Action Potential

By Michelle Kaminski

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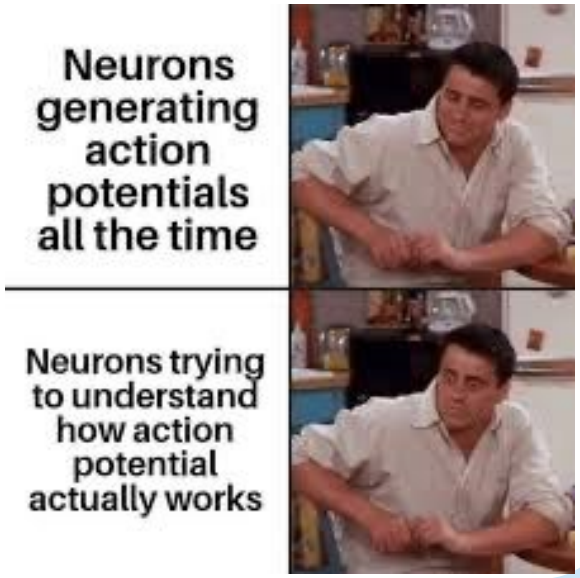
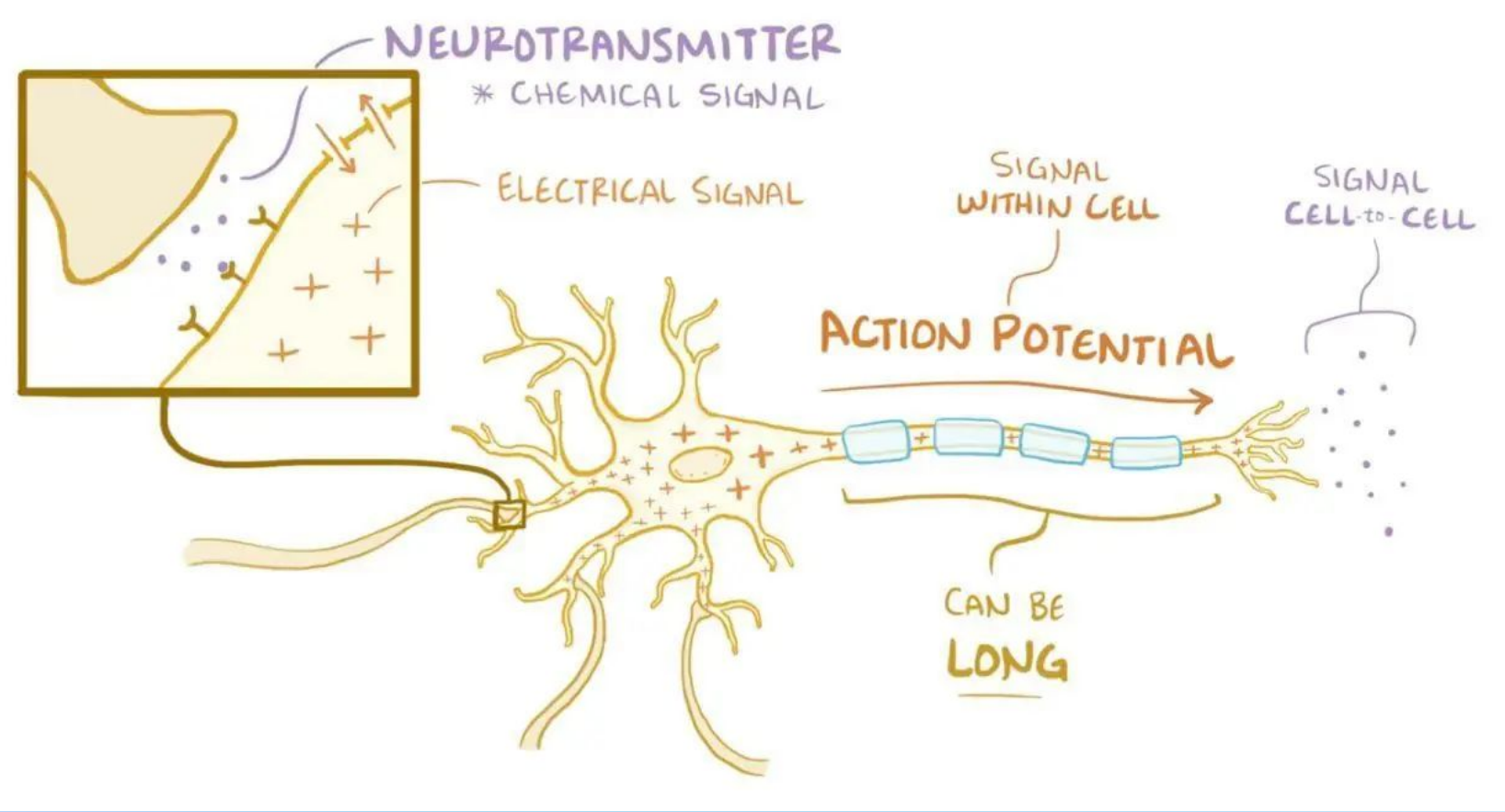
What We Will Learn!

