Nervous System

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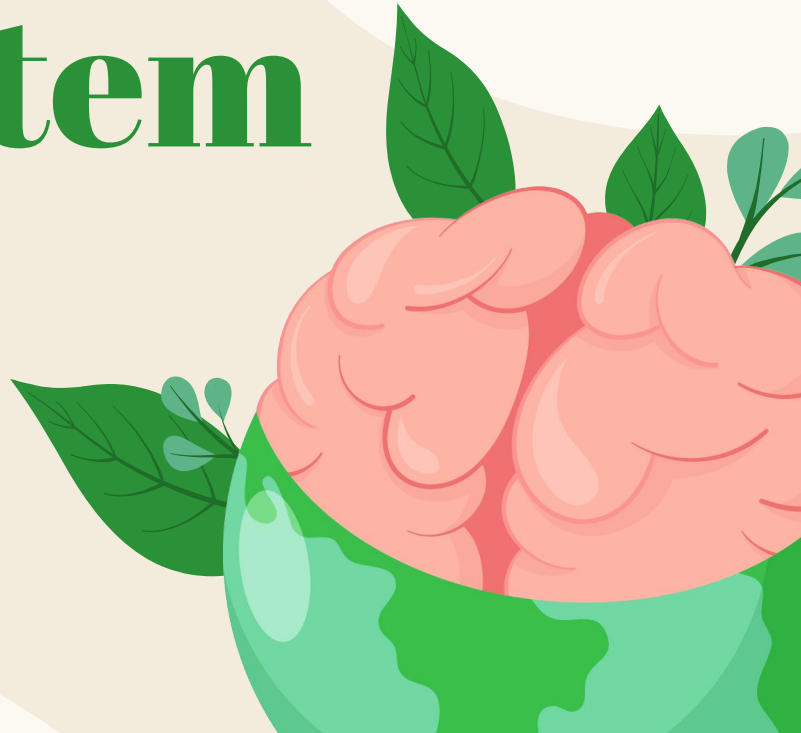


Overview

- What is the nervous system?
- **Section 1**: Learn about the functions of the Macro Nervous System

  -Central Nervous System

  -Peripheral Nervous System

  -Types of Neurons

  -Anatomy of a Neuron

  -Glial Cells
- **Section 2:** Learn about the functions of the Micro Nervous System

  -Action Potential

  -Nerve Impulse

  -Synapses

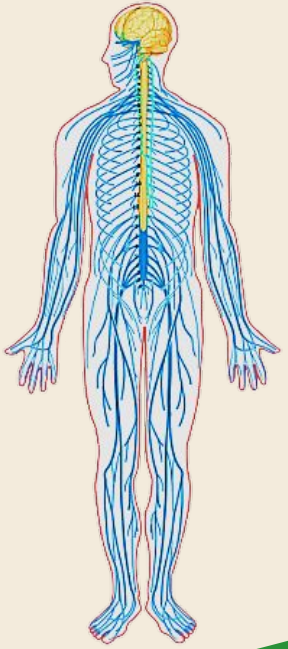
  -Ion Channels

  -Electrochemical Gradient

  -Stimulation

What is the Nervous System?

The nervous system is a **network of nerves** and **nerve cells** that transmit impulses throughout the body. **CONTROLS THE WHOLE BODY!** All organs, psychological and physiological reactions, and even the endocrine system.



