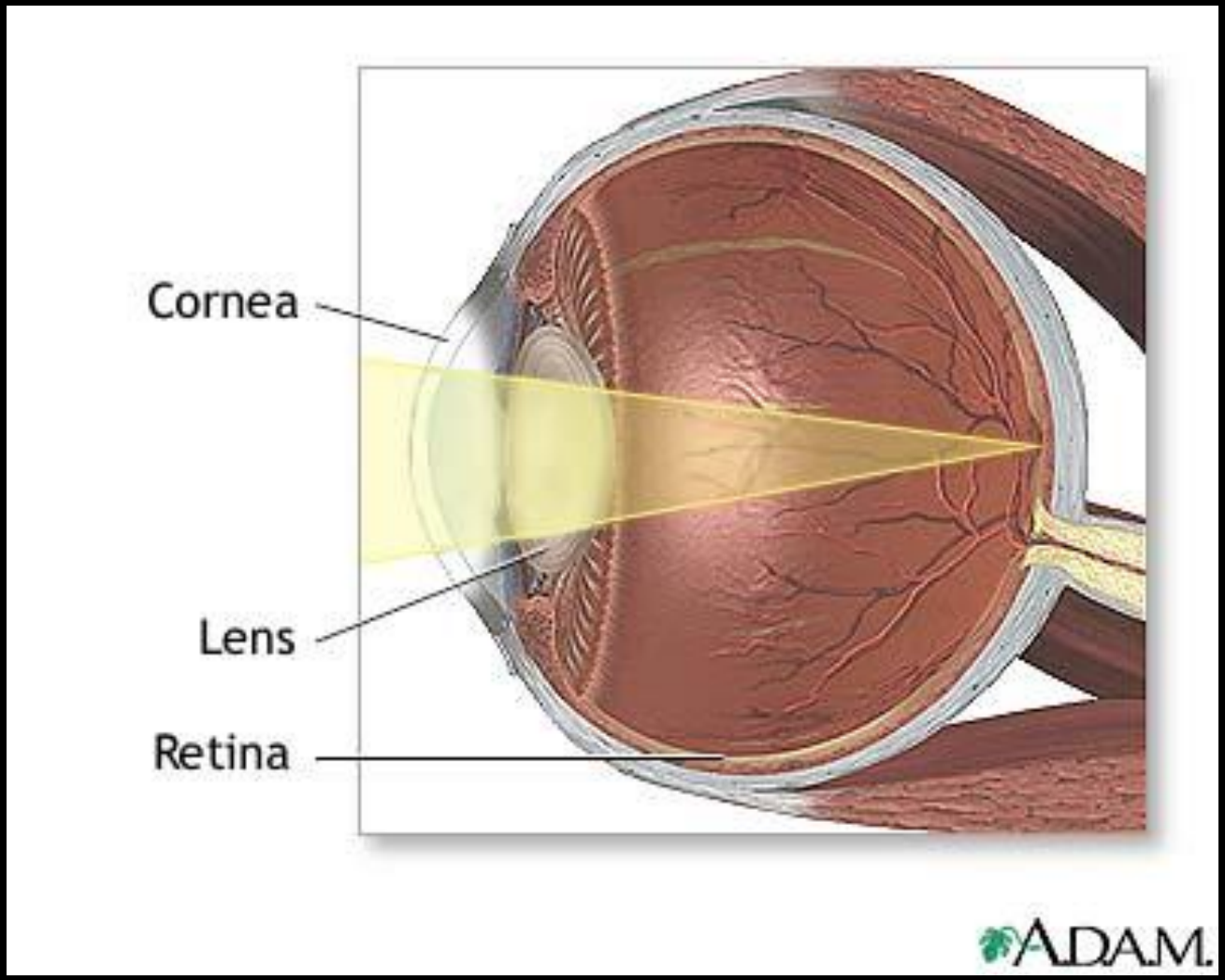


Iris - *colored part of the eye, contains muscles to control opening of the pupil*

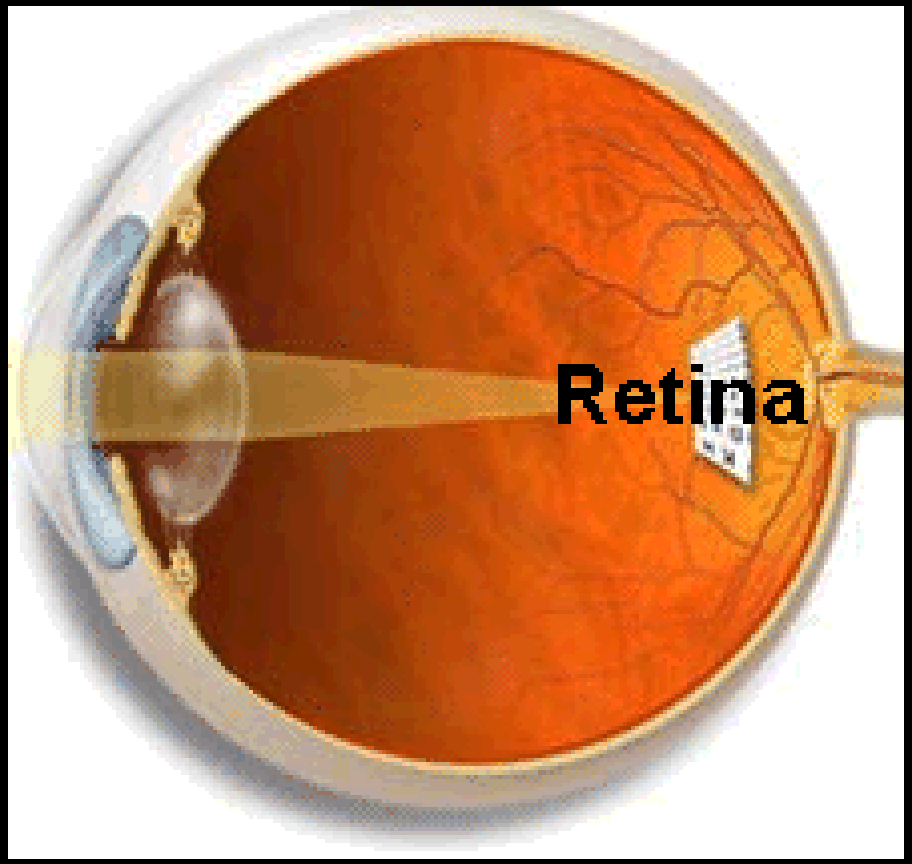


Pupil - *allows light into the eye*

Lens - *adjusts focus, muscles control shape of the lens*

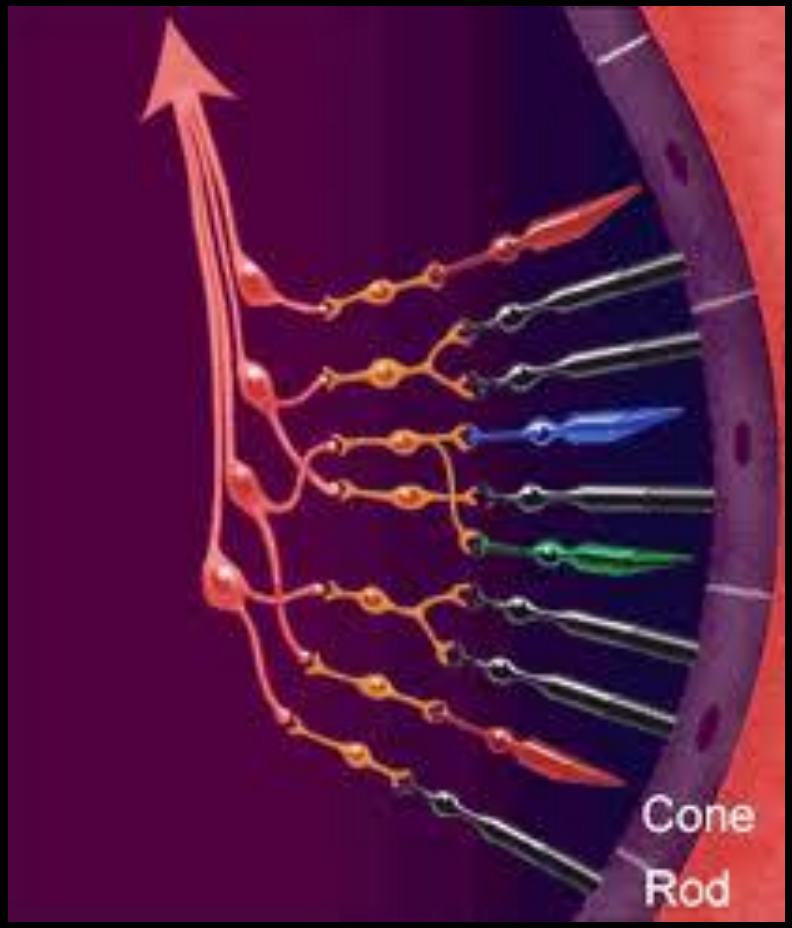


Retina - *contains photo receptors (rods & cones) that convert light to nerve impulses*

