C. Physiology

Impulse Characteristics (impulse = beep)

a. All or none – nerve sends an impulse or it doesn't.

✓ *Explain two ways nerve impulses are similar to musical notes. Explain one way nerve impulses are different from musical notes.*

b. One way impulses- synapse can only carry impulse in one direction.

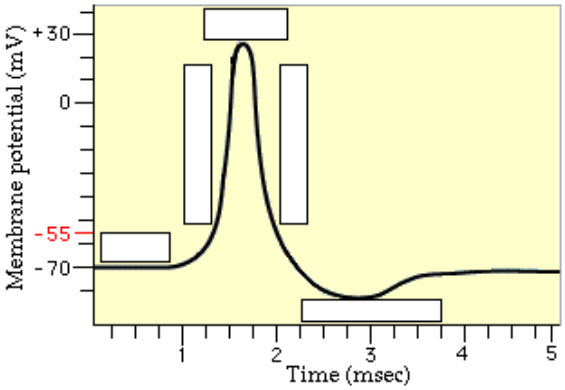
c. Specificity of receptors- every nerve is hard wired to a specific part of the brain. It only knows how to interpret impulses in one way. (eyeball lights)

✓ *Describe the concept of specificity of receptors. How does it reduce the effort required by your brain when interpreting your senses?*

d. Threshold stimulus- for every neuron, there is a minimum intensity stimulus that is necessary to cause an impulse. Differs person to person, neuron to neuron

Nerve Impulse transmission

Non-myelinated – complex connections (brain)



1) resting potential - axon is polarized

a)exterior + (more Na+) cannot diffuse well

b)interior - (less Na+, more K+, organic anions)

✓ *Using your understanding of the membrane potential and how it is created and maintained consider effect of having a cell membrane that was more permeable to Na+ than is normal. What difference in the ion distribution and charge difference would it cause? How would that affect the function of the cell?*

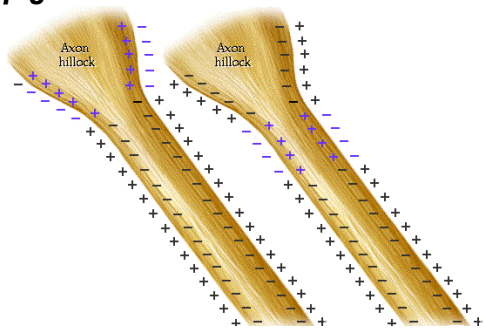
2) Depolarization

a)Threshold Stimulus opens Na+ channels

b)Some (tiny fraction) Na+ rushes into axon causing + net charge inside cell and – outside.

c) after a fixed length of time, the channel inactivates stopping flow of Na+

3) Propigation



a) depolarization at hillock causes next segment of axon to depolarize

b) continues like “doing the wave”

4) Repolarization

Hillock Na+ channels close

K+ channels open, K+ rushes out, restoring a + charge outside. (K+ plus remaining Na+)

b) refractory period - 20 - 30 ms. Cannot fire.

5) Hyperpolarization

the cell is even more + outside than it was before it depolarized. This means the threshold stimulus will have to be stronger to trigger a next contraction.

✓ *Compare impulse transmission to a stadium full of fans by matching each of the following anatomy terms to the corresponding “wave” action or object.*

a. The electrical charges:

b. The resting (membrane) potential:

c. Depolarization

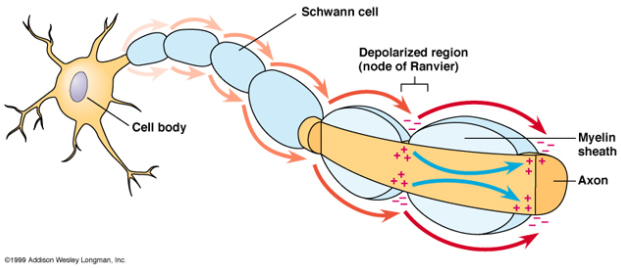
d. Propigation

e. Repolarization

f. Refractory Period

myelinated -Long distance (peripheral)

1)Saltatory conduction



a)Schwann cells have gaps = node of Ranvier.

b) Impulse usually on membrane (axon surface).

Now goes through cyto to next node.

C) 120 M/s vs. .5 M/s

✓ *How is salutatory conduction different for these three things:*

The type of tissue in which it occurs.

The way the message travels down the axon.

The speed of the message.