2 Parts of the Nervous System

- Central Nervous System: Micro
- Peripheral Nervous System: Macro

3 Principal Functions of the Nervous system

Sensory Input

Detection

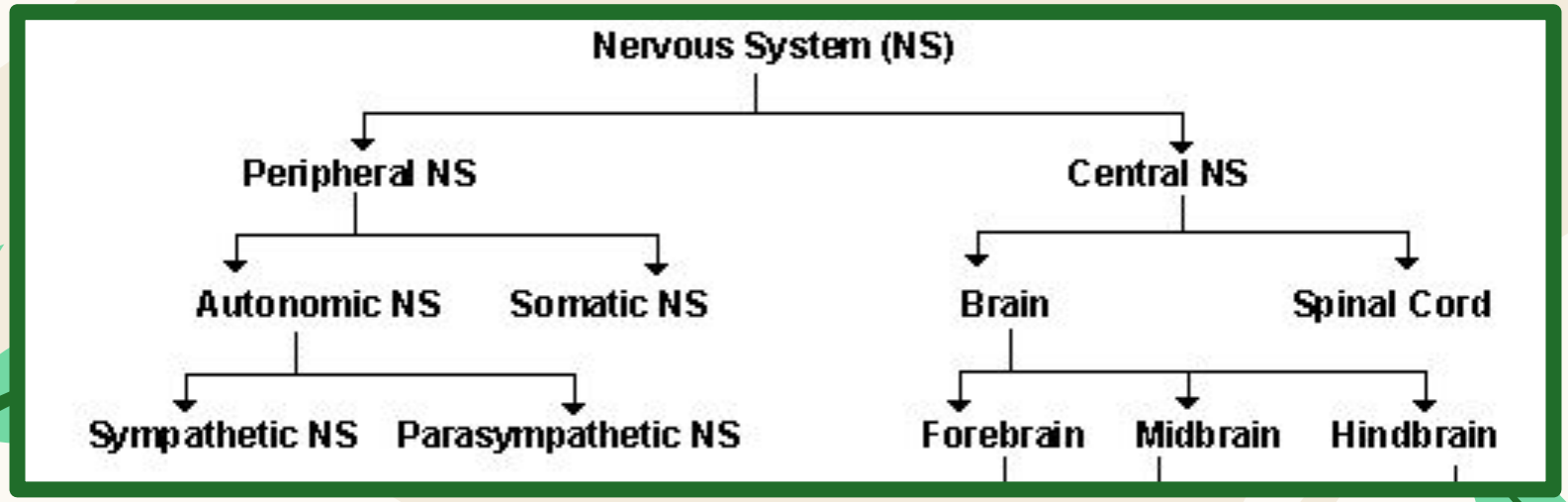
Integration

Information processed & decides what should be done

Motor Output

Response/Reaction

DETECT → PROCESS → REACT


Nervous System (NS)
Peripheral NS
Central NS
Autonomic NS
Somatic NS
Brain
Spinal Cord
Sympathetic NS
Parasympathetic NS
Forebrain
Midbrain
Hindbrain

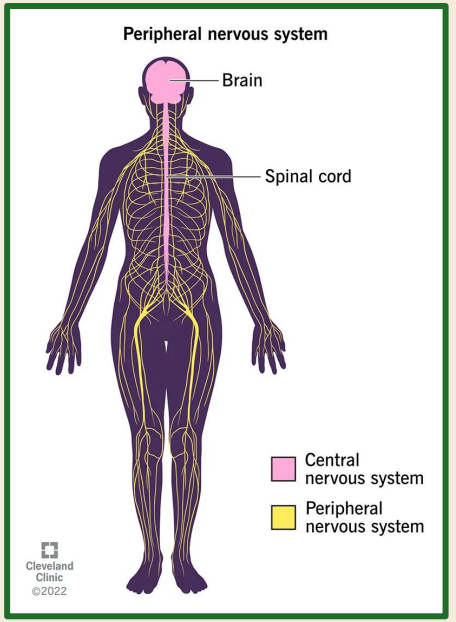
PART 1:
Macro Nervous System

Central Nervous System

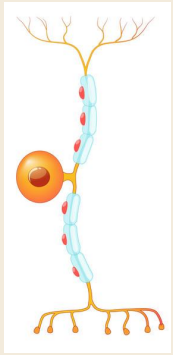
- Consists of the **brain** and **spinal cord**
- Combines informations from the entire body and analyzes information
- Coordinates the organism's activity and essential bodily functions