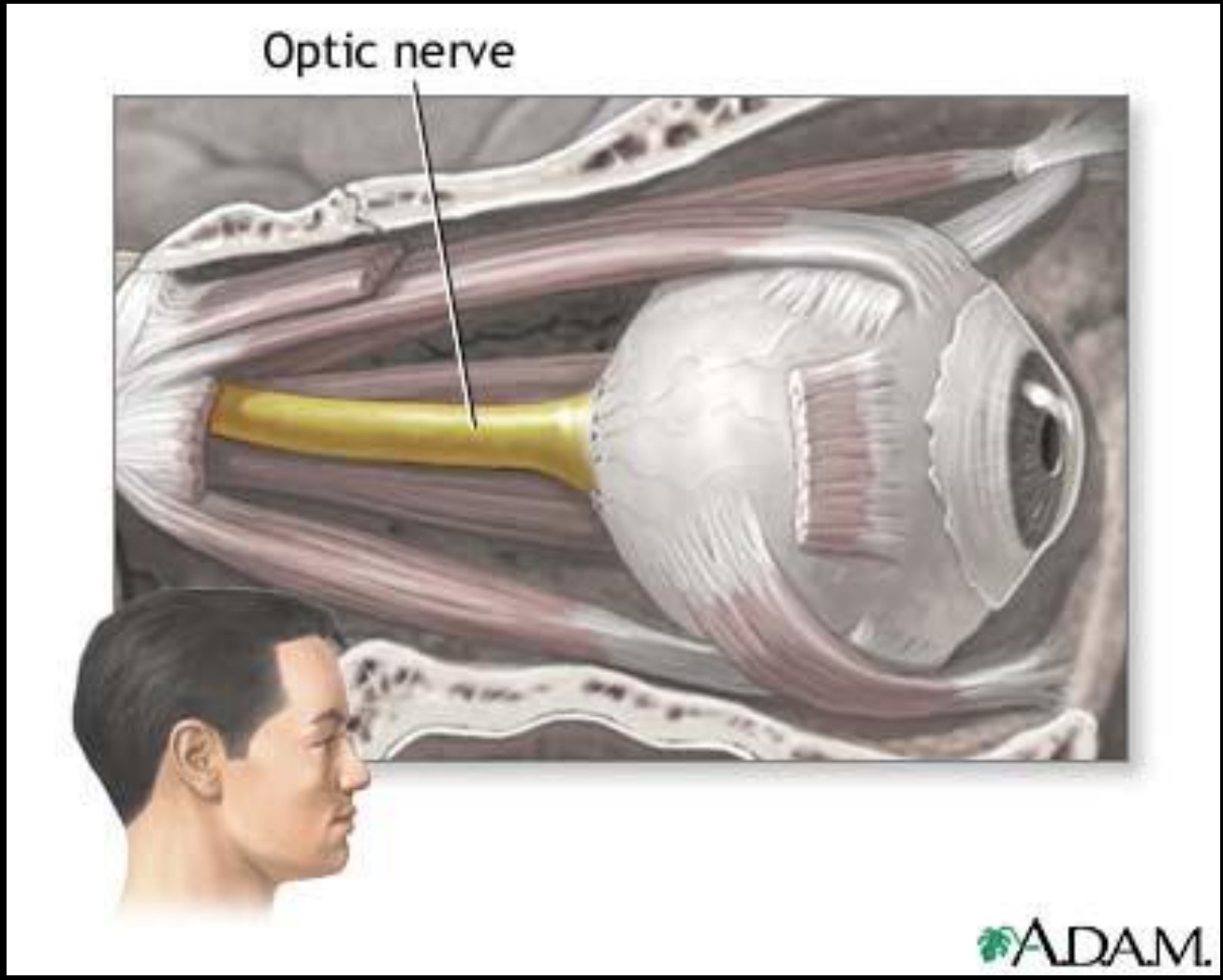


Rods *- sensitive to light,* ***no colors***

Cones -distinguishes color



Optic nerve - *carries impulses to the brain*

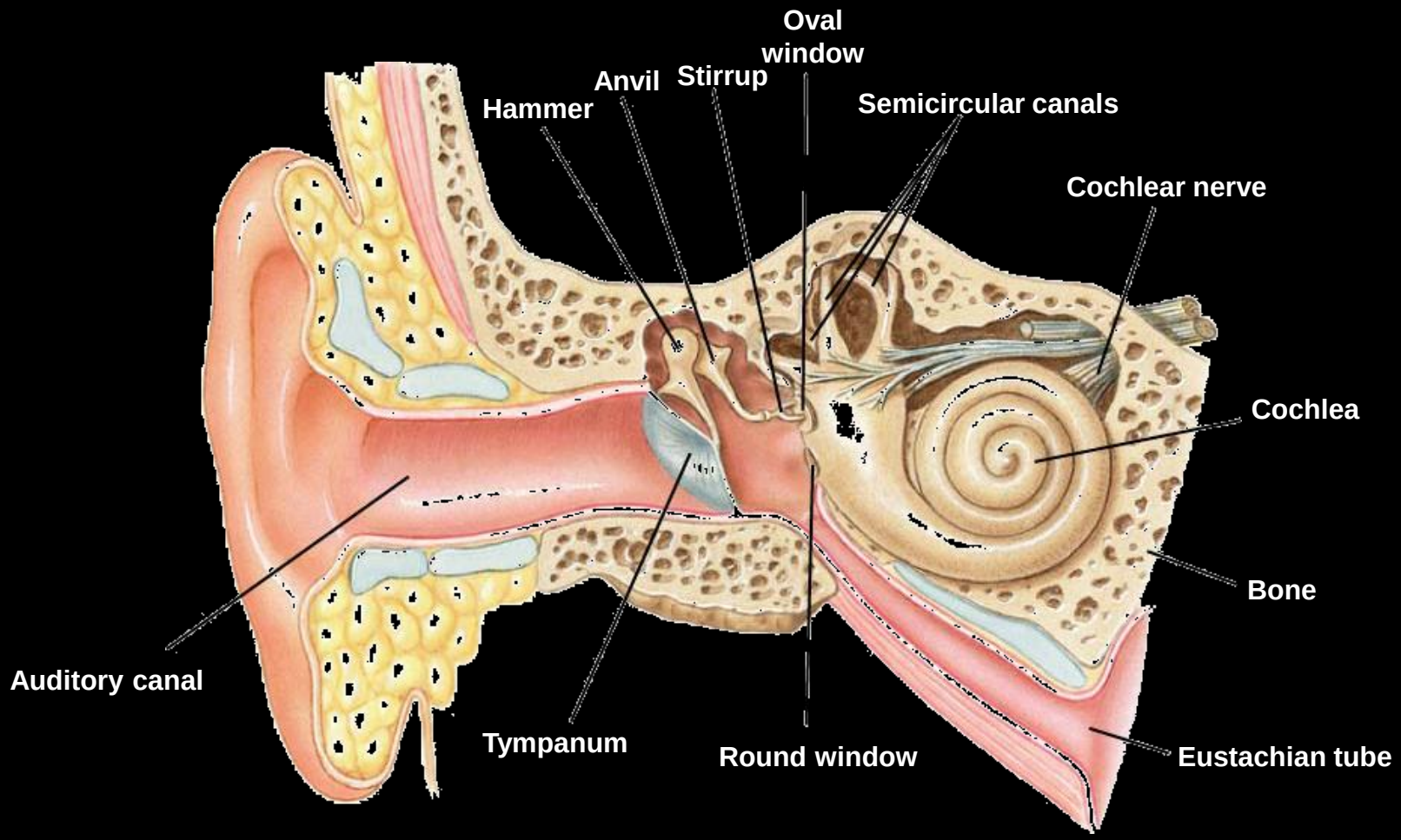


YOUR TURN

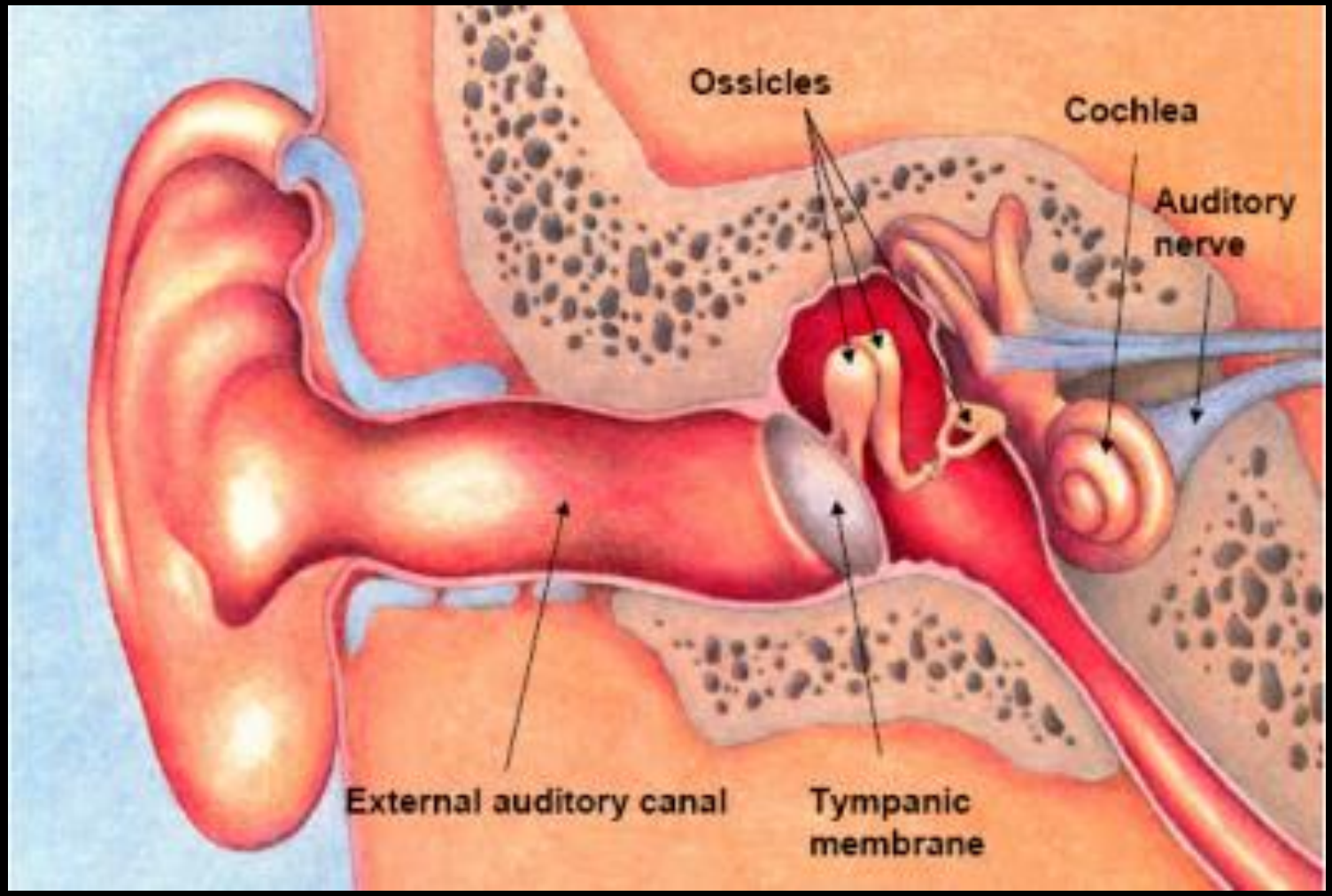
- With a partner, read the Chapter 38 Section 3 Active Reading – Sensory Systems
- 1st - Take turns reading the questions aloud to each other, alternating questions.
