Objectives

- Describe the major structures of the nervous system.
- Explain how a nerve impulse is transmitted.
- Distinguish between the functions of the central and peripheral nervous systems.
- Identify the structures and functions involved in the 5 senses.

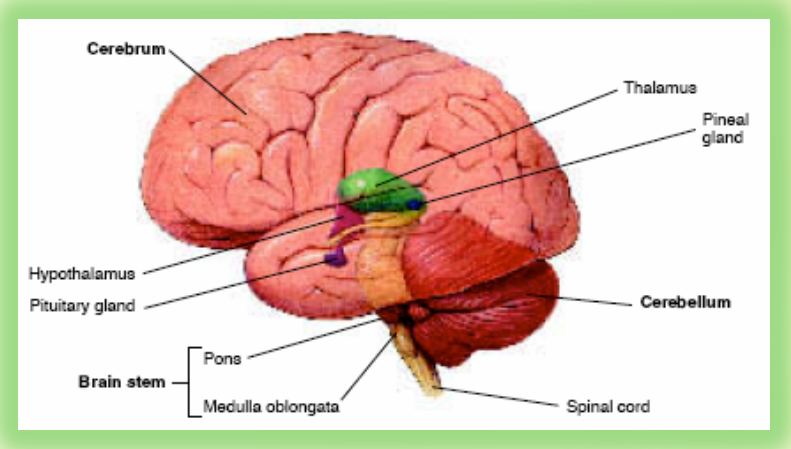
Nervous System

- **Purpose:** To communicate and control mental and physical activities and maintain homeostasis.
- **Components:** Brain, spinal cord, & nerves.

The 2 Nervous Systems

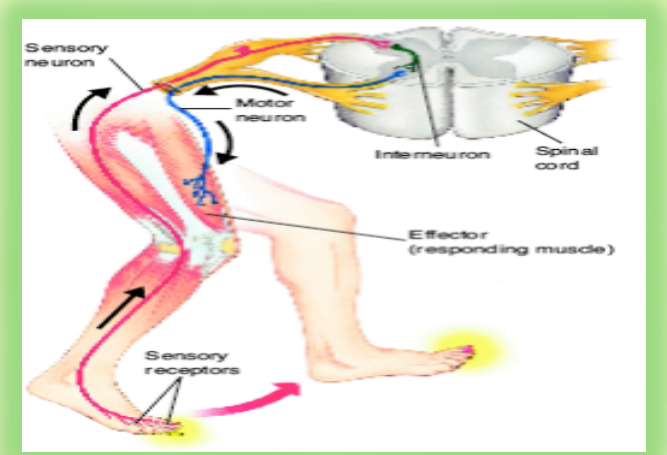
Central Nervous System

- The CNS relays messages, processes and analyzes information.
- C.N.S. consists of the brain and spinal chord.