1. Orientation and Resting Membrane Potential
2. Action potential
   a. Depolarization
   b. Repolarization
   c. Hyperpolarization
3. Refractory Periods
4. WooClap



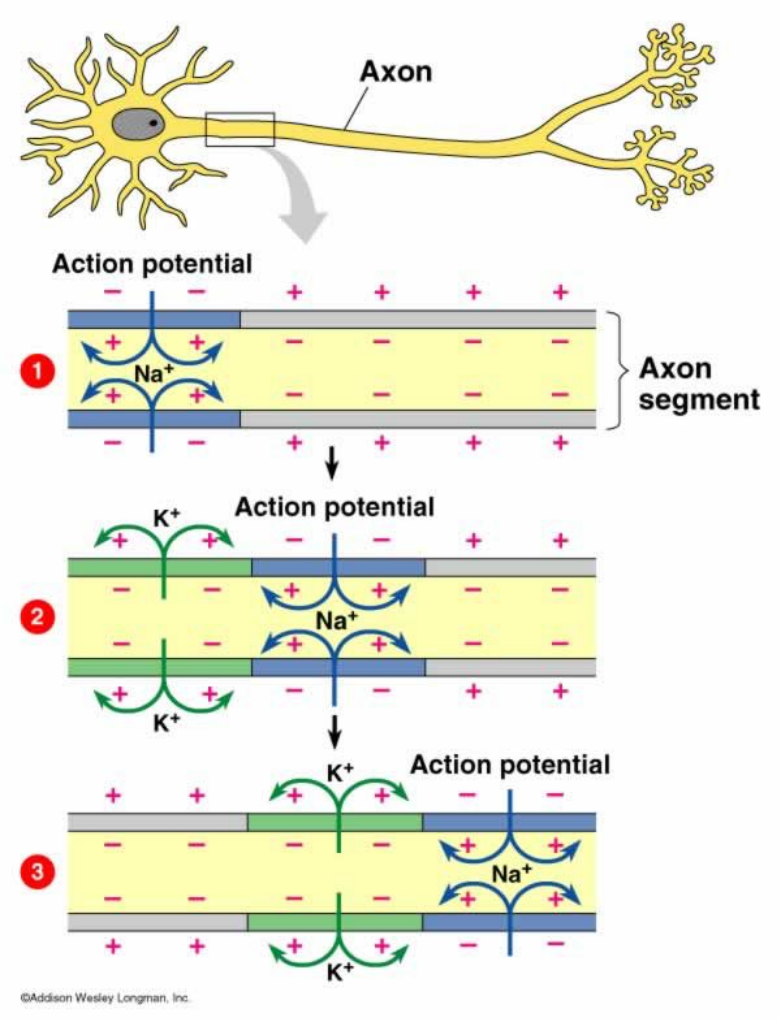
Lets get Oriented!



Lets get Oriented!

Na+ = ECM

K+ = cytoplasm



Membrane potential:
The difference in voltage between in inside and outside of the cell.

This difference in voltage is caused by an uneven distribution of ions (**Na^+, K^+**, Cl^-, etc.) across the cell membrane.

Resting Potential:
The stable membrane potential when the cell is not active.

In Neurons: **-70 mV**

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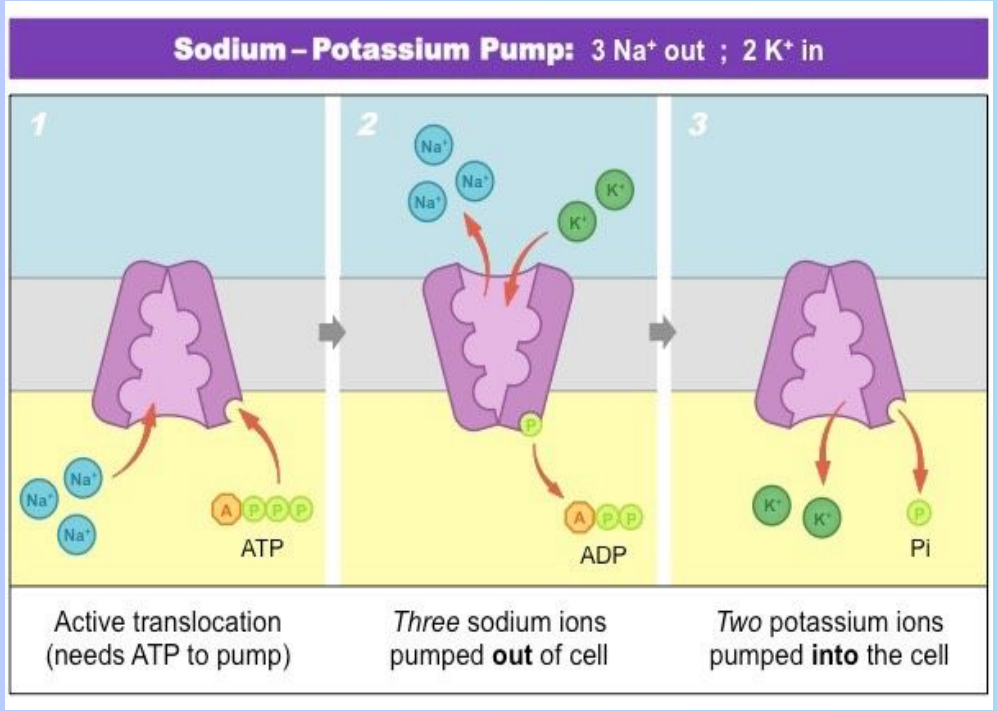
But how does it stay resting???