Peripheral Nervous System

- Consists of all the nerves outside of the Central Nervous System
- Allows Brain/Spinal Cord to communicate and send signals to the body
- Includes motor and sensory neurons

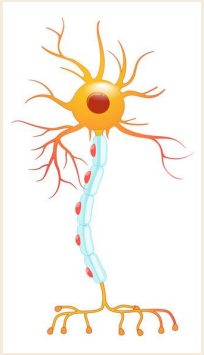


Types of Neurons



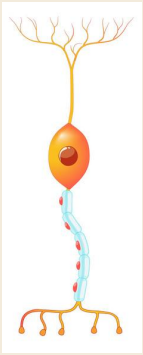
SENSORY

- Receives information/stimuli from outside world
- Converts sensory information into electrical impulses



MOTOR

- Receive impulse from brain/spinal cord or CNS
- Causes muscular contractions



INTERNEURONS

- Communicate/connect with other interneurons (integration)
- Majority of neurons in our brain
- Allows for conscience thoughts; think, see, perceive

Afferent and Efferent Neurons

Afferent Neurons

- Carries info the the brain/spinal cord
- Activated by external stimuli
- “Sensory Stimuli”

Efferent Neurons

- Carries info away from the brain/spinal cord
- “Tells” the muscles to move (for peripheral nervous system)
- “Motor Neurons”

Somatic/Autonomic Nervous System

Somatic Nervous System

- Controls voluntary, conscious actions
- Ex. Movement of your body, fingers, etc

Autonomic Nervous System

- Controls essential bodily functions that don't require thinking
- Ex. Breathing, digestion, etc