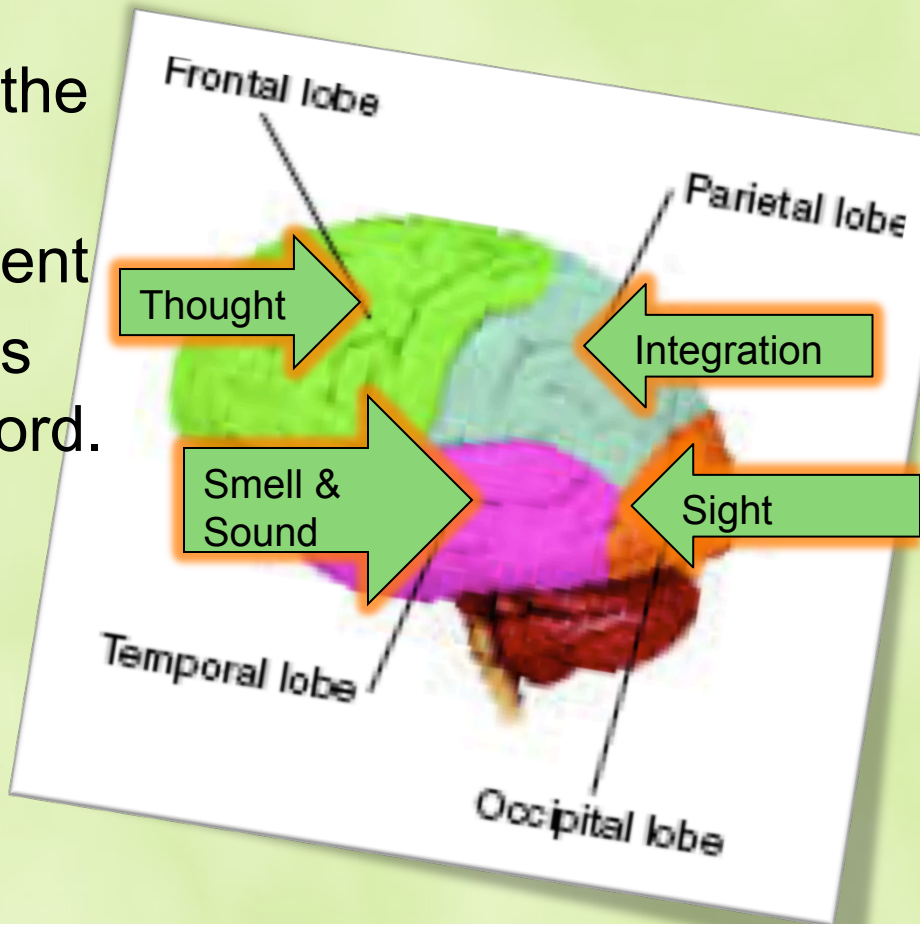
Peripheral Nervous System

- The P.N.S. is divided into:
  - Sensory Division: Transmits information from sensory organs to C.N.S.
  - Motor Division: Transmits impulses from C.N.S. to muscles and glands.



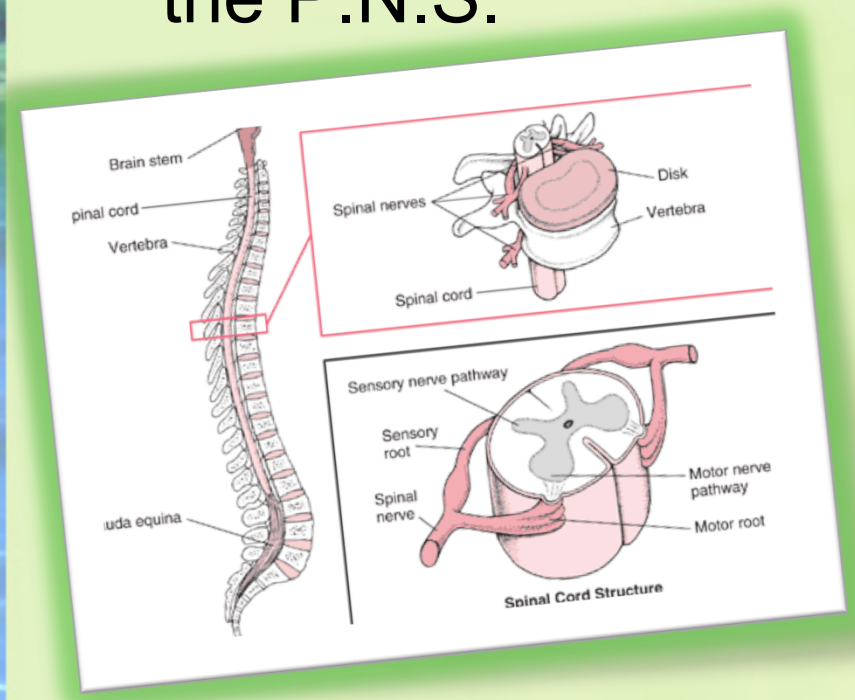
The Brain

- The large portion of the brain is the cerebrum divided into 4 lobes based on function.
- The smaller portion posterior and inferior is the cerebellum.
  - Coordinates movement
- The brain stem connects the brain to the spinal cord.
  - Contains thalamus (sensory organ info) and hypothalamus (sensation center)



