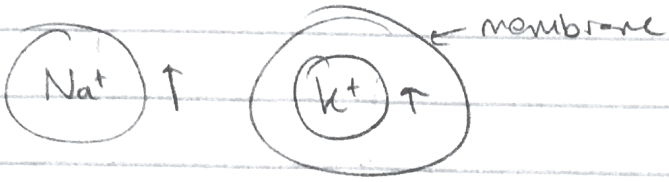
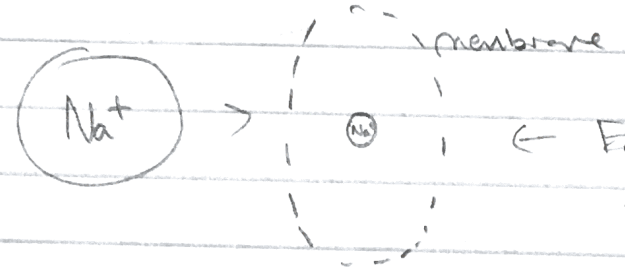
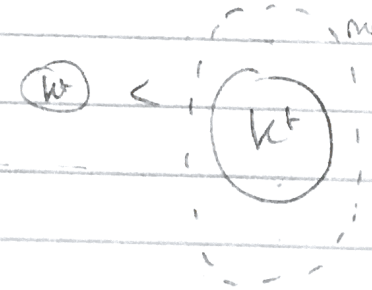
Normal Neurons of Mammalians are Salty Bonanas



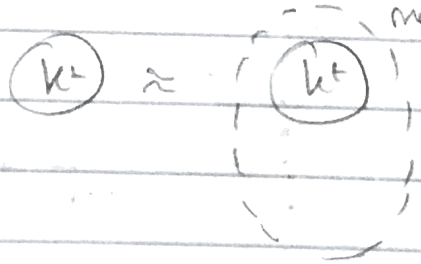
When ion concentrations at equilibrium (rest)

1) 

← Equilibrium Potential >> 0 mV (about 60 mV)

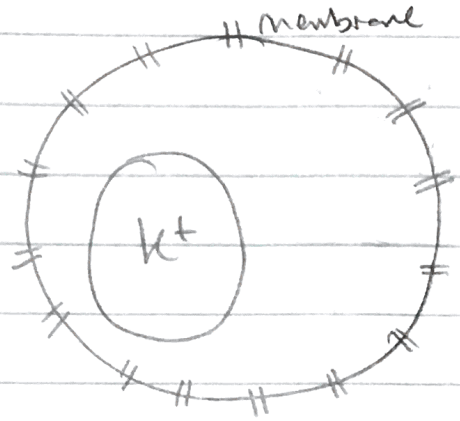
2) 

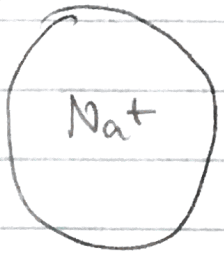
← Equilibrium Potential << 0 mV (about -88 mV)

3) 

