LESSON 51

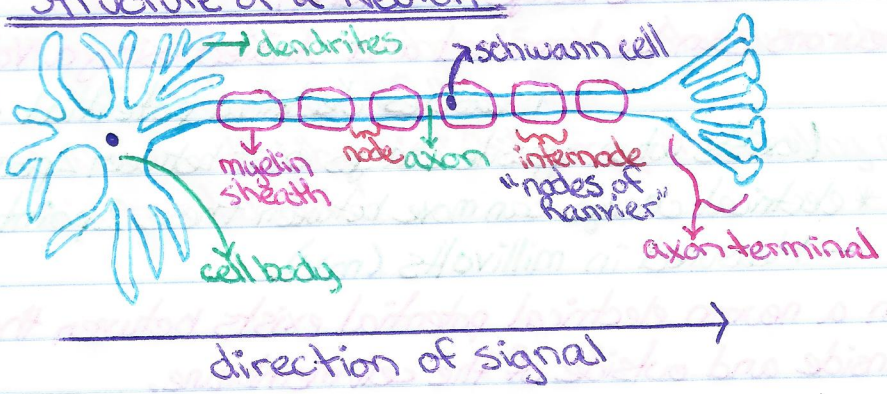
The Nervous System

Function: collects and interprets sensory information, so the body can appropriately react.
- regulates and coordinates the function of other body systems.

Major Parts: Brain, spinal cord, nerve cells (neurons, neuroglia)

2 major divisions exist:
1. Central Nervous System [CNS]
   - brain & spinal cord
2. Peripheral Nervous System [PNS]
   - any nerve tissue outside the brain & spinal cord.