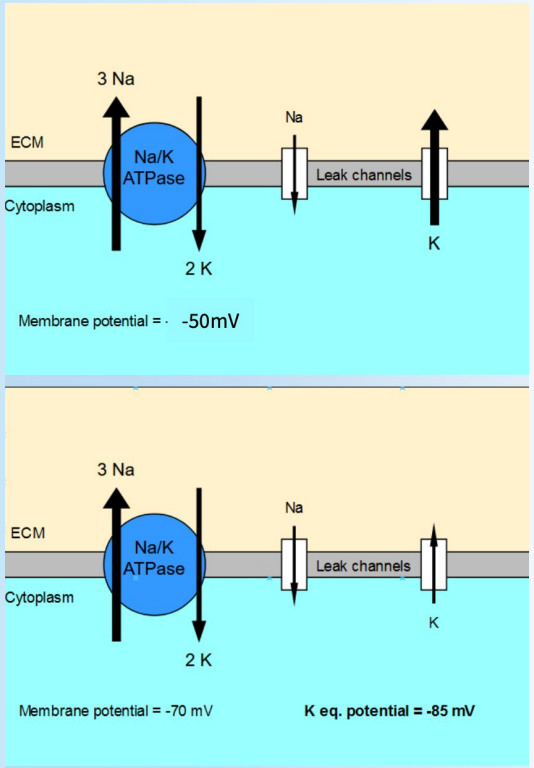
"WHERE DAFUC DA FUNCTIONNNN"
- Drake 2025

Na^+-K^+ ATPase pumps <u>3 Na+</u> out and <u>2K+</u> in using 1 ATP

NOW NEGATIVE CHARGE HAS BEEN BORN

K+ Leak channel has a **high conductance** so it allows more K+ to flow out and make cell even **more negative!!**

Na+ leak channel has much lower conductance.



