Physiology 2

- send answer to iClicker Question 22A now.

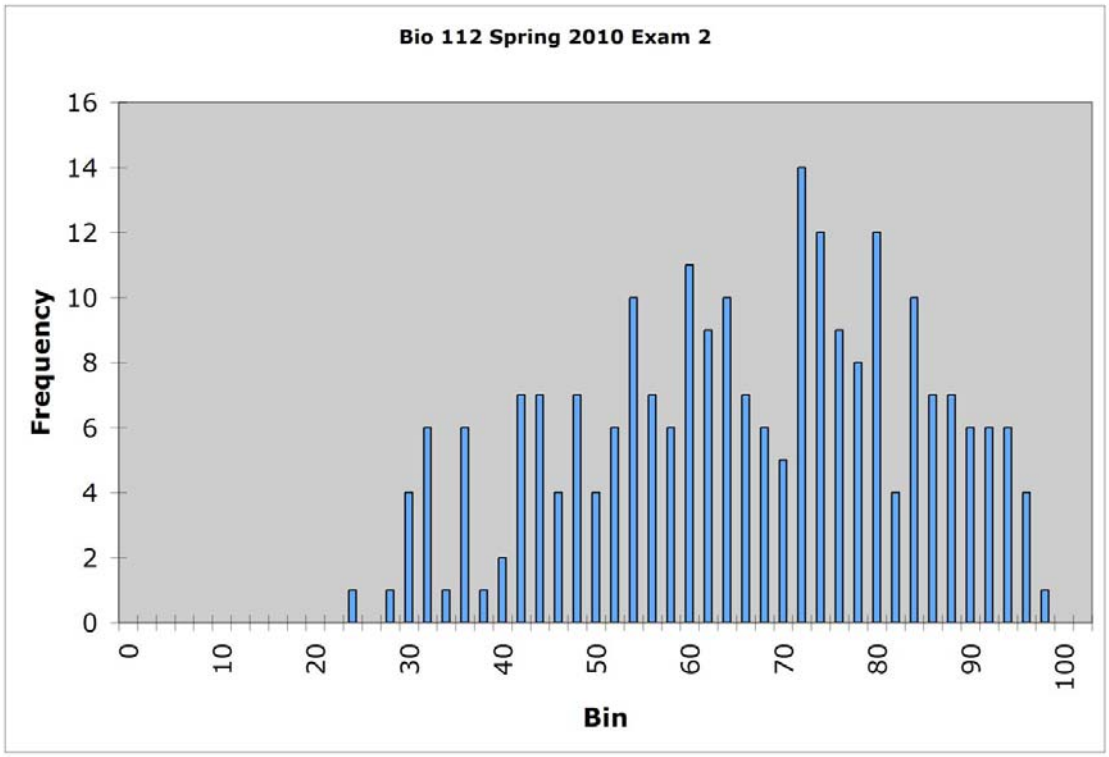
Neurons: Transmission

- playing pieces
- players
- the game I
  - resting potential
    - animation
- iClicker Question 22B
    - animation revisited

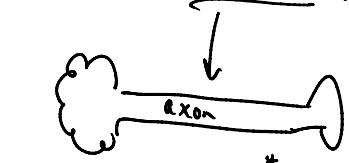
Umass worcester admissions comm
presentation + Q/A 3-430
W-3 Venture devel. ctr
free food :)

Amelia B, see me

Due in lab **this** week:
⇒ Animal Diversity Pre-lab (Lab manual page 103 & on-line)
⇒ Plant Diversity Lab report



Neurons : transmission of information



chemical → electrical* → chemical

max speed ~ 120 m/sec ~ 270 mph

* really electro-chemical

ions moving in/out of cell

not electrons moving along cell

The "playing pieces" = ions = electrically-charged atoms

K^+ = potassium ion : (+) charge

Na^+ = sodium ion : (+) charge

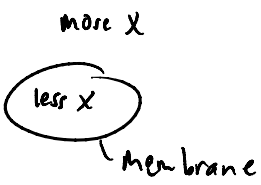
Cl^- = chloride ion = (-) charge

Rules

① ions can't cross a membrane without help from a specific membrane protein

∴ can have more ion X inside cell than outside (& vice versa)

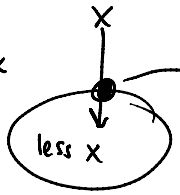
ex



* difference in X concentration "concentration gradient"

② specific proteins allow specific ions to cross membrane

③ more X



protein: an "X-channel" allows X to go from high X to low X spontaneously

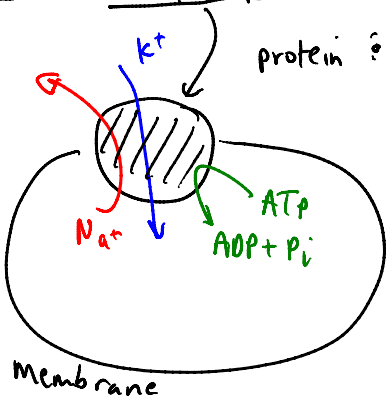
($\Delta G-$: "X wants to go from hi X to lo X")

④ to move X from low X to high X $\Delta G+$ (not spontaneous)

∴ requires energy input from ATP → ADP + P_i

also need a different protein: an "X-pump" active transport

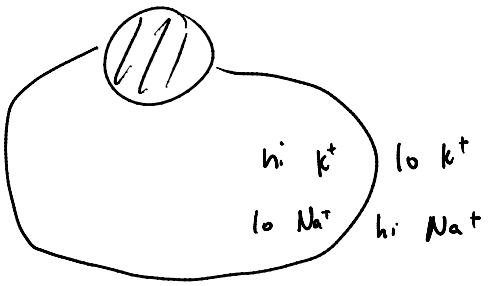
Players ① Na^+/K^+ pump (a.k.a. "Na^+/K^+ ATPase")



protein & enzyme

uses energy from ATP to pump Na^+ out & K^+ in

run for a while



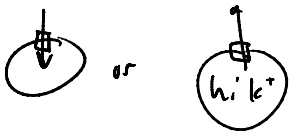
result:

now: "Na^+ 'wants' to go in"

"K^+ 'wants' to go out"

② K^+ channel protein - lets K^+ move freely from hi K^+ → lo K^+

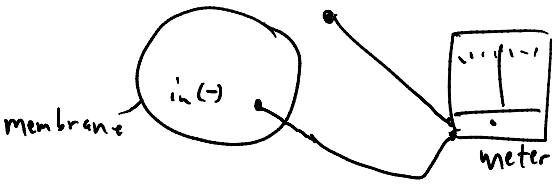
* only K^+ can go thru

hi K^+  or

no ATP needed

The game: all neurons (& most other cells) at rest (not signalling) have slight excess of (-) charge on the inside of the cell ⇒ "resting potential"

out (+)



measured in milli-volts (mV)

resting = -70mV

(-0.07 volts)

keeping score

① which way does Na^+ want to go?

hi Nat → lo Nat

② which way does K^+ want to go?

hi K^+ → lo K^+

③ what is the membrane voltage?

* calculate net charge on each side of membrane

\+ Sum of (+)'s
Sum of (-)'s
net charge

if not zero
then V_m is ⊕ or ⊖
↑ membrane voltage