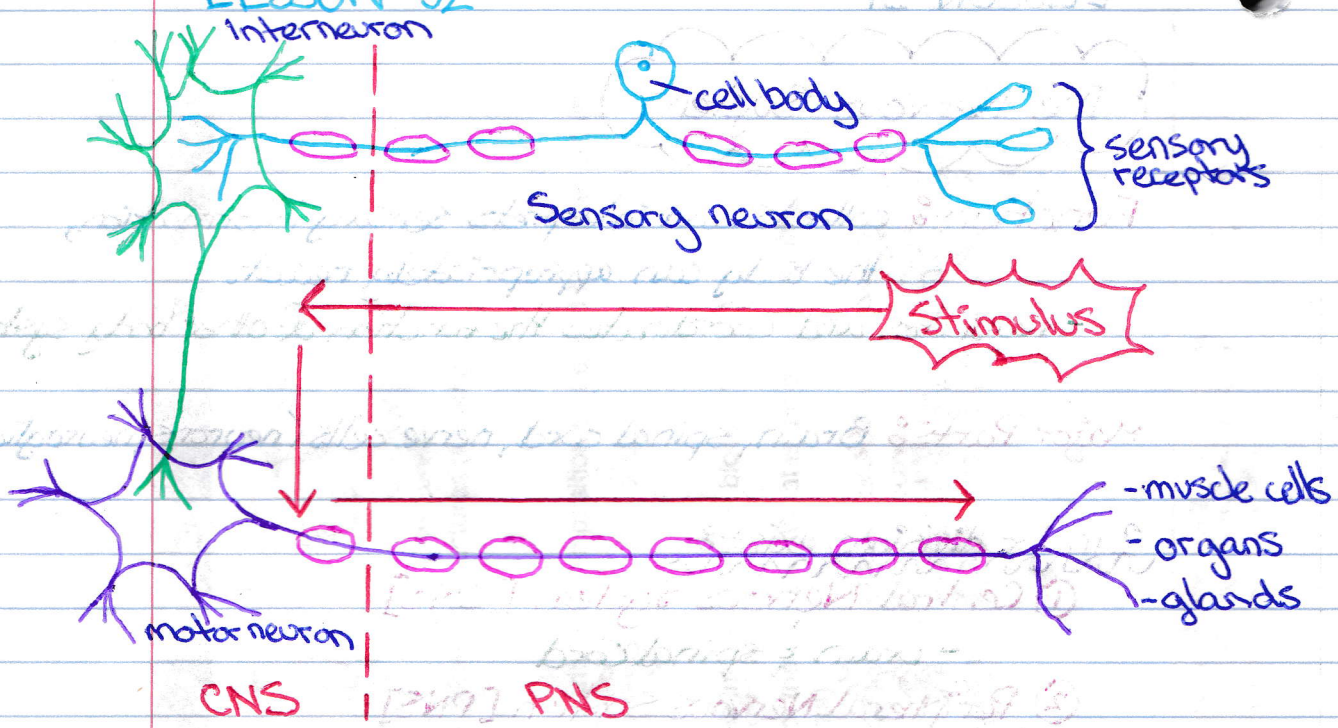
Structure of a Neuron



Types of Neurons

1. Sensory neuron → receives stimuli and sends information from PNS to CNS
   - cell body: PNS
   - axon: PNS
   - axon terminal: CNS
2. Interneuron → receive signals from PNS (sensory neuron) & send signals within the CNS.
3. Motor neurons → send signals from CNS to an effector (muscle cell, organ, gland) within the PNS.

LESSON 52



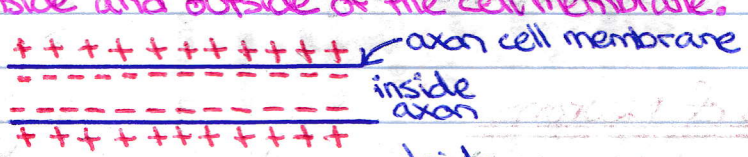
Nerve Impulse Transmission

→ neurons can be large (1m long)

→ neurons can be removed and studied using a Voltmeter.
measures electrical potential
(exists when opposite charges exist between 2 points + and -)

* electrical charges can move between these 2 points.
— Measured in millivolts (mV).

→ in a neuron electrical potential exists between the inside and outside of the cell membrane.

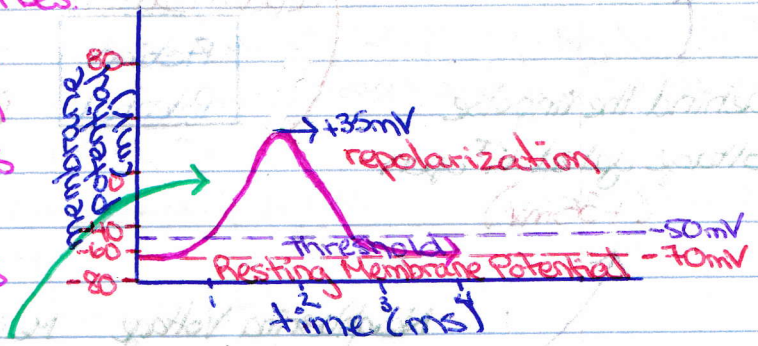


→ using the electrodes of a voltmeter the electrical potential is measured to be -70mV. (Resting Membrane Potential)

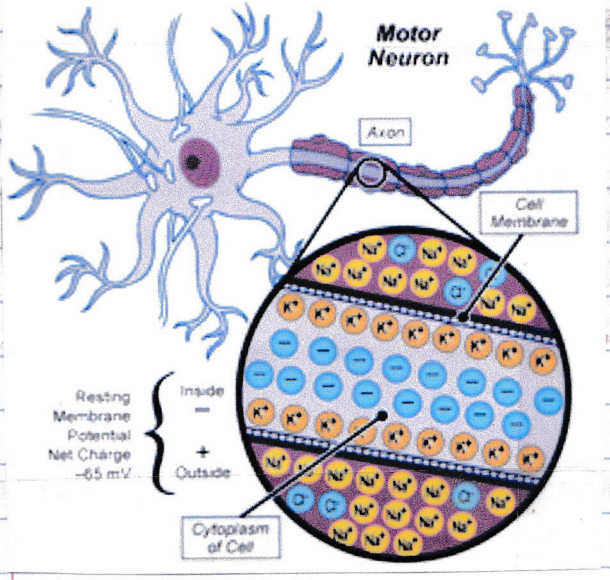
* measured when the neuron is at rest (not sending an impulse).

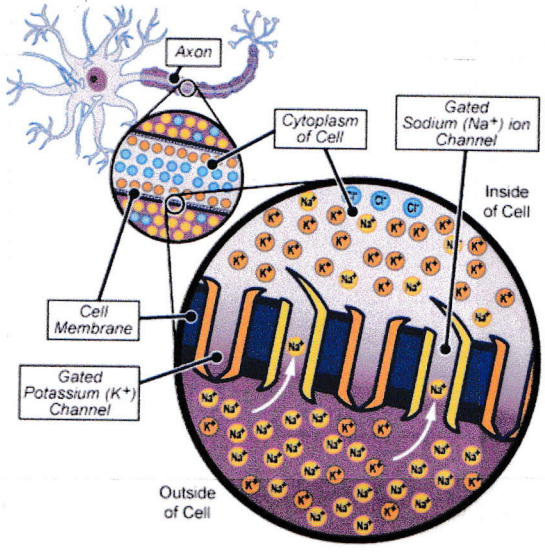
* created using the Na^+/K^+ pump, 1 cycle of the Na^+/K^+ pump moves $3Na^+$ out of the cell and $2K^+$ ions into the cell.