- 2nd - Take turns reading the selection aloud to each other, alternating sentences or paragraphs.

YOUR TURN

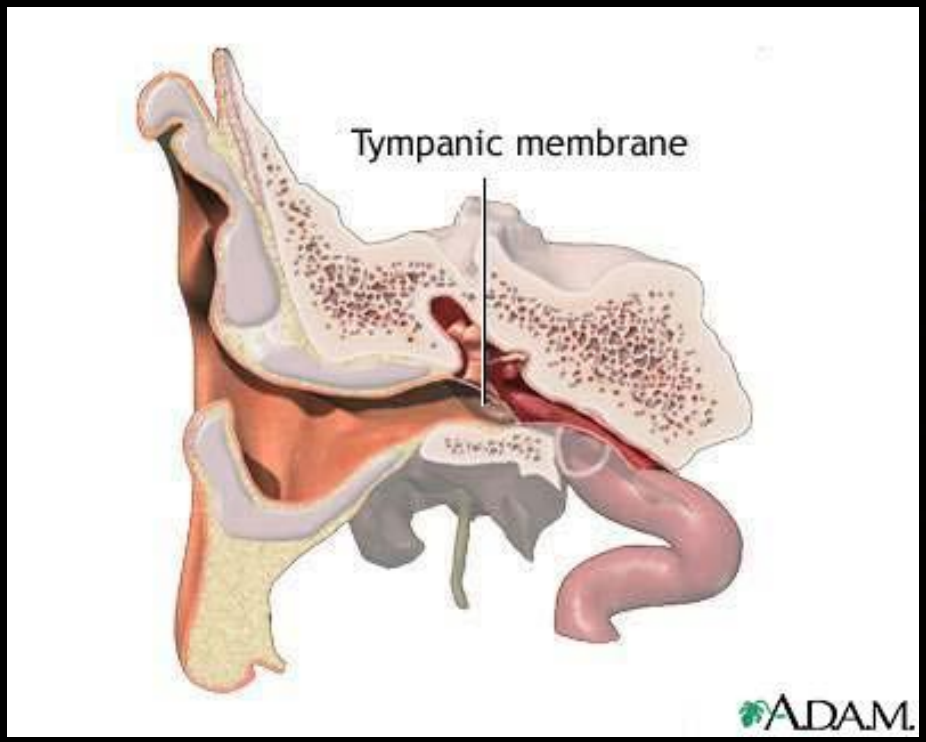
- As you read discuss the content.
- Reread and discuss each question. Write down the best answer to the question using full descriptive sentences.
- Be prepared to share with the class.


Oval window
Anvil
Stirrup
Hammer
Semicircular canals
Cochlear nerve
Cochlea
Bone
Auditory canal
Tympanum
Round window
Eustachian tube