Nerve Impulse: Macro

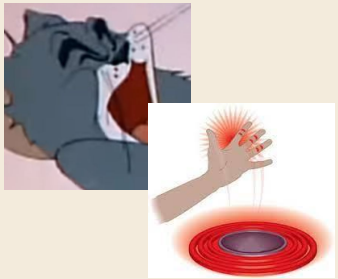
Hot Stove

Sensory Neuron

Interneuron

Motor Neuron

Skeletal Muscle



Pull Hand Away

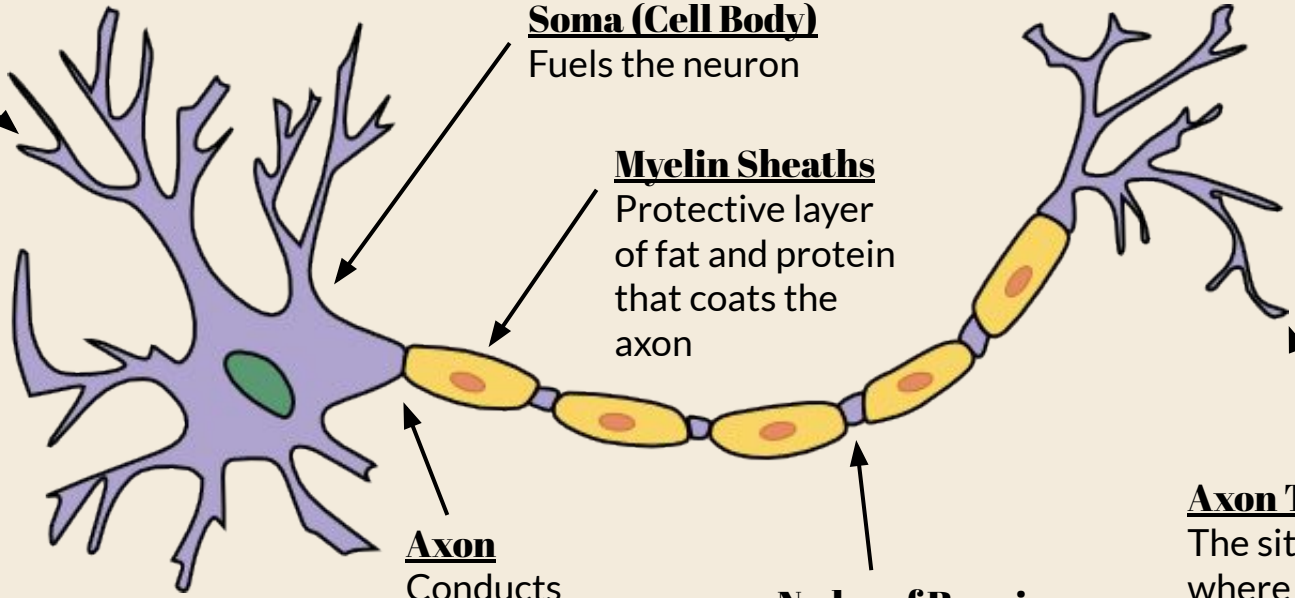
PART 2:
Micro Nervous System

Breakdown of a Neuron

Dendrites
Receives input from other cells

Soma (Cell Body)
Fuels the neuron

Myelin Sheaths
Protective layer of fat and protein that coats the axon



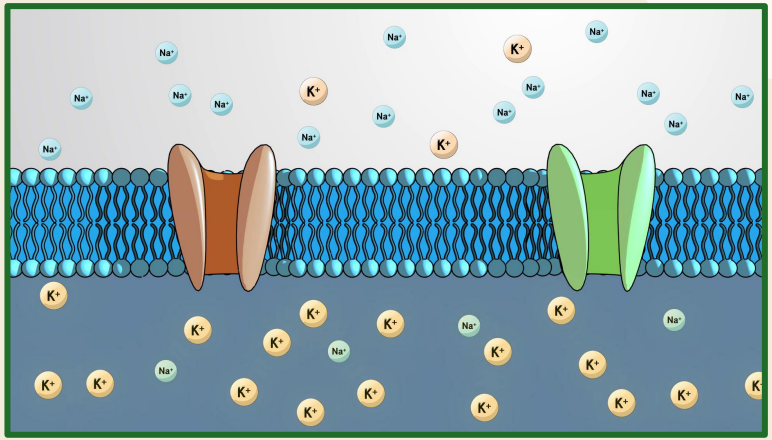
Axon
Conducts electrical impulses

Nodes of Ranvier
Facilitates the rapid conduction of nerve impulses

Axon Terminals
The site of synapses where neurotransmitters are stored to communicate with other neurons (output)

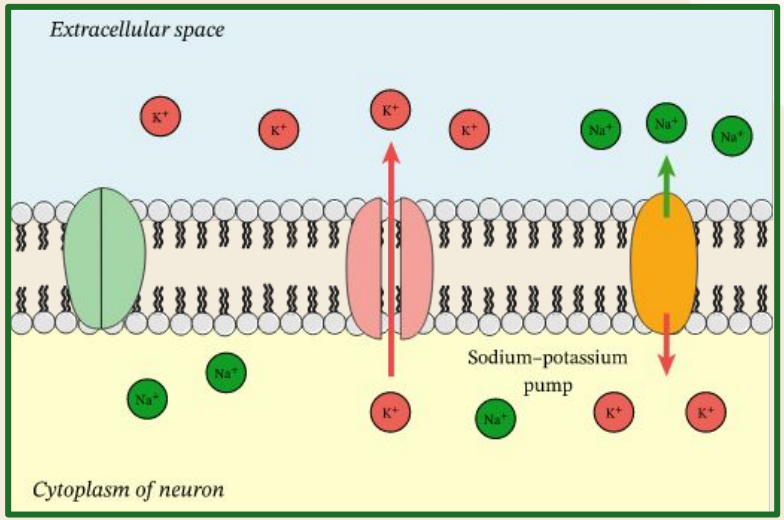
Electrochemical Gradient of a Neuron

- Comprised of Sodium Ions (outside) and Potassium Ions (inside)
- Neurons transmit information through changes in the electrical potential of their membrane
- Inside of the cell is more negative than its surroundings @ -70mV