← Equilibrium Potential ≈ 0 mV

Neuron Cell Behavior





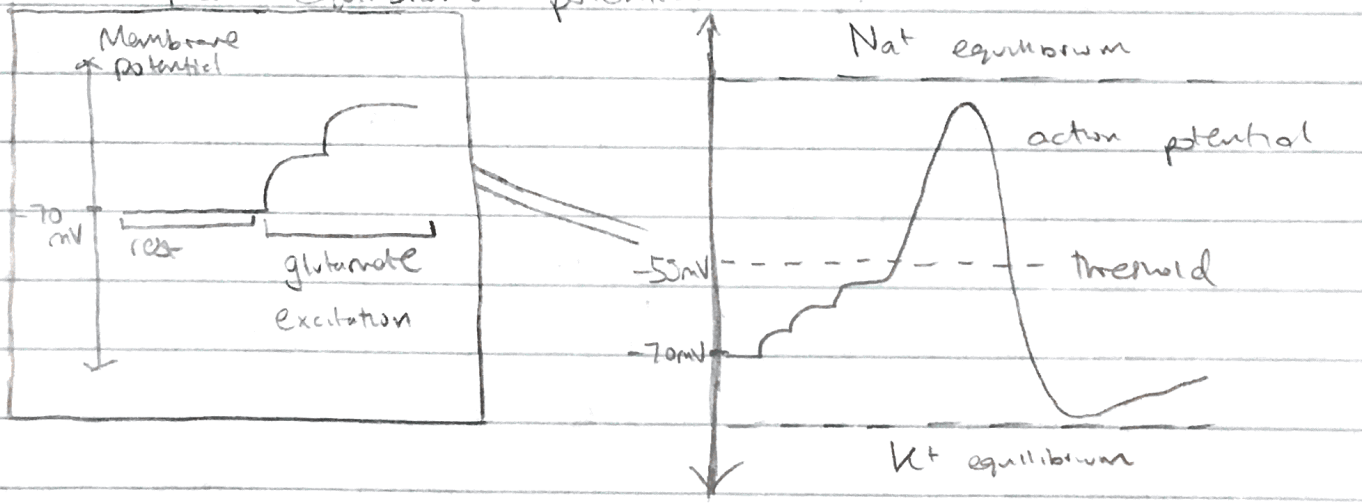
* Net movement of Concentration gradient causes more K^+ ions inside than outside

Leakage channels also keep Na^+ outside higher than K^+ ions inside

1) At rest- membrane potential ≈ -70 mV

2) With excitation from Glutamate, depolarization occurs within cell

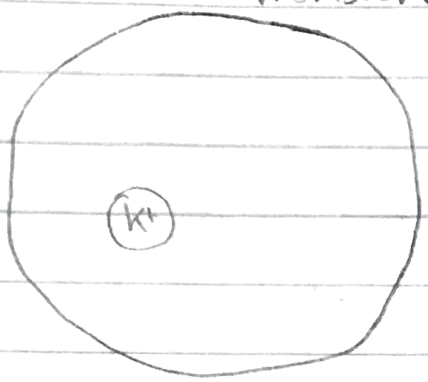
This increases membrane potential toward Na^+ equilibrium potential

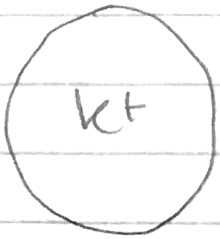


3) With enough excitation, membrane potential can cross threshold to activate all V-G Sodium channels and "fire" an action potential!

Hair Cell Behavior

membrane





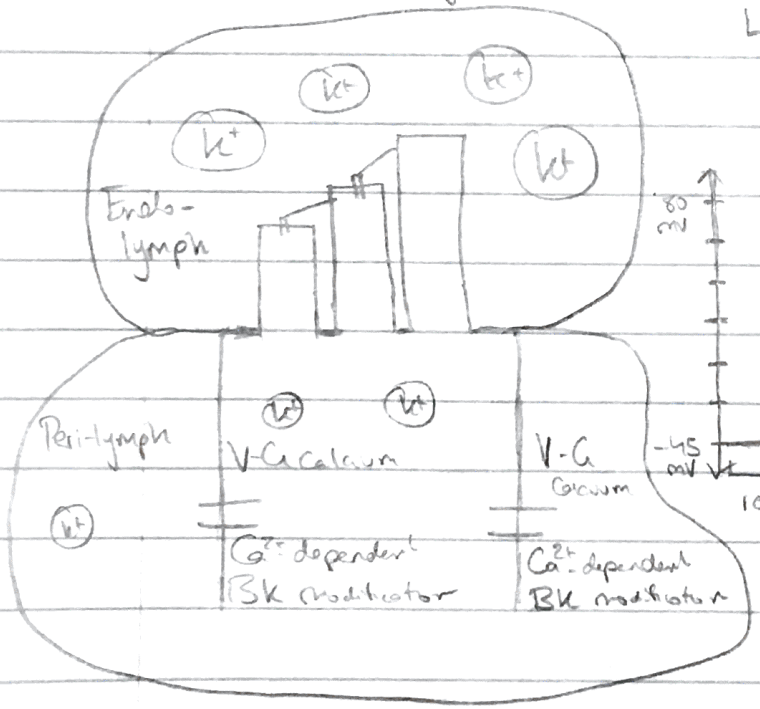
Because of higher K^+ in extracellular space, K^+ permeability is reduced so K^+ cant the drive to depolarization