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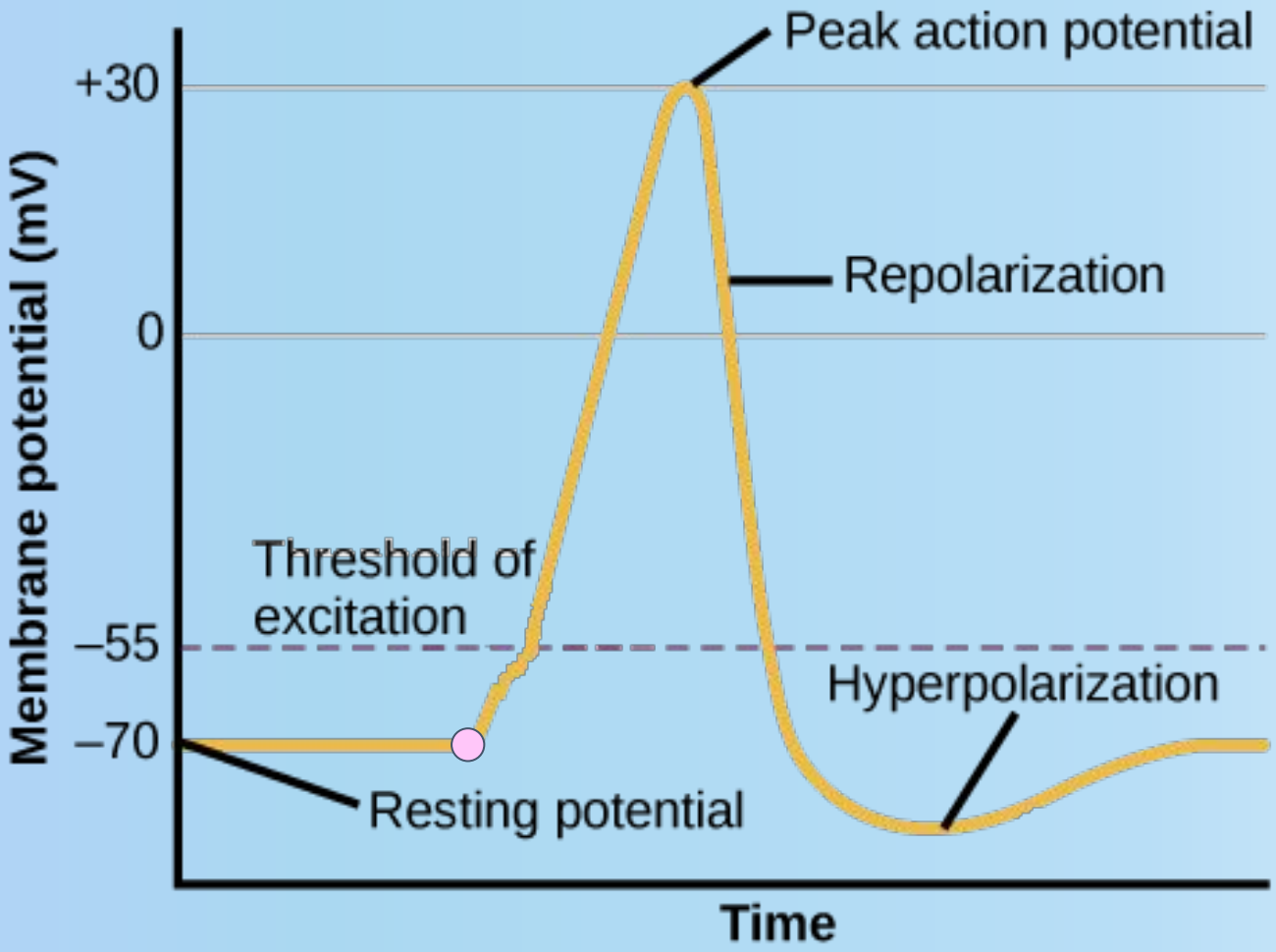
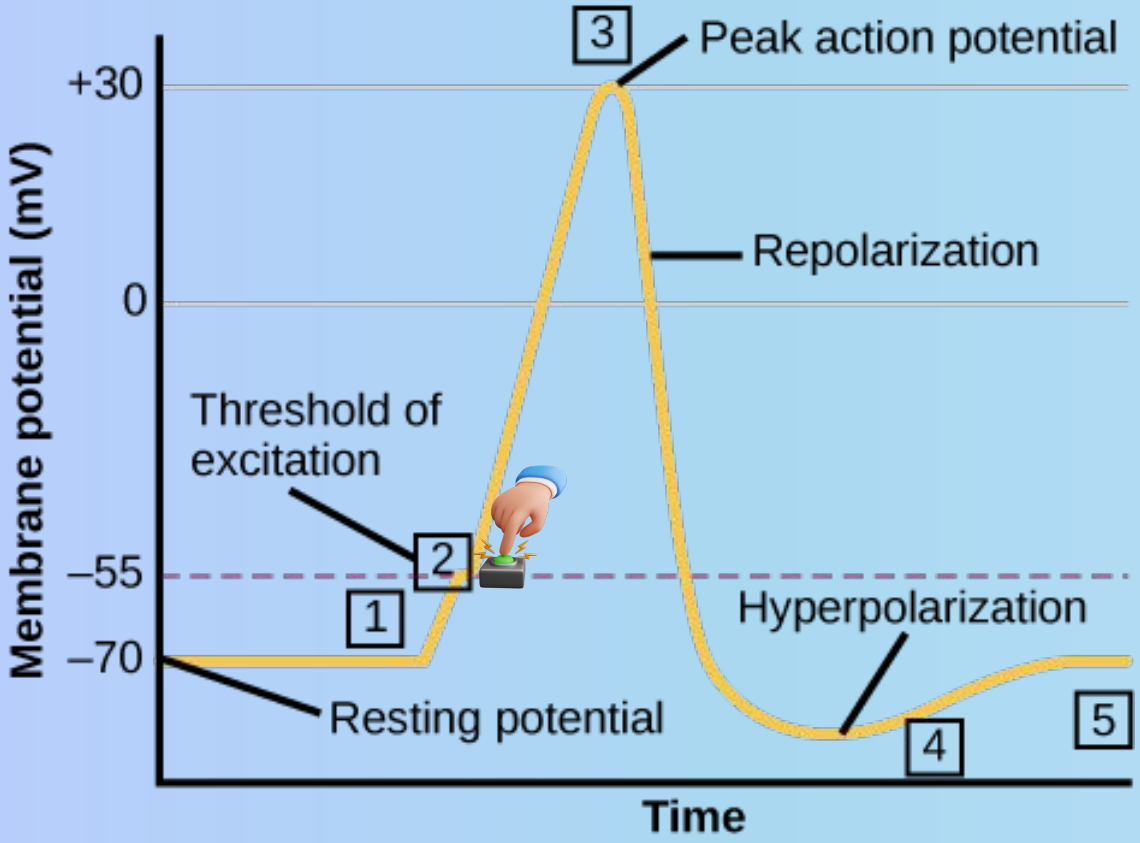
Action Potential



Depolarization



1. **THRESHOLD STIMULUS IS RECEIVED!!**
   a. Finally the neuron got a stimuli big enough to start an action potential
2. **Cell Membrane Threshold is reached!**
   a. VG Na^+ are now open and Na^+ will rush into the cell

Voltage gated Na+ Channels are open !!