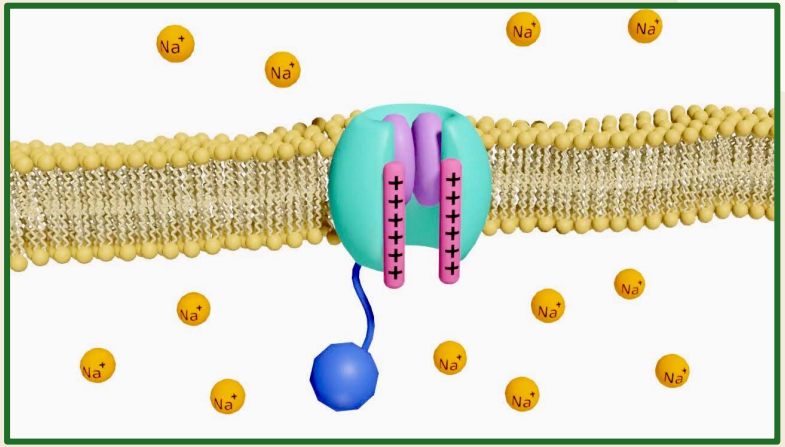
Ion Channels

- Proteins that are found on the cell membrane that allow for the passage of specific ions
- Sodium Channels
- Potassium Channels
- Sodium Potassium Pump/ATPase



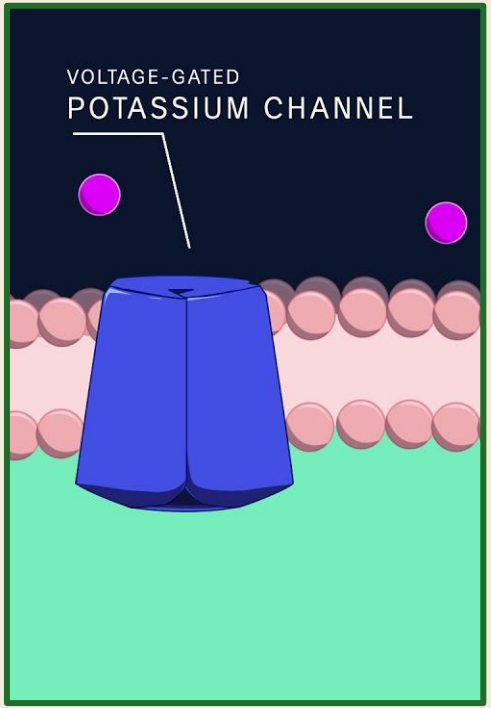
Sodium Channels

- Opens when a neuron is stimulated
- Allows for sodium ions to enter the cell, creating a change in the electrical potential; Depolarization
- Make the inside of the cell more positive