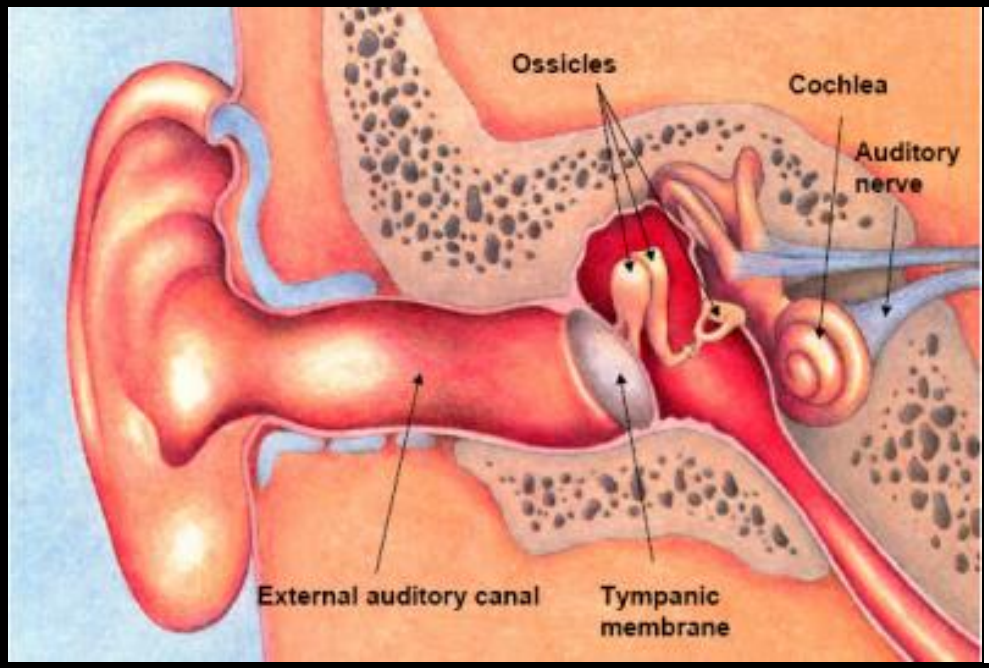
Auditory canal -funnels sound into ear

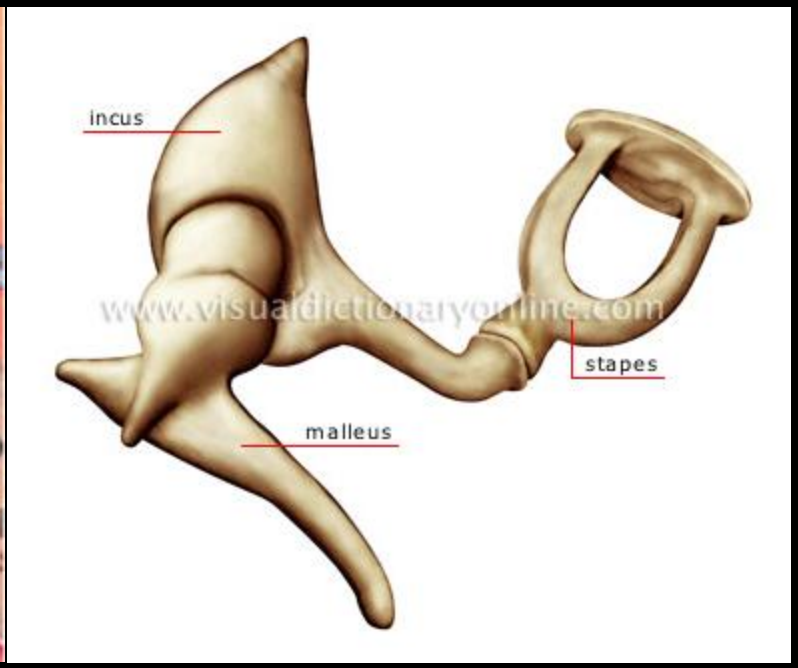


Tympanic membrane - vibrates to further transmit sound

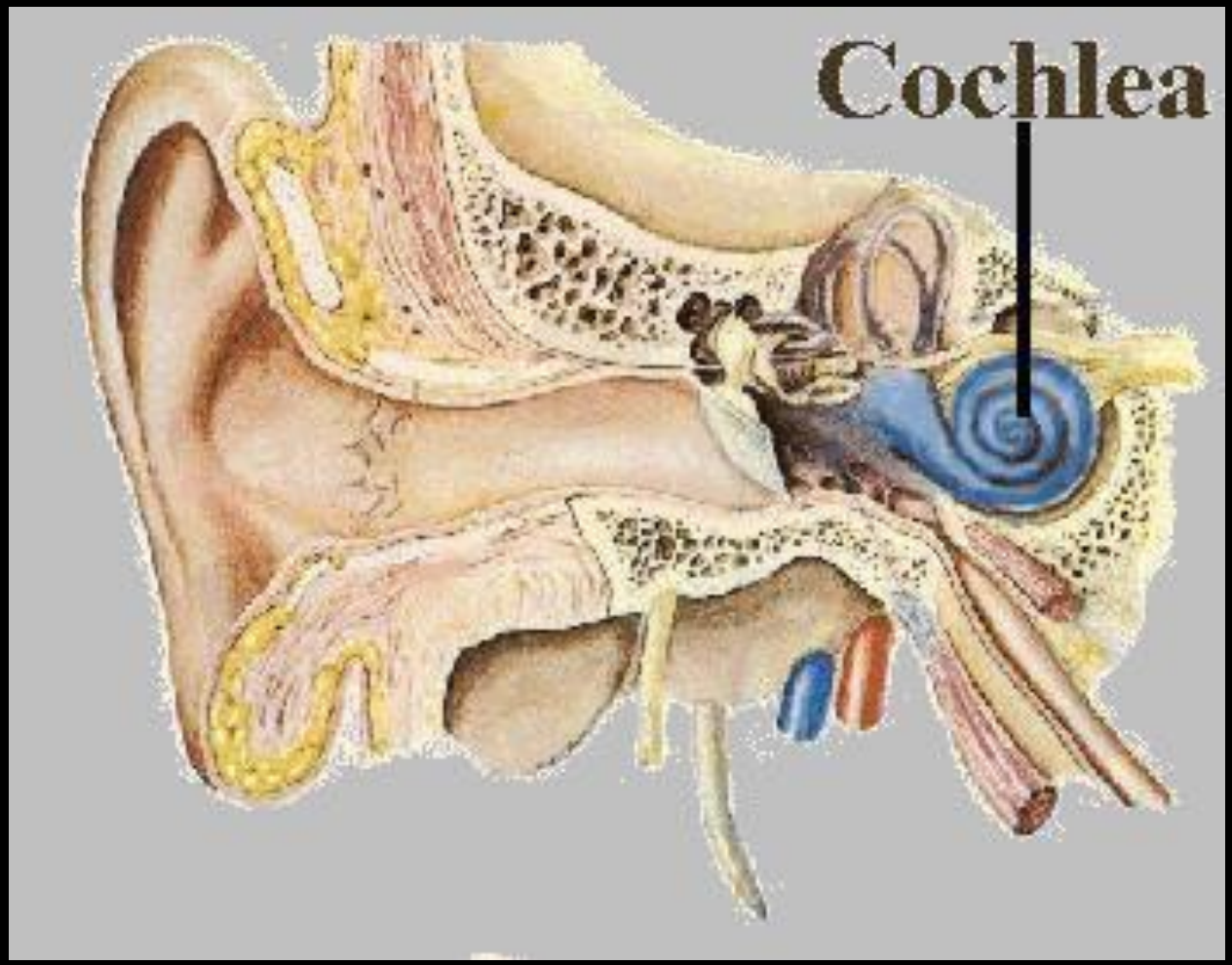


Ossicles - small bones, transmit vibrations into the cochlea





Cochlea - fluid filled chamber that converts sound waves to nerve impulses



Think, Share, Write #6

How do hair cells detect sound waves?

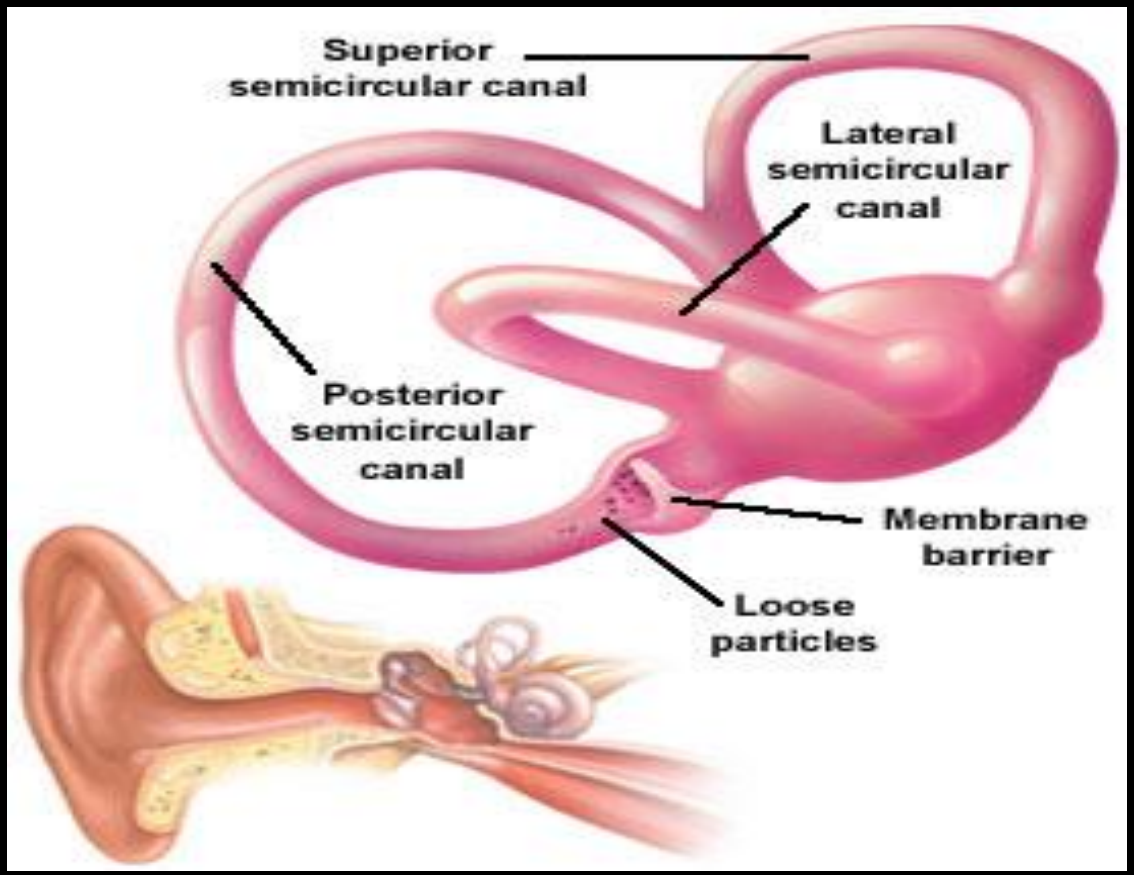
Think, Share, Write #6

How do hair cells detect sound waves?