The Synapse

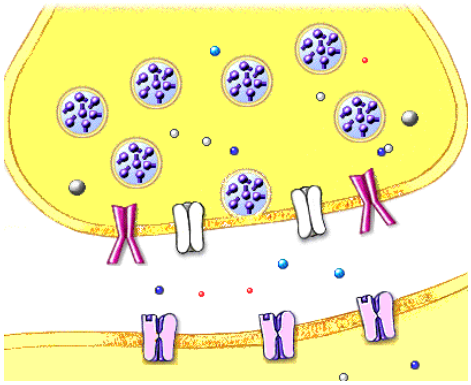
Defn. - junction between Axon & (dendrite or soma)

Types

1. Electrical – Direct connection between cells. No ability to vary signal

2. Chemical

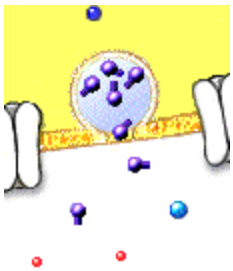
REVIEW OF THE EVENTS OF SYNAPTIC



c. Physiology Just like neuromusc. Junction

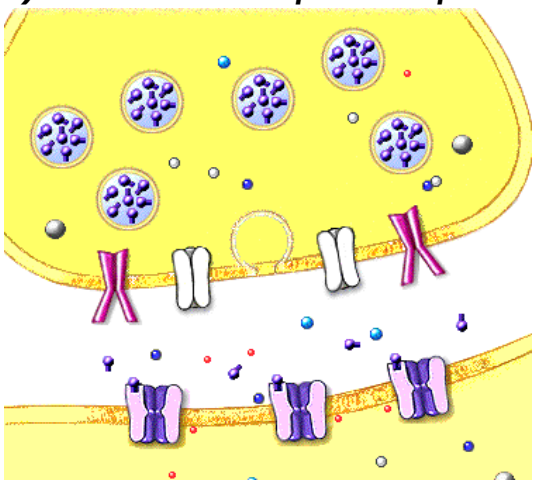
1)imp reaches pre Sm

2) Vessicles fuse, exocytosis. Release NT (amount depends on freq and dur of impulse)



3)NT diffuses across syn

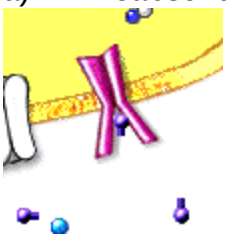
4)NT touches receptors on post Sm



5)Post Sm depolarizes

6) Impulse is stopped

a) NT reabsorbed (slow)*



b)NT destroyed (costly)* this is 1 Theory for why we sleep

d. Type of synapse- one synapse can be either one.Depends on which NT is used.

1)excitatory – message increases activity of the target

2) Inhibitory message decreases activity of target

✓ *Explain how excitatory and inhibitory synapses allow you to focus on a conversation in a distracting environment.*

e. Neurotransmitters

1) Function – Transmit nerve messages across a synapse

2) Examples

Neurotransmitter		Disorder Involving It
Excitatory		
Acetylcholine is a very widely distributed excitatory neurotransmitter that triggers muscle contraction and stimulates the excretion of certain hormones. In the central nervous system, it is involved in wakefulness, attentiveness, anger, aggression, sexuality, and thirst, among other things.		Alzheimer's disease is associated with a lack of acetylcholine in certain regions of the brain.
Glutamate is a major excitatory neurotransmitter that is associated with learning and memory.		Alzheimer's disease, whose first symptoms include memory malfunctions.
Norepinephrine is a neurotransmitter that is important for attentiveness, emotions, sleeping, dreaming, and learning. Norepinephrine is also released as a hormone into the blood, where it causes blood vessels to contract and heart rate to increase.		mood disorders such as manic depression.
Inhibitory		
GABA (gamma-aminobutyric acid) is an inhibitory neurotransmitter that is very widely distributed in the neurons of the cortex. GABA contributes to motor control, vision, and many other cortical functions. It also regulates anxiety.		Some drugs that increase the level of GABA in the brain are used to treat epilepsy and to calm the trembling of people suffering from Huntington's disease.
Dopamine is an inhibitory neurotransmitter involved in controlling movement and posture. It also modulates mood and plays a central role in positive reinforcement and dependency.		The loss of dopamine in certain parts of the brain causes the muscle rigidity typical of Parkinson's disease.
Serotonin contributes to various functions, such as regulating body temperature, sleep, mood, appetite, and pain.		Depression, suicide, impulsive behaviour, and agressiveness

c) Neuropeptides

1) Enkelphaline (like morphine)

2) Betaendorphine - from pituitary (runners high)