→ axon membranes have a large number of Na/K pumps.
→ over time, this creates a positive environment outside of the axon and a negative environment inside.
→ if a stimulus occurs along an axon, Na channels open, sodium moves into the axon by diffusion.
→ the membrane potential rises.
→ if membrane potential reaches threshold, then voltage-gated Na channels will open.
→ potential quickly rises (depolarization)



→ local depolarization causes neighboring channels to open and depolarization travels down the axon.
→ once potential reaches 35mV, potassium channels open (K^+), K^+ diffuses out of the cell.
→ along with the Na^+/K^+ pump, the Resting membrane potential is reestablished.





LESSON 53

Nerve Impulse Transmission Summary

ESSON 54

Questions

1) How is the RMP established in a neuron?
   Sodium / Potassium Pump
2) Which ions are important in impulse transmission and where are they most highly concentrated?
   K^+ ions are more highly concentrated inside the axon,
   Na^+ ions are more highly concentrated outside the axon.
3) What is the net charge on both the inside and outside of neuron?
   Inside - has a net ⊖ charge Outside - has a net ⊕ charge
4) What happens within the cell membrane of a neuron when a stimulus is encountered?
   Na^+ channels open, Na^+ moves into the axon by diffusion

→

5) These are 3 different protein channels within the membrane of an axon that allow movement of ions by facilitated diffusion. What are these channels called? When do they open? Which direction do the ions move through these channels?

1) Na^+ channels → opens with stimulus Na^+ diffuses in.
2) Voltage gated Na^+ channels → opens when membrane potential (threshold) reaches -55mV Na^+ diffuses in
3) Voltage gated K^+ channels → opens when membrane potential reaches +35mV K^+ diffuses out

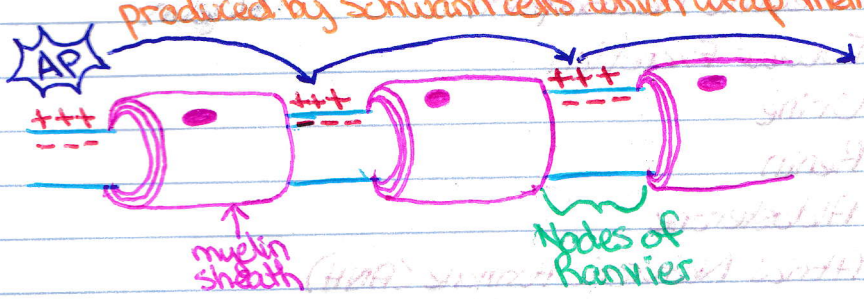
6) Describe the difference between depolarization and repolarization of the membrane within an axon.

Depolarization - occurs as membrane potential changes from -70 to +35mV
Repolarization - occurs when membrane potential returns to resting state (+35mV → -70mV)

Saltatory Conduction

→ an action potential travelling down a neuron as we have shown would be slow (0.5m/s)

- to speed up conduction, axons are coated in a myelin sheath, produced by schwann cells which wrap themselves around axons.



→ Nerve impulses can "skip" from node to node.
→ Speeds up transmission to 150 m/s or 540 Km/hr.
→ Each schwann cell can mylinate 1mm of axon.
* Mylelin is a lipid, a solid fat... this gives mylinated neurons a white, glistening appearance.
→ All neurons in the PNS are mylinated, because impulses travel long distances.

LESSON 55

→ In the CNS neurons can be mylinated (white matter) or non-mylinated (grey matter)

→ the brain has a grey appearance because the outside is Grey Matter.

→ White Matter is located inside the brain transmitting signals to the spine.

Complete Flashcards

Vocabulary Unit 4 words to Know

Kidneys
Ureters
Urethra
Bladder
Metabolic Wastes
Nephron
Pressure Filtration
Selective Reabsorption
Tubular Excretion
Urine
Renin
Aldosterone
Atrial Natriuretic Hormone (ANH)

PNS
CNS
Neurons
Action Potential
Resting Membrane Potential
Ion channels
Saltatory Conduction
Myelin