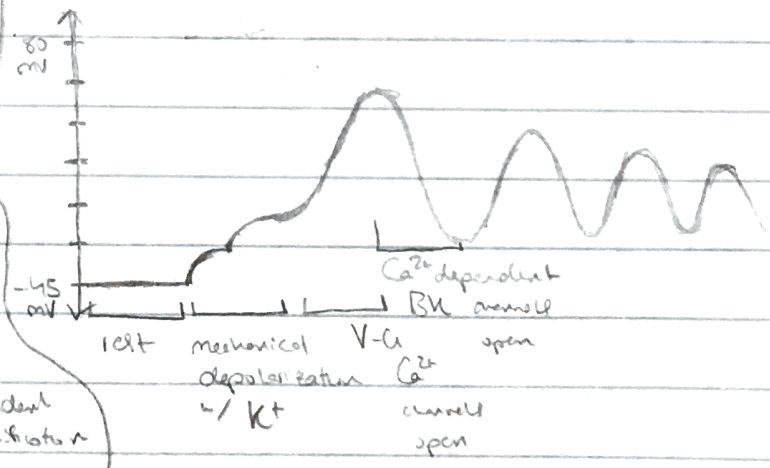
✡ At rest, membrane potential −55mV

Actual Diagram

✡ High extracellular K^+
Low intracellular K^+

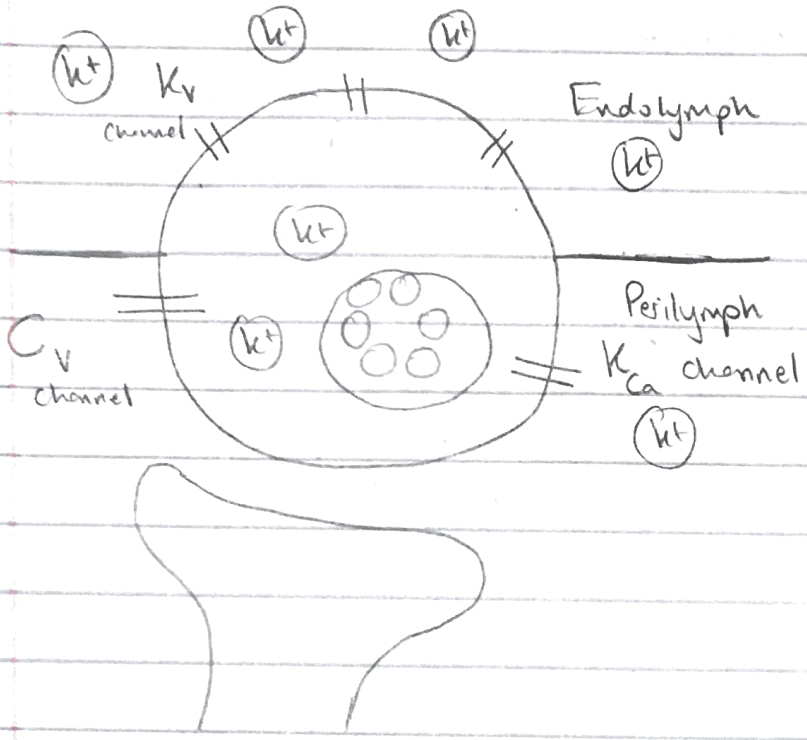
= +80mV K^+ equilibrium potential