Hair cells detect sound waves by resting on a membrane that vibrates when sound waves enter the cochlea.

.

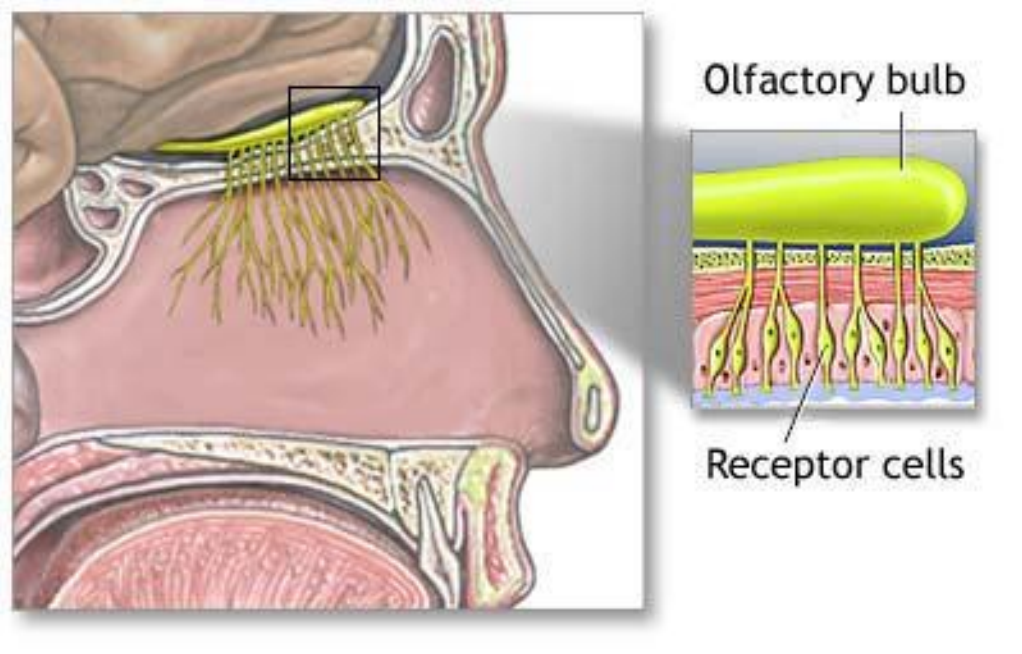
Semicircular canals - fluid filled canals that are involved in balance and equilibrium

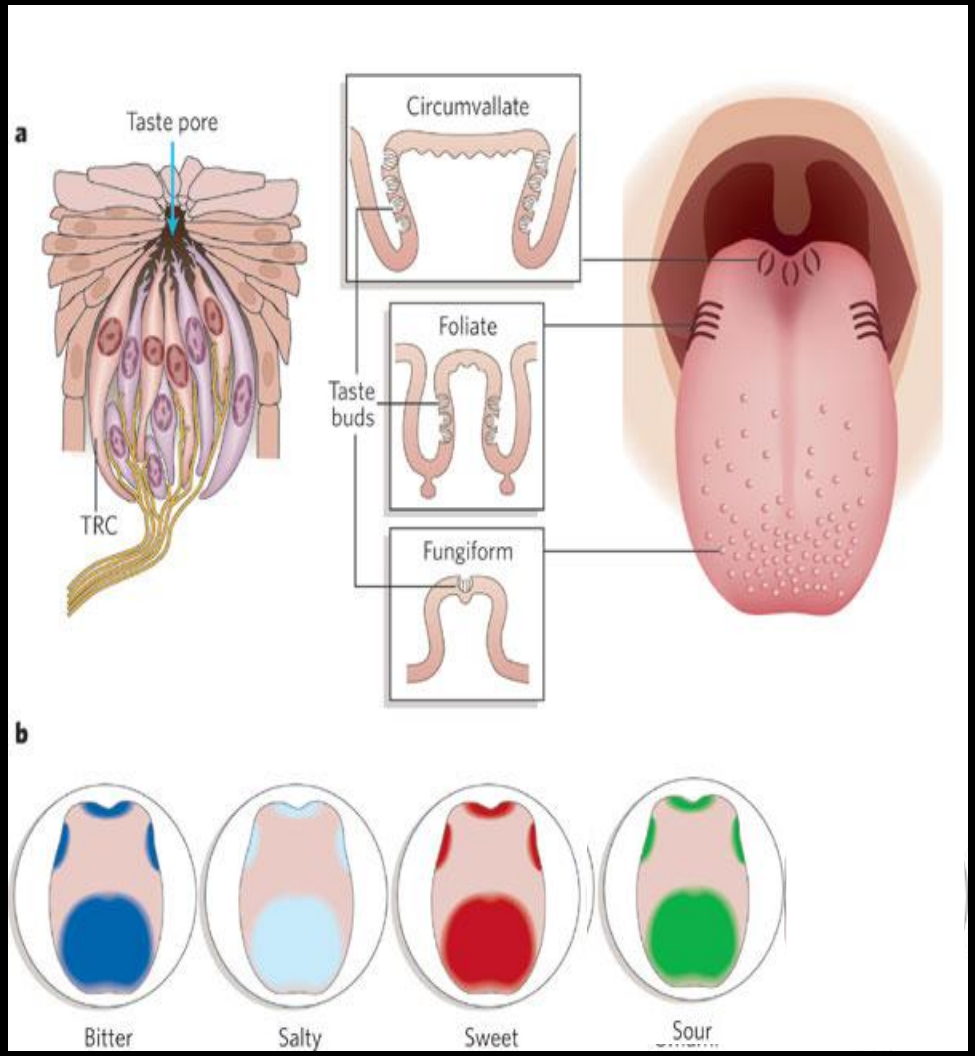


Smell – Nose

Receptors located in nasal passages

Chemical sense - odor molecules must be moist





Taste - tongue

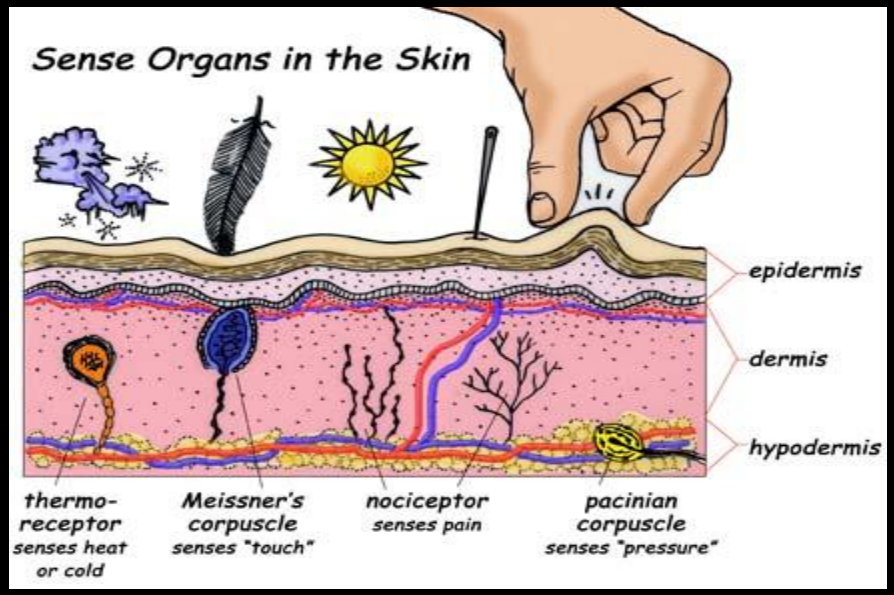
Receptors located on the surface of the tongue

Four tastes only - *sweet, sour, bitter, salty*

Touch and pressure

Receptors located in skin all over body surface

Most on fingers, toes and face



Content Objectives
Write these down!

I will be able to identify:

- Why psychoactive drugs are dangerous..
- The neural mechanisms that underly drug addiction.
- How nervous system function is damaged.