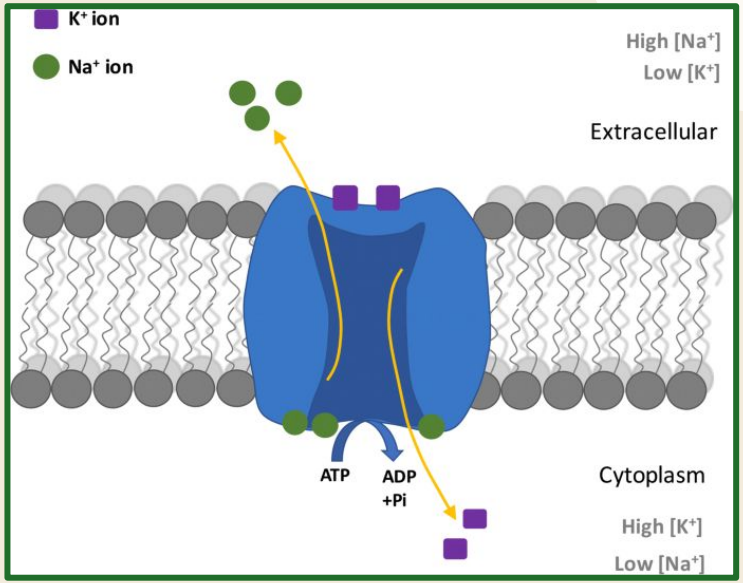
Potassium Channels

- Opens after Depolarization
- Allows for potassium ions to enter the cell, making the cell negative again; Repolarization



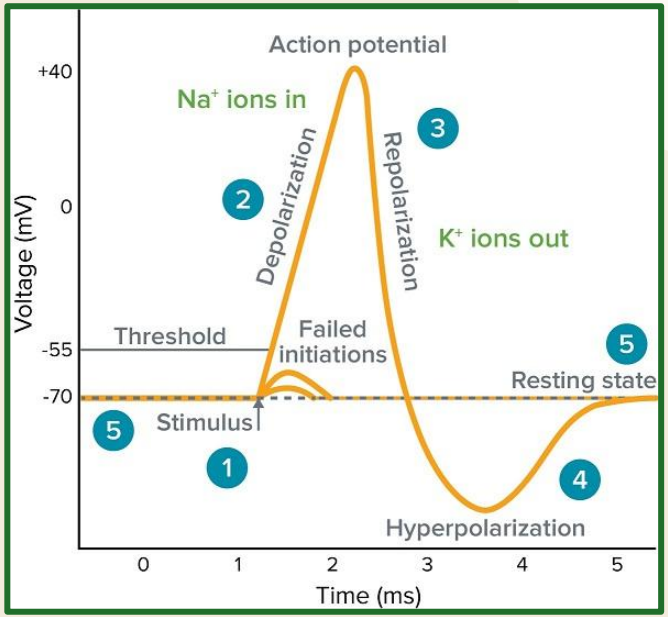
Re-Establishing Resting Potential

- Done by Sodium Potassium pump/ATPase
- Pumps sodium/potassium against their concentration gradient, putting neuron back into resting potential



Action Potential

1. Stimulus triggers sodium channels to open
2. If Depolarization passes threshold (-55mV), sodium ions enter
3. Reaches 30mV
4. Sodium Channels close, Potassium Channels open (Repolarization)
5. Sodium Potassium pump resets neuron to resting potential by pumping against concentration gradient



