**Action Potential Notes**---- from The Nervous System, Part 2 - Action! Potential!: Crash Course A&P #9 (<https://www.youtube.com/watch?v=OZG8M_ldA1M>)

**~~ Ion channels regulate electrochemistry to create action potentials~~**

Neurons only have \_\_\_\_ signal they can send. It only transmits at a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. They do vary the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of the pulses. The brain translates these signals and categories them according to location, sensation, magnitude, and importance. This nerve impulse is called the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_- the measure of potential energy generated by separated charges. In a cell, it is the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

* Large difference between\_\_\_\_\_\_ and\_\_\_\_\_\_\_\_\_\_\_ charges, so larger potential and larger voltage
* Measured in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. In body, measured in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_- the flow of electricity from 1 point to another

* Current = voltage

Resistance

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_- whatever is getting in the way of the current.

* Increased resistance= \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Decreased resistance= \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* In the body, currents indicate the flow of + or – charged ions across the resistance of your \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
* Membranes separate the charges and provide the “potential” to convert electricity to something useful

Sketch & indicate charges

Resting Neuron—

* More \_\_\_\_\_\_\_\_\_\_\_\_\_ inside compared to environment
* Resting membrane potential is \_\_\_\_\_\_\_\_\_\_\_\_\_\_ mV
* Outside= \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ ions
* Inside= \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ ions with – charged proteins
* A negative membrane potential = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* The Na+ / K+ pump (which is actually a protein) will pump \_\_\_\_\_\_K+ ions in and \_\_\_\_Na+ ions out. This makes it more\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ outside and creates an electrochemical gradient.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_- large proteins that form gates that open and close dependent upon structure and purpose.

* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ channels- open/close in response to change in membrane potential
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ channels- open/close in response to specific neurotransmitter or hormone attaching to it
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ channels- open/close in response to physical stretching of membrane

When open, ions quickly diffuse across the membrane and even out concentrations. This movement of ions is key to all electrical events in neurons.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ potential- change in membrane potential at only one small place (localized)

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_- a large charge that causes voltage-gated channels to open. Necessary to send signals over long distances.

* To create an action potential, the resting neuron must be \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

Steps in the creation of an action potential

* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ State- all ion channels (mechanically-gated, Na+ ion, and K+ ion) are closed. Inner voltage is at \_\_\_\_\_\_\_mV
* STIMULUS received—\_\_\_\_\_\_\_\_\_\_ channels open, ions rush in, increase charge inside the membrane. Stimulus and charge must be strong enough to cause the threshold to occur (a change from -70mv to -55mv). If \_\_\_\_\_\_\_\_mV is reached, voltage-gated Na+ channels will open and Na+ will rush in. If -55mv is not reached, nothing will happen (all or none).
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_- temporary reversal of membrane potential that occurs as the impulse moves down the neuron while the voltage-gated Na+ channels open.
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_- voltage-gated K+ ion channels open to let\_\_\_\_\_+ out and rebalance charges.
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_- briefly occurs when the voltage drops below -70mv to -75mv. Then, the K+ ion channel gates close and the Na+/K+ pumps take over and bring things back to normal levels.
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Period- time when neuron is in the middle of repolarization and cannot respond to any stimulus regardless of how strong it is.

The strength of an action potential is always the same. What changes is the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of the action potential. A weak stimulus tends to trigger less frequent action potentials.

Action potentials also vary by speed (\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_). It is fastest in pathways like reflexes and slower in areas like glands, guts, and blood vessels.

The factor that influences speed the most is the presence of the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. Present= faster speed. The current leaps from 1 gap in the myelin to the next (saltatory conduction). Gaps are called nodes of Ranvier.