Chapter 38 - Section 4: Nervous System Dysfunction

Notes

Adapted from Holt Biology 2008

Commonly Used Drugs

Drug Type	Medical Use	Examples	Effects on the body
Stimulants	Used to increase alertness, relieve fatigue	Amphetamines	Increase heart and respiratory rates; elevate blood pressure; dilate pupils; decrease appetite
Depressants	Used to relieve anxiety, irritability, tension	Barbiturates Tranquilizers	Slow down the actions of the central nervous system; small amounts cause calmness and relaxation; larger amounts cause slurred speech and impaired judgement
Opiates	Used to relieve pain	Morphine Codeine	Act as a depressant; cause drowsiness, restlessness, nausea

Drugs and the Nervous System

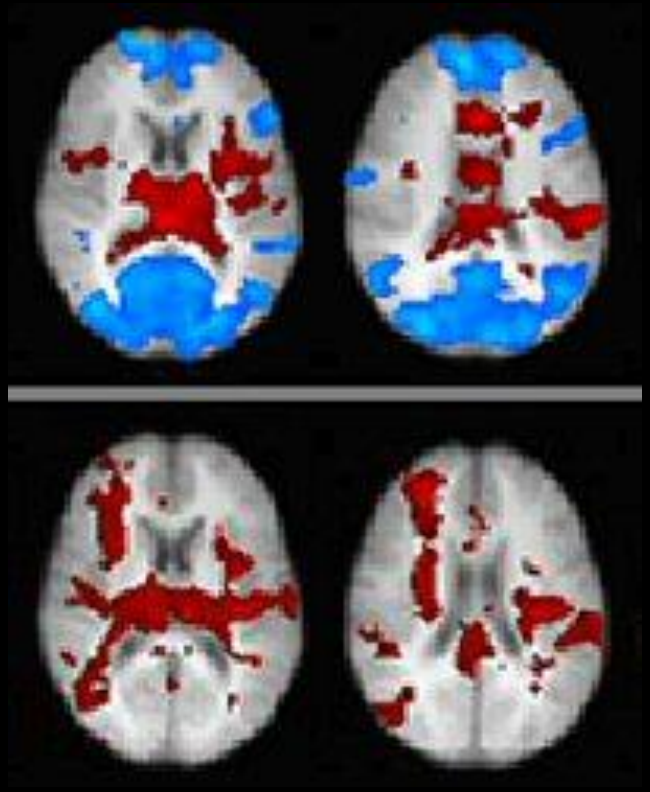
Drug - substance that causes a change in the body