Action Potential

Resting Potential

↓

Stimulus

↓

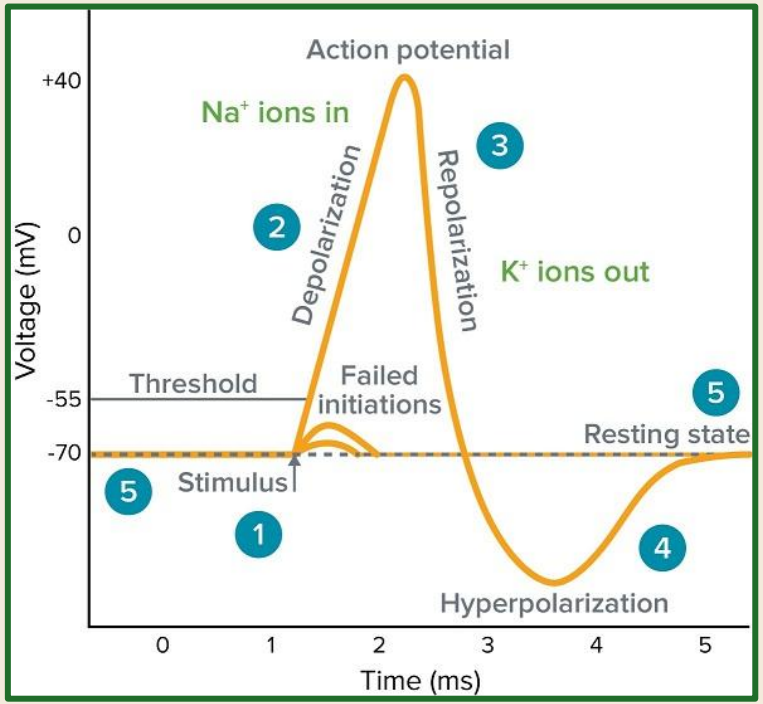
Depolarization

↓

Repolarization

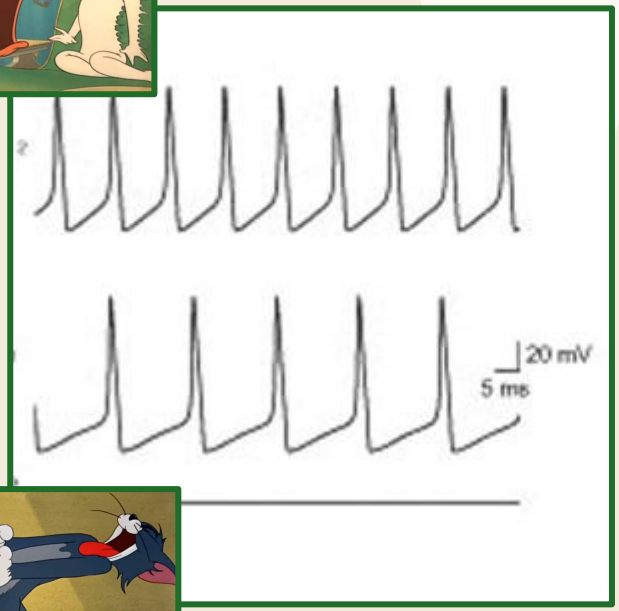
↓

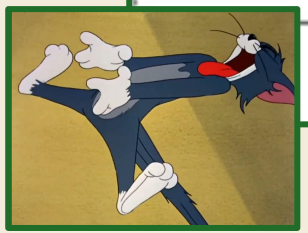
Hyperpolarization → Resting Potential



Action Potential (Continued)

- Strength of stimulus depends on the frequency of action potentials
- Stronger stimulus/more pain = more action potentials
- Weaker stimulus/less pain = less action potentials
- Note* the size of action potentials do not change, only the frequency

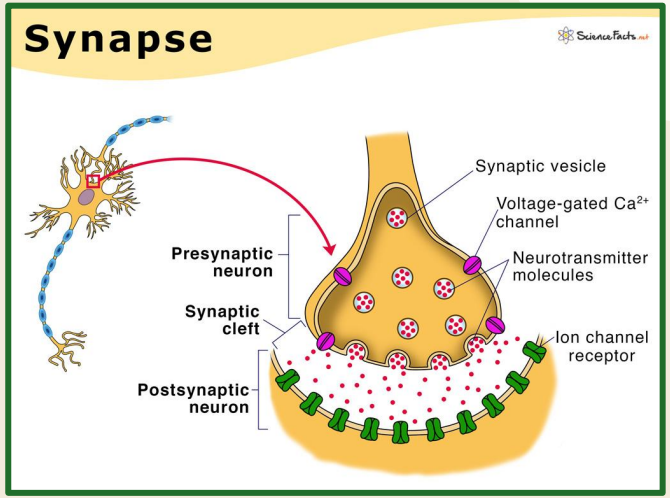




Synapses/Cell Communication

- Where the electrical impulse moves from neuron-to-neuron

1. Action potential reaches the end of a neuron at the axon terminal
2. Neurotransmitters are released into the synaptic cleft
3. Neurotransmitters bind to receptors on ion channels in the postsynaptic cell
4. Ion channels let sodium ions into cell, changing membrane potential and carrying signal



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