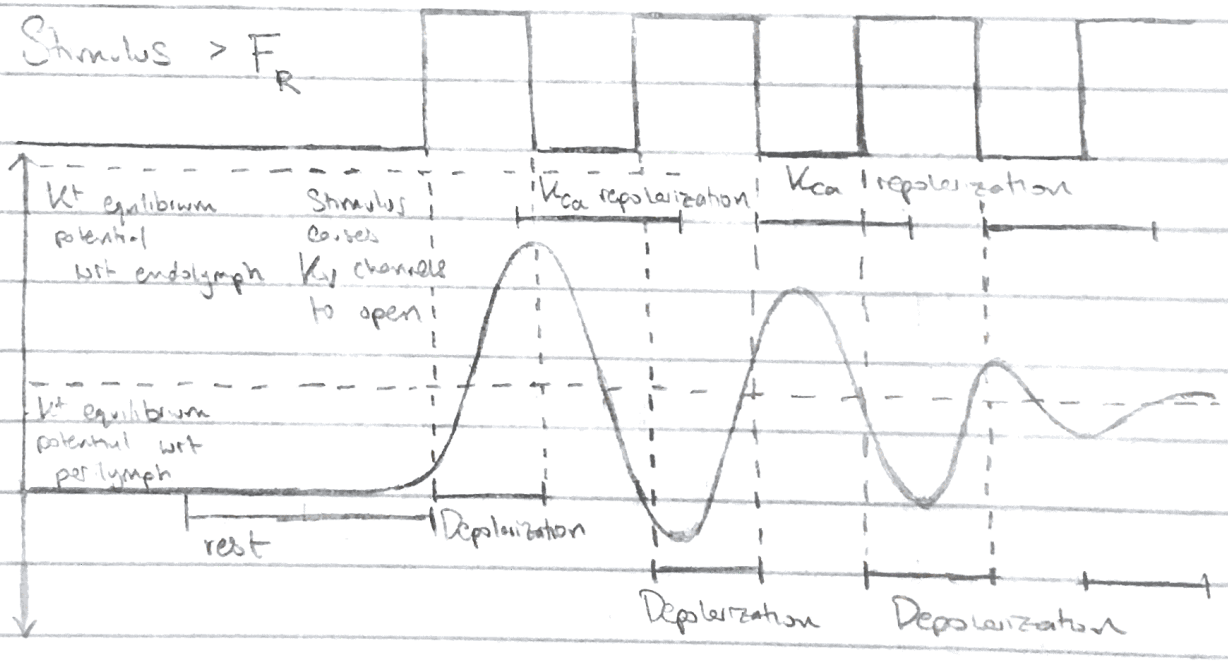




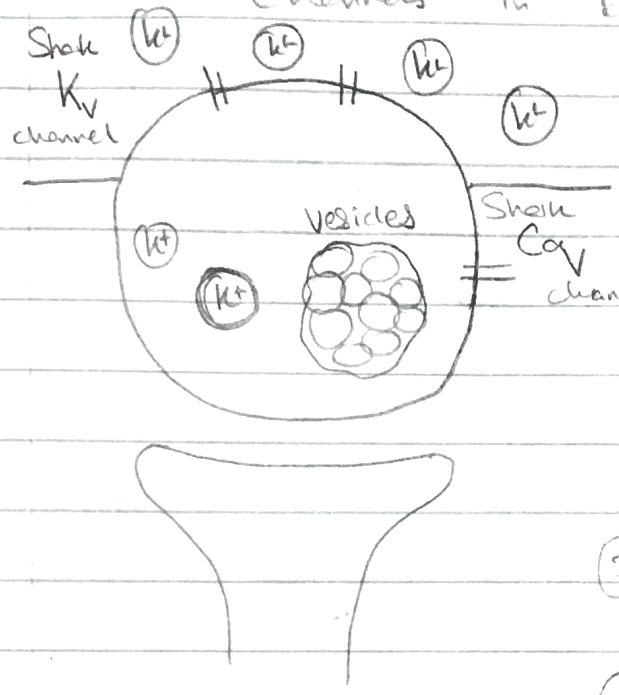
Potassium can leave using BK channels because Perilymph has lower concentration so efflux of K^+ causes repolarization