Various outcomes from drugs

a. Kill bacteria or treat disease

b. Affect specific systems

c. Cause changes in brain, nervous system or synapse



Drugs that affect synapse

Stimulants

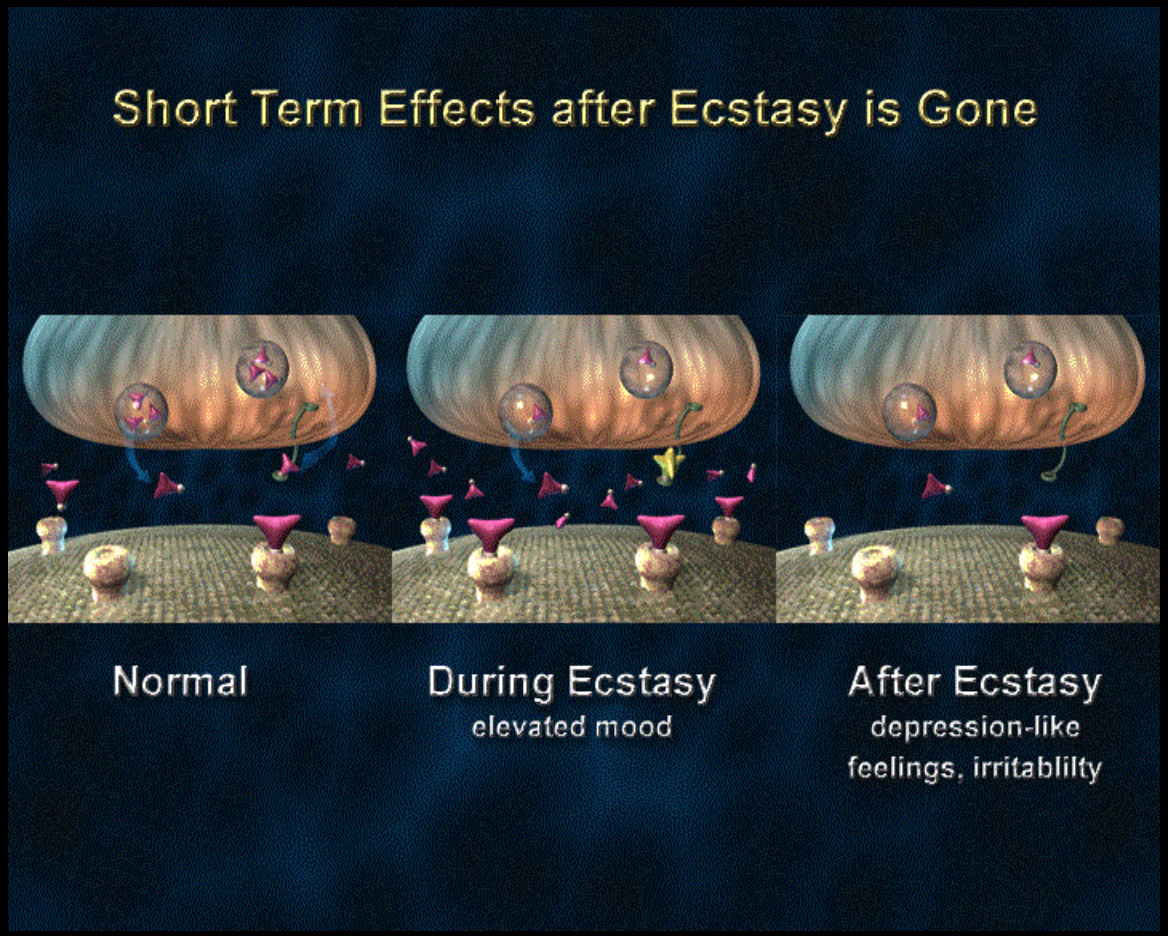
Depressants

Cocaine

Opiates

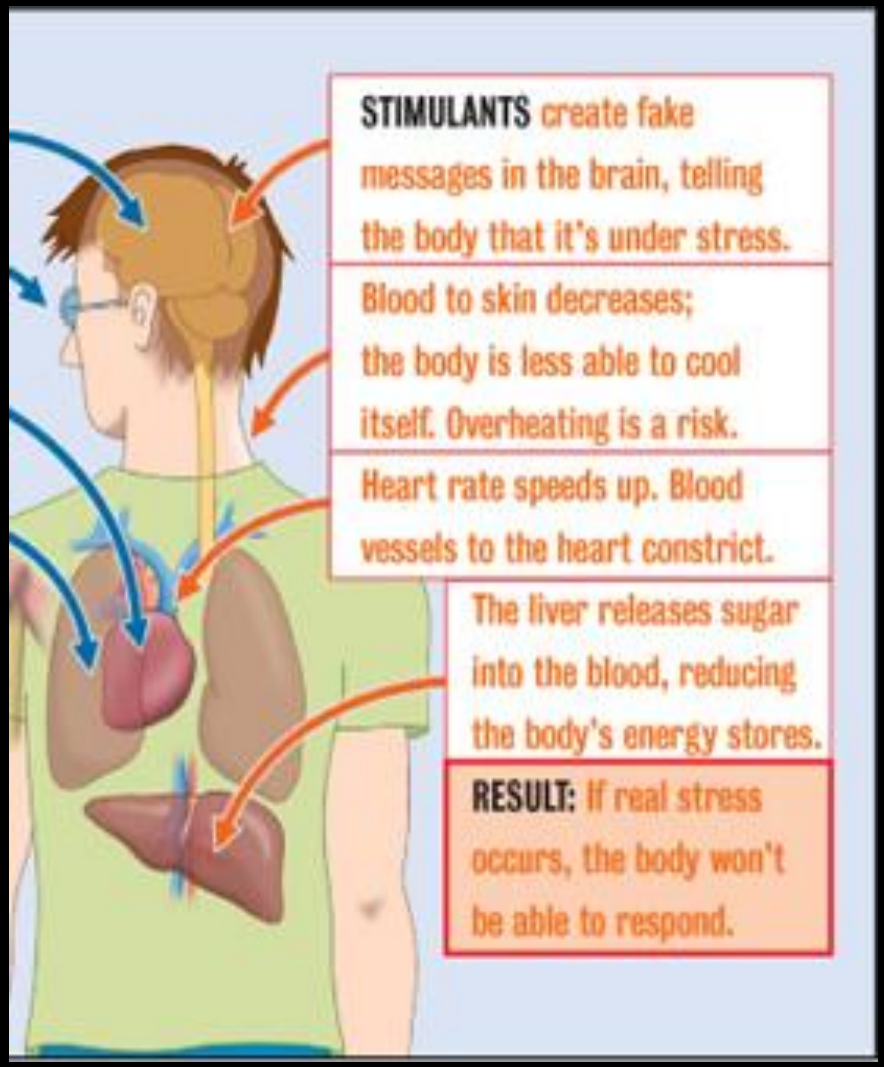
Marijuana

Alcohol



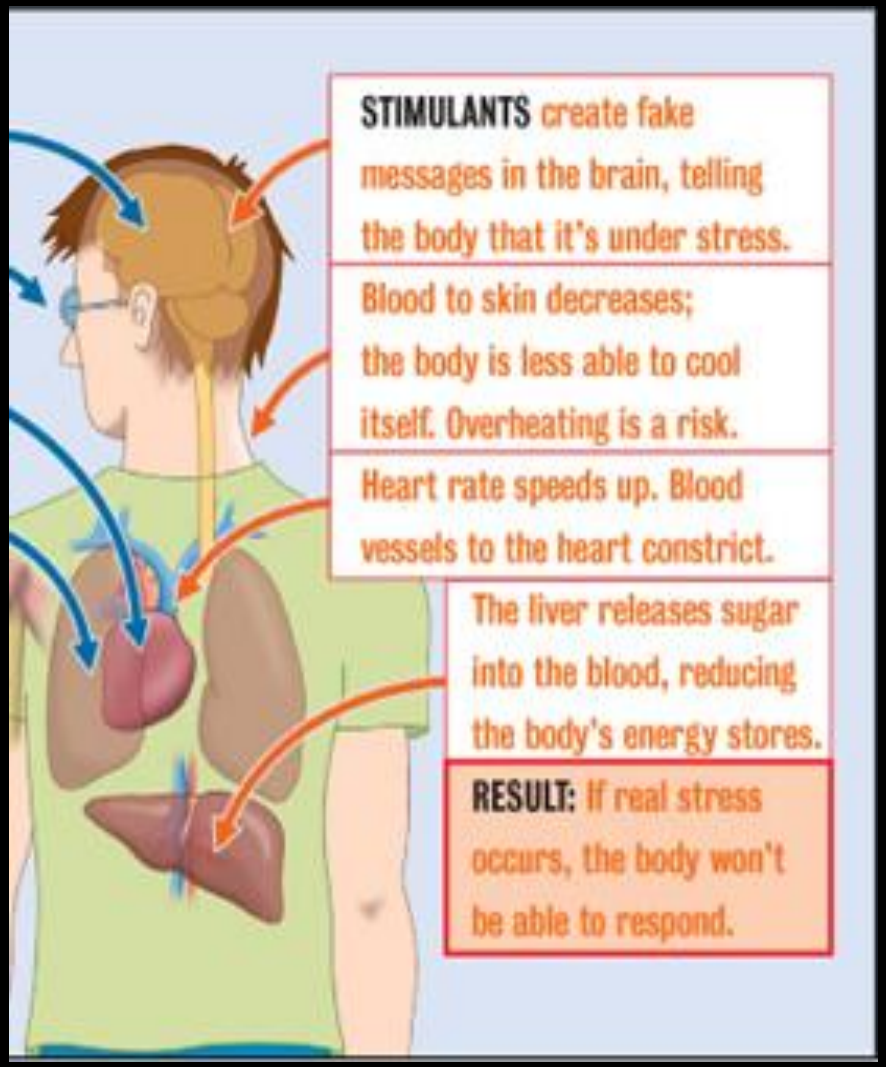
Stimulants – increase:

- Action of nervous system
- Heart rate, blood pressure, and breathing rate



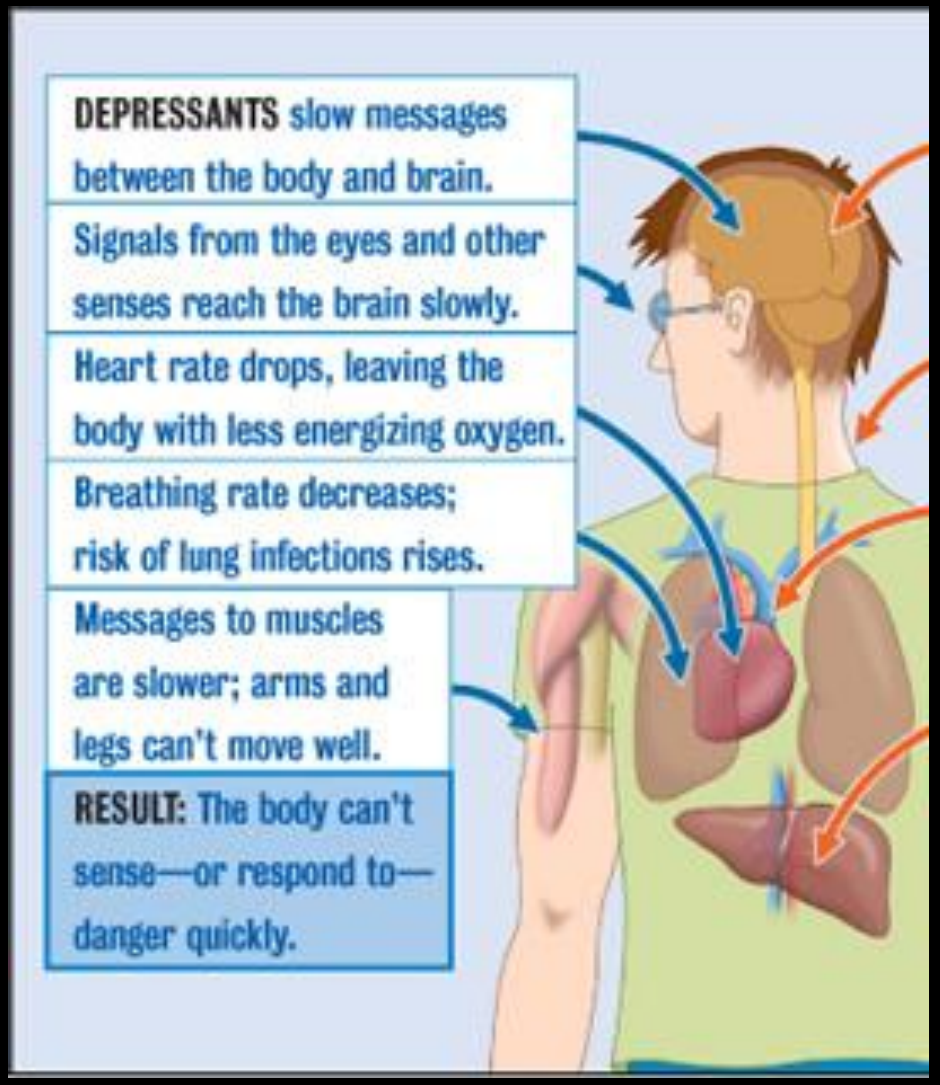
Stimulants – increase:

- Release of neurotransmitters at some synapses in the brain



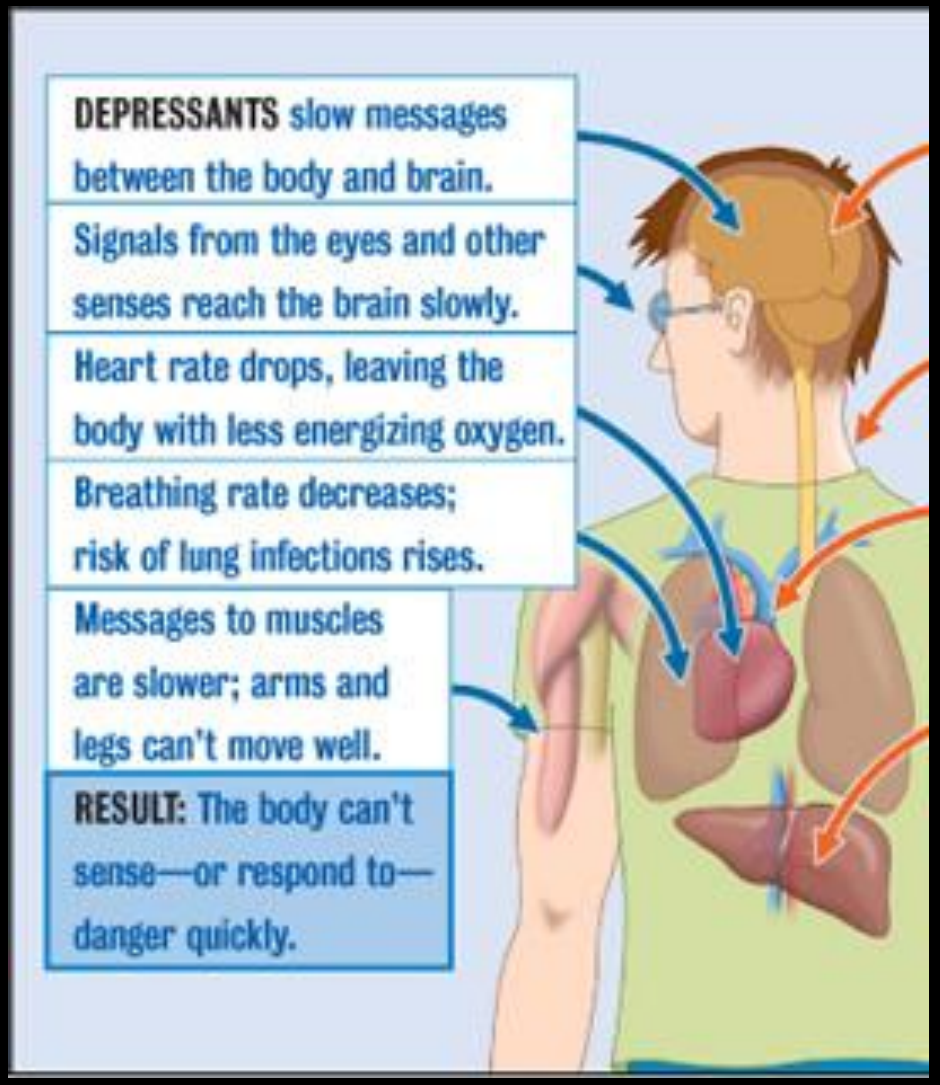
Depressants

- Slow action of the nervous system
- Slow down respiration rate & heart rate – may cause death



Depressants

- Lower blood pressure
- Relax muscles and relieve tension



Think, Share, Write #6

How can depressants cause death?

Think, Share, Write #6

How can depressants cause death?

Depressants can slow down hart rate and breathing rate enough to cause death.

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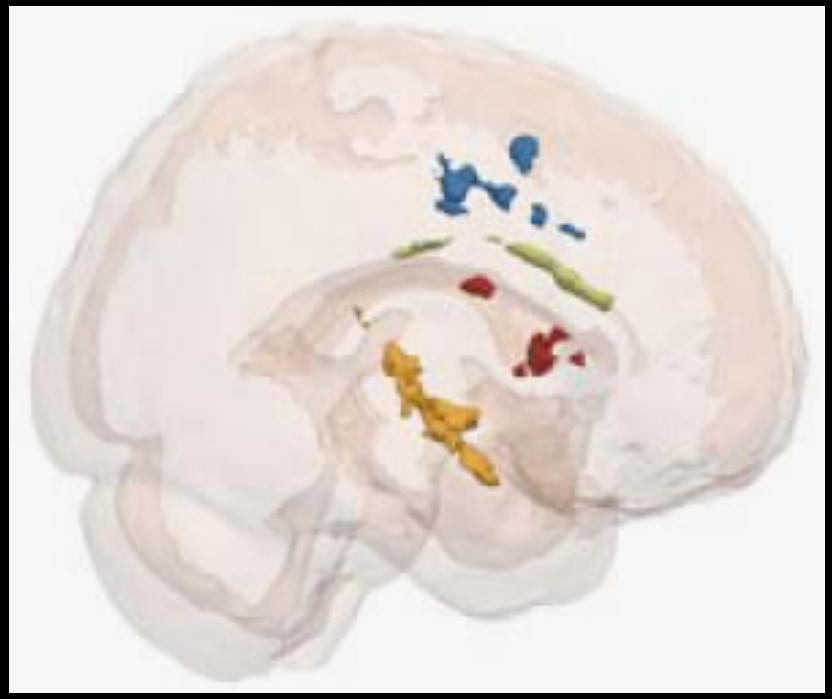
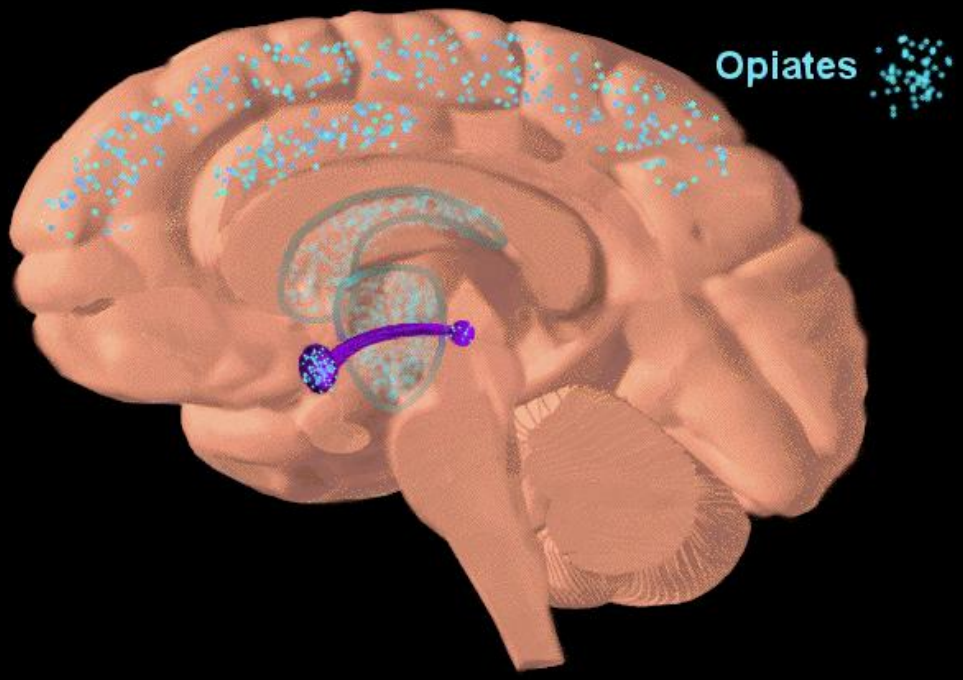
Cocaine



Causes the sudden release in the brain of a neurotransmitter called dopamine which causes feelings of pleasure that may lead to depression when it wears off and can cause heart attack.

Opiates



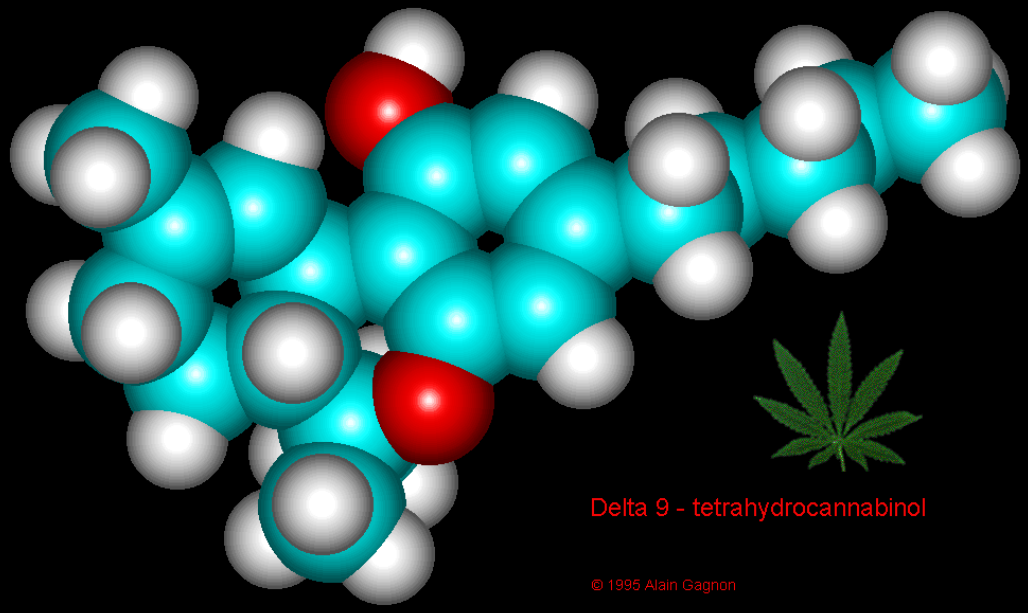
Mimic natural chemicals in the brain known as endorphins, which normally help to overcome sensations of pain.

Pain killing drugs are addictive

Marijuana - active ingredient THC

Euphoria and disorientation; more destructive to lungs than cigarettes

Loss of memory- inability to concentrate – less testosterone in males



Alcohol - depressant, even small amounts will slow down the rate at which the nervous system functions

slows reflexes, disrupts coordination, impairs judgment

Fetal Alcohol Syndrome

Many mental and physical abnormalities.

DO NOT DRINK IF COULD GET PREGNANT OR IF YOU ARE PREGNANT.