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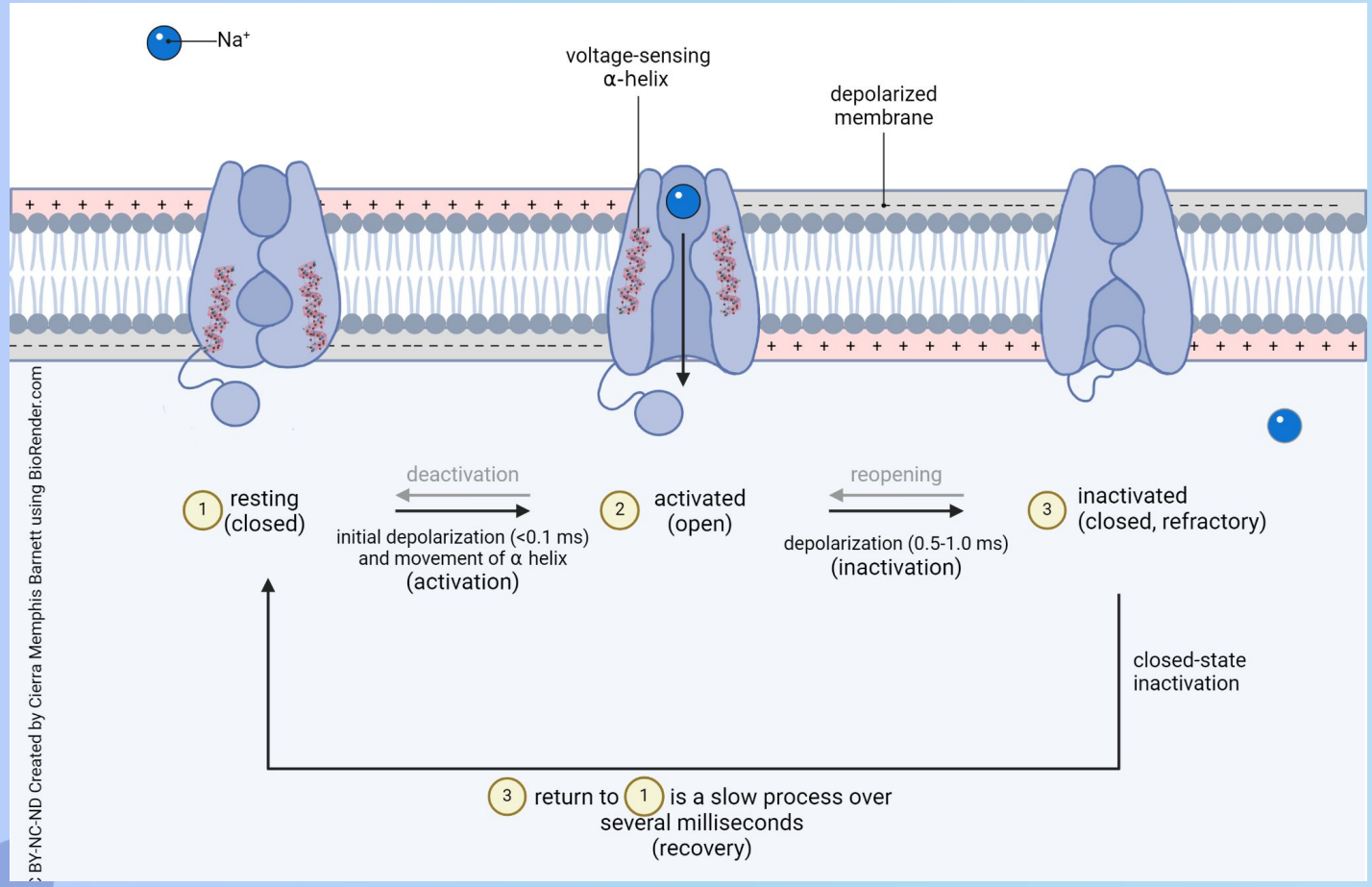
Voltage Gated Channels



Na^+ voltage gated channels: Open, Closed, Inactivated

K+ voltage gated channels: Open and Closed.

