

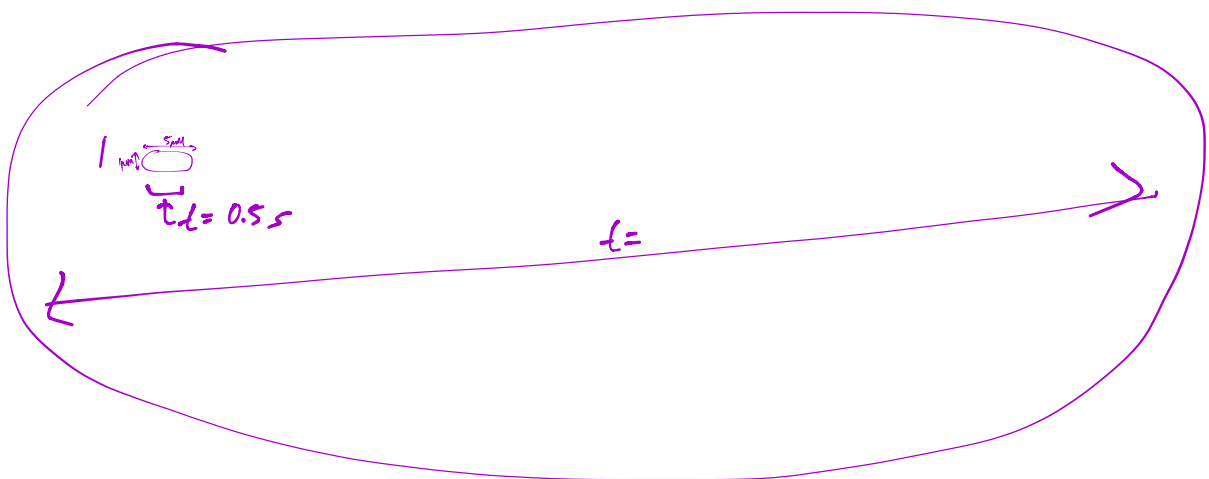
SHOW BROWNIAN MOTION SLIDE.

$\langle r \rangle = \sqrt{\frac{k_B T}{\gamma r_H}}$ ← STOKES · EINSTEIN.
 ↑
 HOW FAR IT GOES, ON AVERAGE. r_H ← SIZE PARTICLE
 $t = \frac{\langle r \rangle^2}{\gamma r_H}$ 2 MEANS LONG DISTANCES ARE HARD!

HOW DO CELLS DEAL WITH SLOW DIFFUSION?

- SUBDIVIDE
 - ORGANELLES
 - ALSO ALLOWS SPECIALIZATION.
- MOVE STUFF
 - BOXES
 - ROADS
 - RATCHETING MOTORS.

RAILWAYS.



SHOW PICTURE EUKARYOTIC CELL.

SOMETIMES, CELLS JUST HAVE TO MOVE STUFF

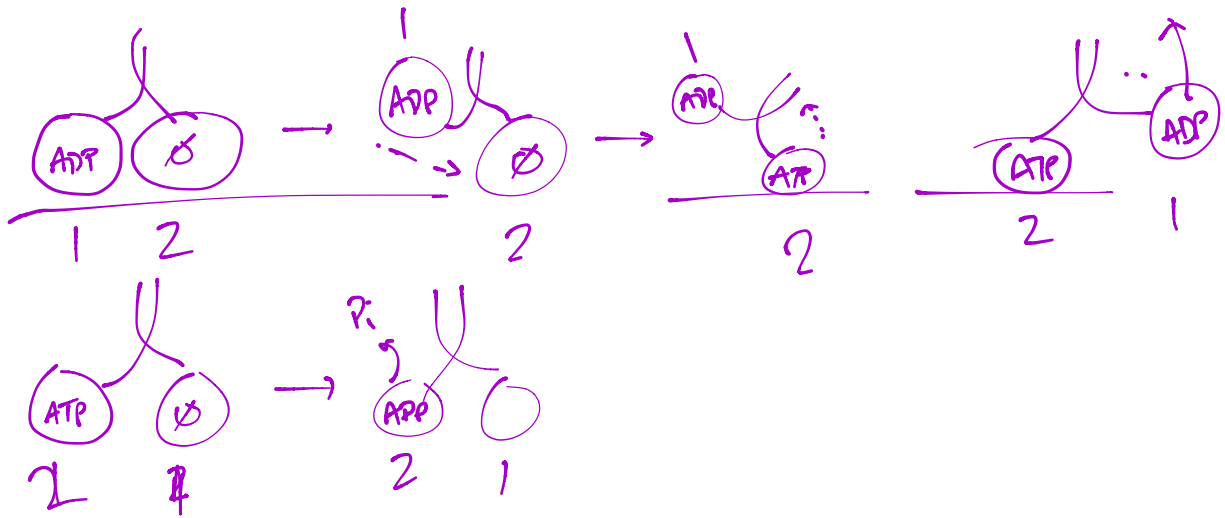
SHOW NEURON. 1m ← X YEARS!

USE RAILROADS.

SHOW VIDEO OF WALKING.

TUBULIN POLYMER ASSEMBLY.

HAND OVER FIST.



- KINESIN ~~BREAKDOWN~~) CAN BE R.G. LIKE... NEED NOT BE.
- WHICH
- ATTACHMENT