Spinal Cord

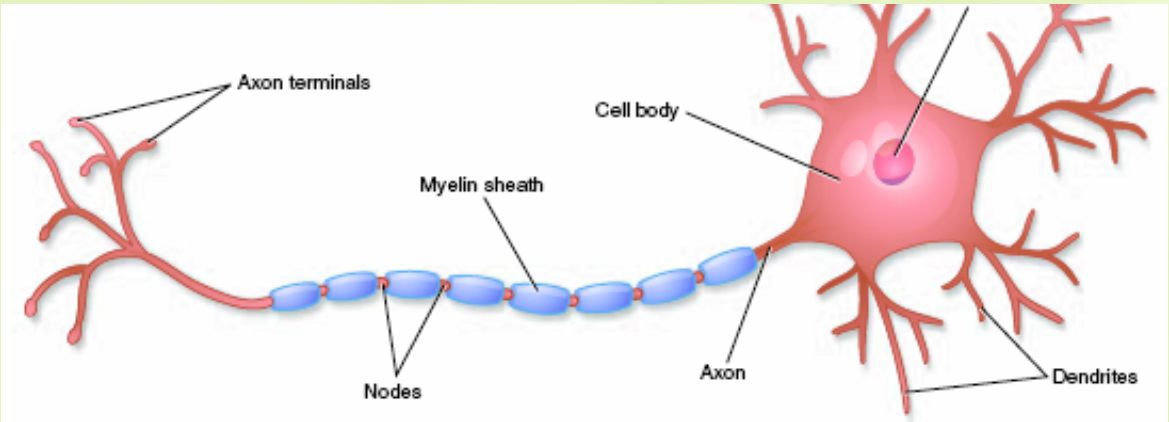
- The spinal cord extends from the brain, down the vertebrae and branches into a spinal nerves at each.
- Each spinal nerve controls a specific part of the P.N.S.



- The spinal chord is protected by the bones of the vertebrae.
- If damaged, most functions of P.N.S. from below the damaged area will be impaired.