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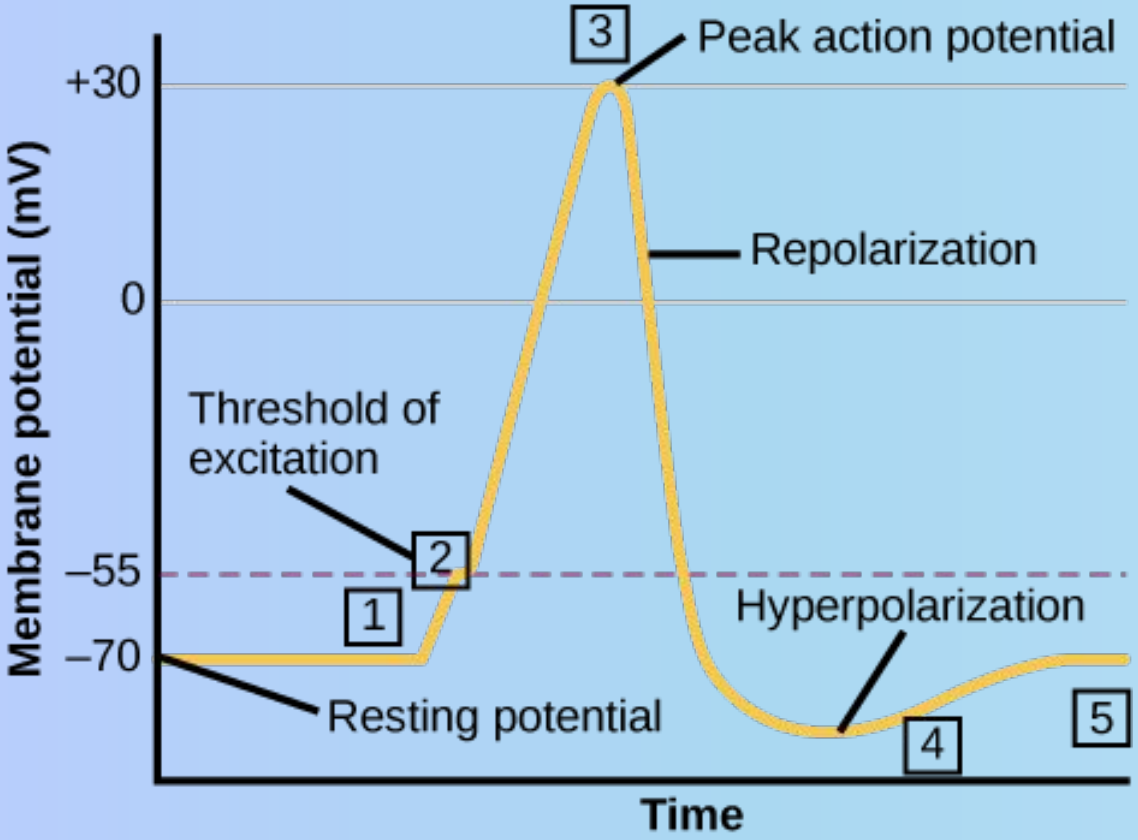
Repolarization



3. Cell Membrane <u>Overshoots</u> into ~30mV.

a. VG Na^+ Channels become **INACTIVATED,** and sodium flow into cell halts
b. VG K^+ Channels **SLAM OPEN** and K+ rushes out of the cell.

VG Na+ Channels are Closed.

VG K+ Channels are Open!

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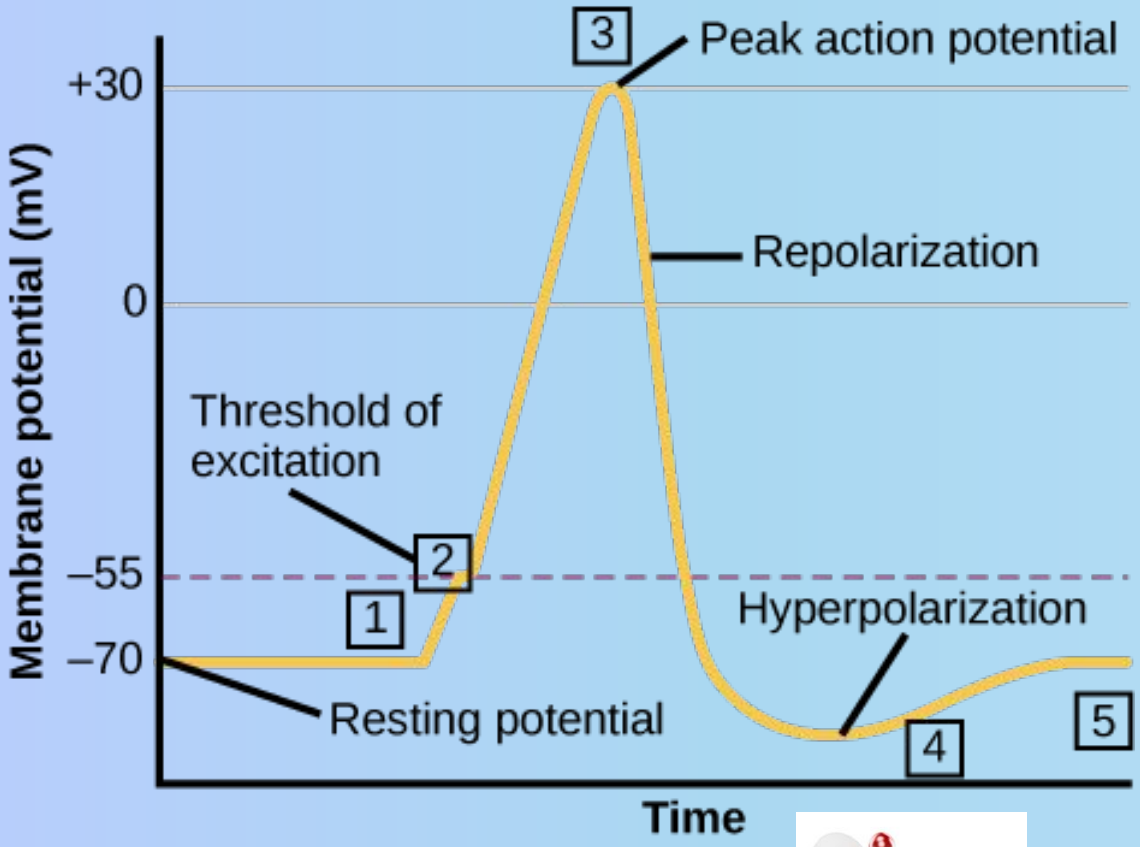
Hyperpolarization