Deep Dive into Voltage Oscillations





Voltage-Gated Potassium & Calcium Channels in Electroreception in Sharks

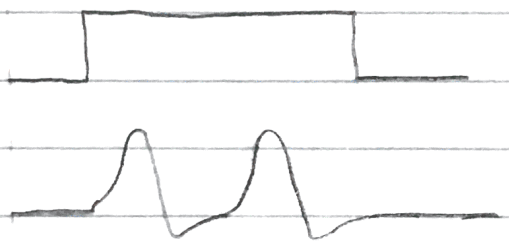


(1) Stride change in voltage from electric field

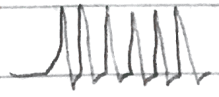
(2) K_V channels open releasing K^+ into cell that cause depolarization like in hair cells

(3) When depolarization causes a threshold, Ca^{2+}_V channels are opened to release Ca^{2+} to bind to vesicles and release.

(4) All vesicles are released once threshold has been crossed and inactivation / deactivation occurs to reset cell's vesicles



Shark



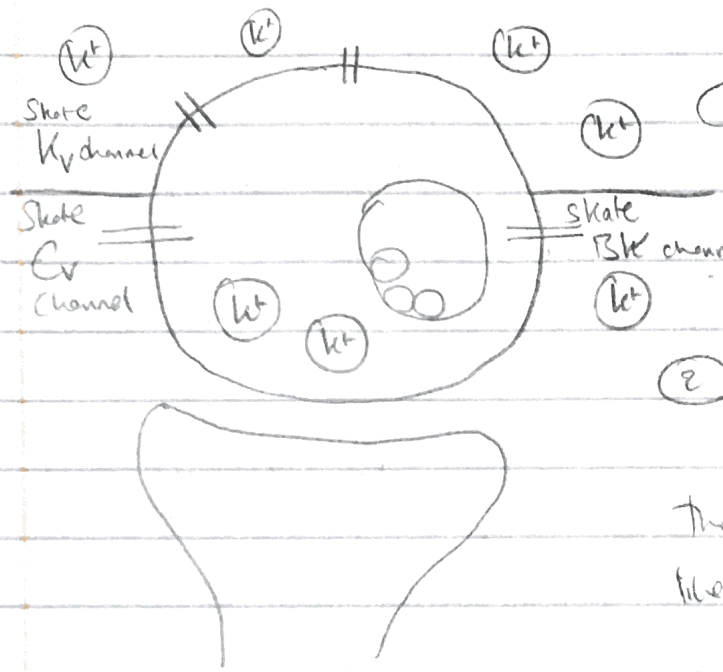
Electroreception also supports repetitive currents with fast activation & deactivation to maintain large amplitudes

Shark-Specific

1) "Readily releasable" pool of vesicles

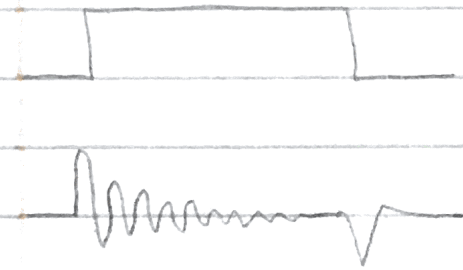
2) Shark voltage stimulus had larger changes to C_m

Voltage-Gated Potassium & Calcium Channels w/ Calcium-Dependent Potassium Channels in Skates



(1) Outside charge in electric field

(2) K_V channels open releasing K^+ channels that cause depolarization like in hair cells



(3) Depolarization causes membrane potential increase until crosses a threshold to trigger Ca_V channel to open and release Ca^{2+} to bind to neurotransmitter vesicles

(4) As Ca^+ increases, skate BK channel opens to release K^+ outside to repolarize the cell and refill the neurotransmitters