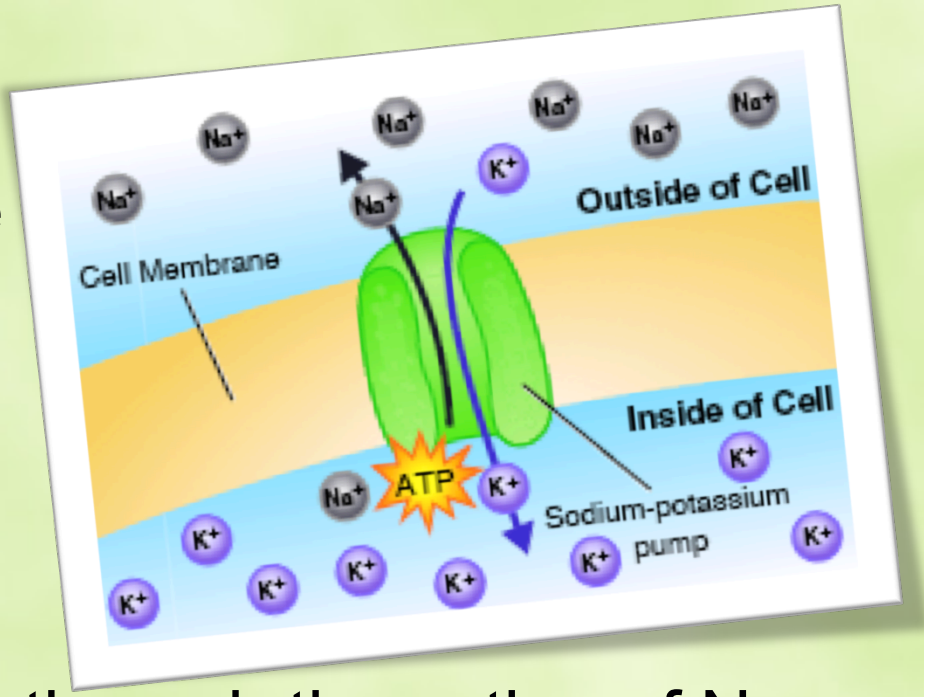
Neurons

- Messages in the N.S. are coded into electrical signals called **impulses**.
- Neurons transmit impulses from one part of the N.S. to another.
- Types of neurons:
  - Sensory : Sense organs➔spinal cord➔-brain
  - Motor: brain➔spinal cord➔muscle
  - Interneurons: connect sensory and motor neurons



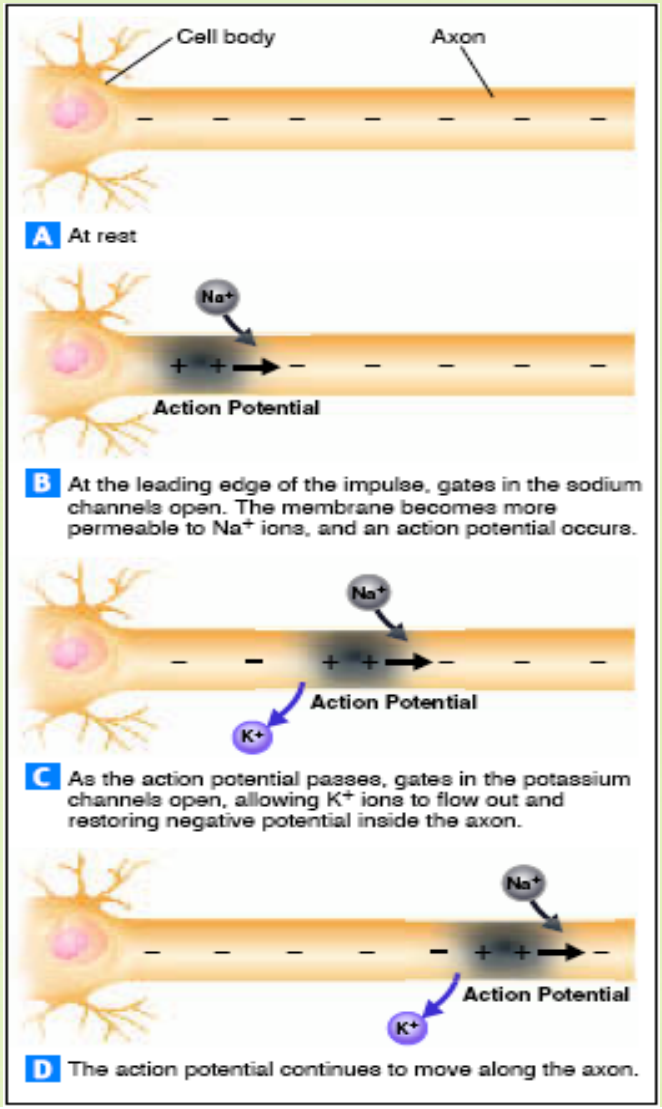
The Nerve Impulse

- When a neuron is at rest, the inside of the cell has a net negative (-) charge and the outside has a net positive (+) charge.



- This is accomplished through the action of Na +/K- pumps.
- The balance holds an overall neutral charge, called resting potential, until stimulated, which results in a nerve impulse.