4. K^+ Channels are so hard to close!!

a. K^+ continues to flow out of the cell until membrane potential become hyperpolarized

5. Once Hyperpolarized, K^+ Channels are now forced to shut.

a. To restore balance, our handy **Na^+-K^+ ATPase** comes back into play! Slowly but surely, 3+ out and 2+ in.

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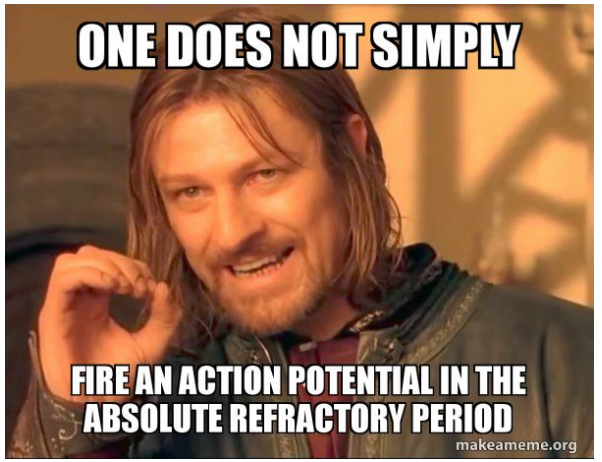

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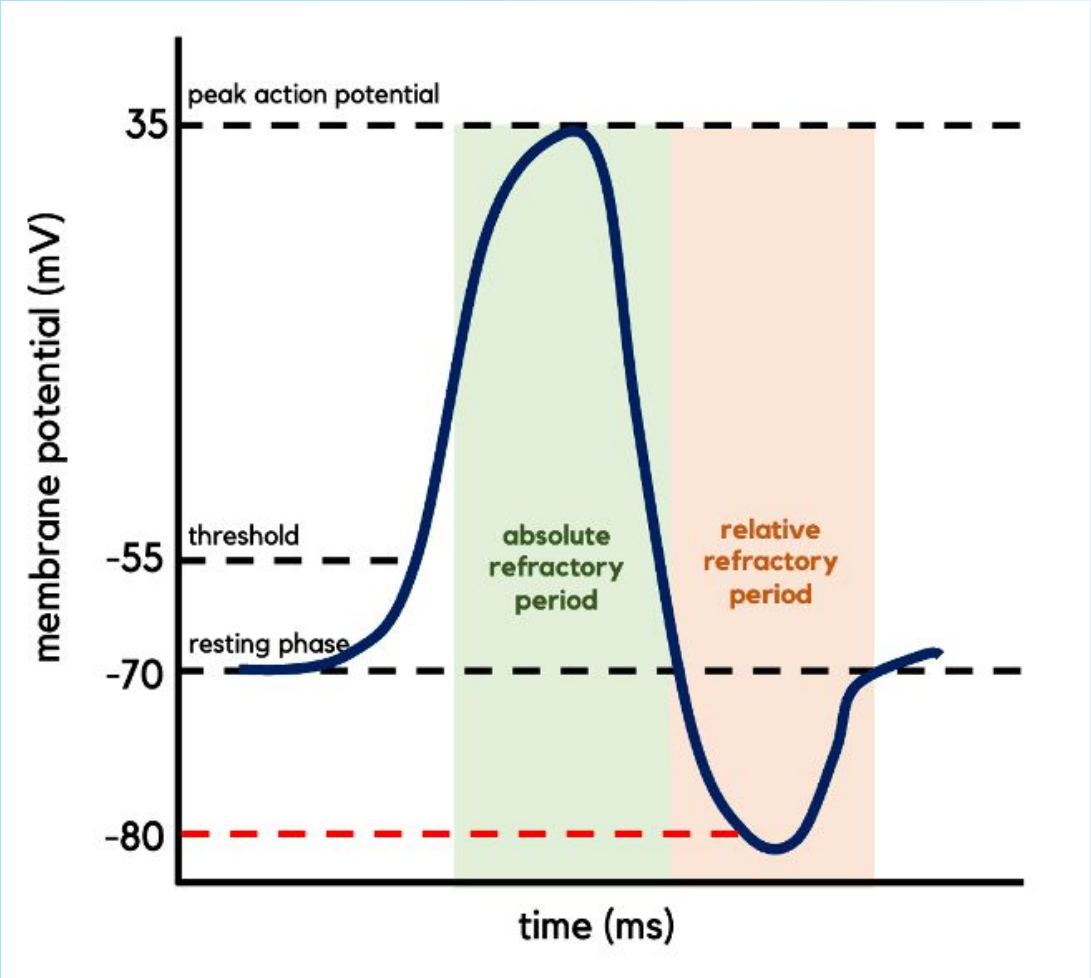
Refractory Periods

Absolute Refractory period

- When Na+ channels close their inactivation gate, An action potential is **impossible** at this time.
- No amount of stimulus can activate another action potential
- This prevents the action potential from moving backwards on the axon



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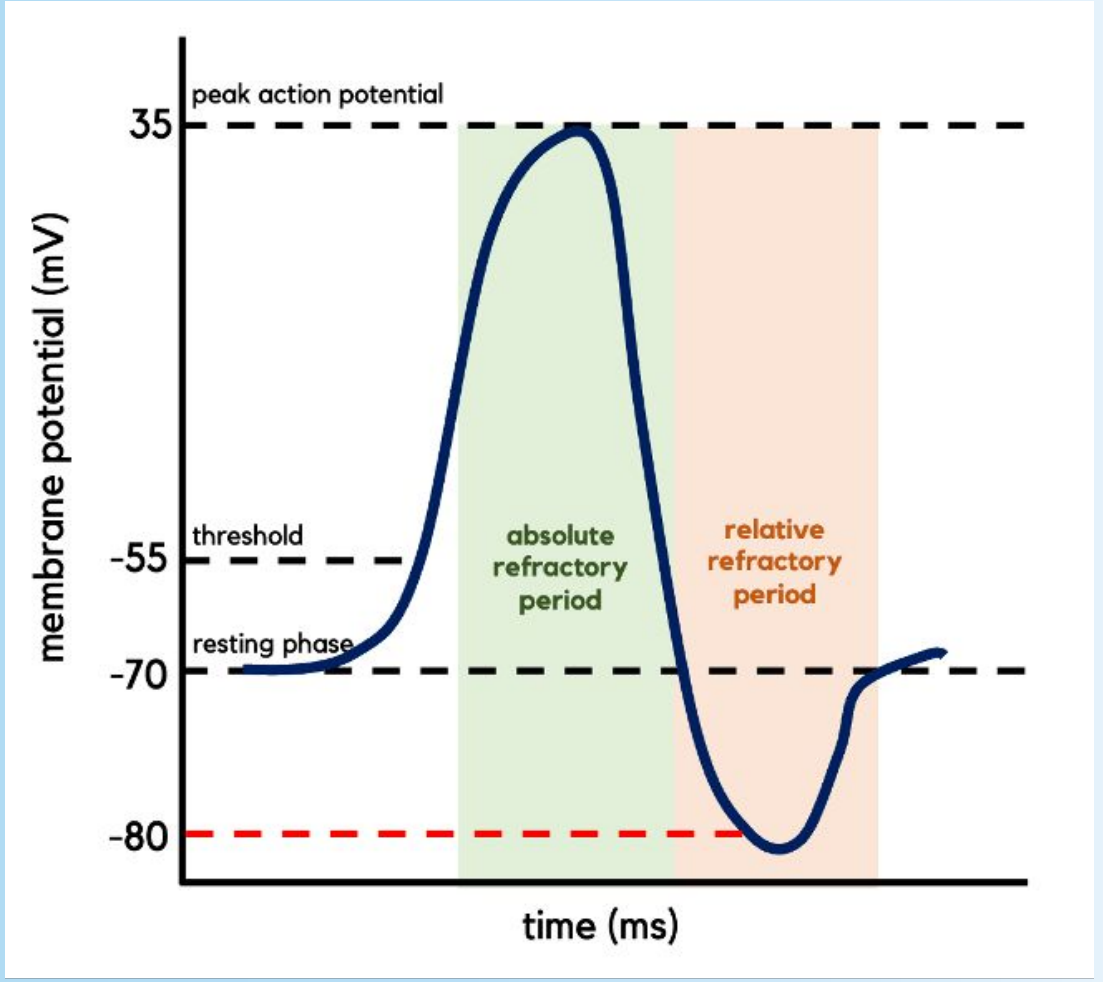
Refractory Periods

Relative Refractory Period

- After some time the inactivation gate on the Na+ channel opens.
- The activation gate can open at the threshold potential.
- Some Na+ channels take longer to re-activate.
- Open K+ channels make it very difficult to reach the threshold.



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WOOCLAPPP