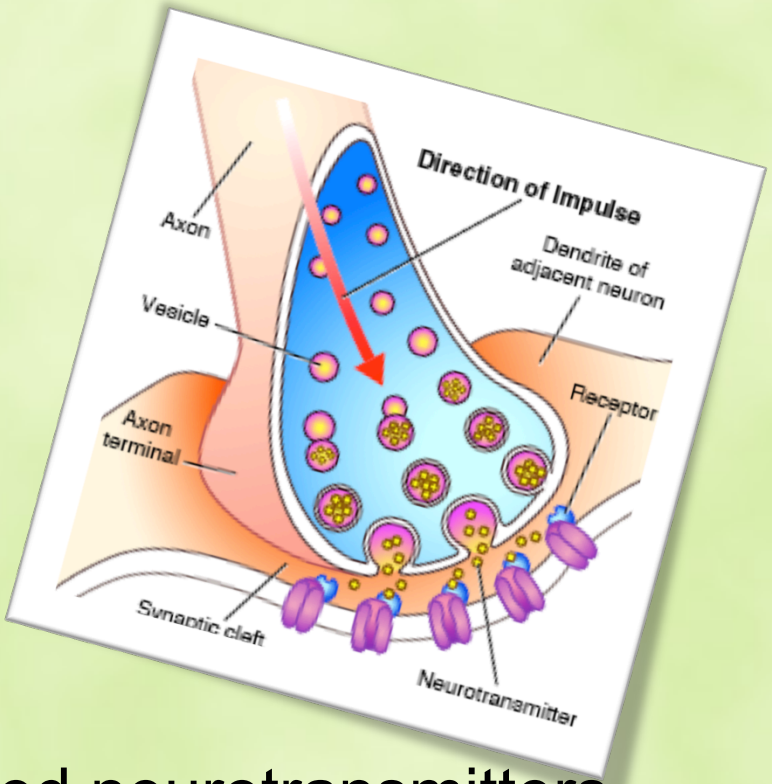
The Nervous Response



- Environmental conditions can trigger a nervous response.
- Another neuron can send an impulse and trigger an impulse in the next neuron.
- The impulse is carried from the cell body, down the axon, to the axon terminals.
- All impulses are the same strength (on/off), but the stimulus must be strong enough to start the impulse.
- The minimum level of stimulus required to activate a neuron is called the threshold.

The Synapse

- When the impulse hits the end of the axon terminal, reaches the synapse, which is the space between neurons.



- Chemical substances called neurotransmitters carry the impulse across the synapse to the next cell.
- If the impulse reaches the terminal and exceeds the action potential, resulting in a response.
- Some substances such as alcohol and drugs can effect the efficiency of this process.

Sensory Organs

- There are 5 senses, each with organs that allow organisms to perceive outside information.
- Information is transmitted to the brain where it is interpreted.
- Vision – Eye contains light sensitive nerve cells (cones & rods)
- Hearing - Organ in the ear called cochlea perceives vibrations as sound (also responsible for balance.)
- Taste/Smell: Taste buds on tongue and chemoreceptors in nose perceive chemical compounds as flavor and scent.
- Touch: sensory receptors in skin (all over body) perceive pressure, temperature, and pain.

Voluntary vs. Involuntary Response

Somatic Nervous System

- S.N.S. is part of the P.N.S. that is responsible for actions under conscious control by the organism.
- EXAMPLES:
  - Wiggling toes
  - Jump in the air
  - Writing notes
  - Etc.

Autonomic Nervous System

- A.N.S. regulates body functions and response that are automatic or involuntary.
- EXAMPLES:
  - Heart Rate
  - Breathing
  - Reflexes
- Functions can change due to environment, stress, or other stimulus.

Effect of Drugs on N.S.

- Stimulants
  - Increase heart rate, BP, and breathing.
  - Increase release of neurotransmitters in brain.
  - Includes caffeine & “speed”
- Depressants
  - Decrease heart rate and breathing.
  - Cause relaxation of slowed nerve response.
  - Includes alcohol & marijuana.
- Cocaine
  - Sudden, drastic increase of dopamine in brain.
  - Extreme feeling of pleasure followed by depression.
- Opiates
  - Produces endorphins to compensate for pain.
  - Very addictive.

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