LECTURE #16: INTRO TO MEMBRANES:

BACTERIA RUN @ 1mM ATP.

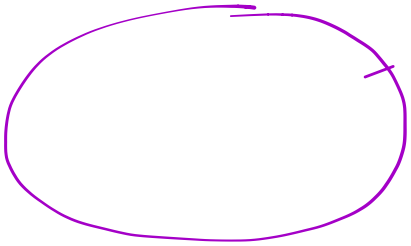
~ 10^{30} BACTERIA ON EARTH
~ 10^{-15} L CYTOPLASM/BAC
10^{15} L BAC. CYTOPLASM.

1×10^{21} L H_2O!

$\frac{10^{21}}{10^{15}}$ ⇝ MILLION-FOLD CONCENTRATION!

WHAT PROPERTIES WOULD WE WANT?

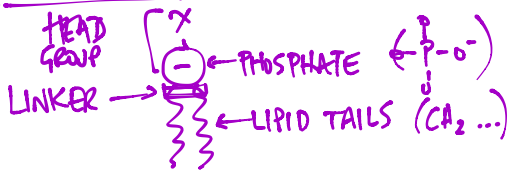
LIPID BILAYER

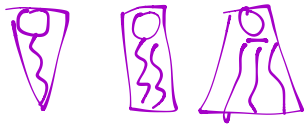


DESIGN SPEC:

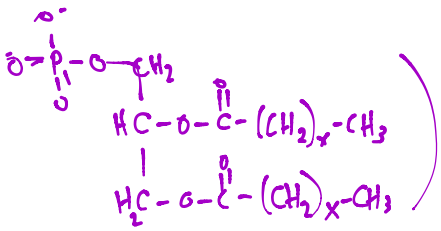
1. MODULAR PARTS
2. SELECTIVELY PERMEABLE
3. FLEXIBLE
4. CLOSED LOOP
5. DIVIDABLE.

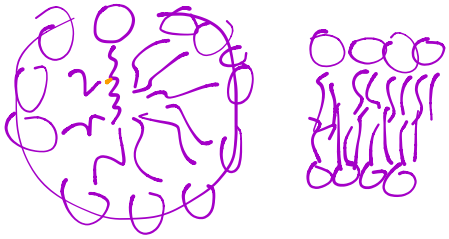
MODULARITY





PHOSPHOLIPID:





SHOW BILAYER ON SCREEN, GRAPH OF CONTENT.

SELECTIVE PERMEABILITY

PERMEABILITY
- ~~IONS~~
- ~~WATER~~
- HYDROPHOBES
- ~~MACRO MOLECULES~~

FLUIDITY
- LATERAL DIFFUSION ↔ ↑ WITH UNSATURATED
  ↓ WITH CHOLESTEROL
- ROTATION
- CHAIN MOVEMENT
- FLIP/FLOP ~~ms~~ SLOW

CLOSED: HOW DO YOU CLOSE INFINTE SHEET?

ADD MORE ON ONE SIDE!

FLIPPASE ENZYMES DO THIS

DIVISION: EXTREME CURVATURE.

MATH ETC. FOR [ATP].

~1 mM ATP / CELL

9×10^{29} BACTERIA ON EARTH

CELL IS ~1 μm RADIUS.

$(1E\text{-}6\ m)^3 \times \pi \times 4 \times \frac{(100\ cm/m)^3}{3} \times \frac{mL}{cm^3} \times \frac{L}{1000\ mL}$

$1E\text{-}18 \times 4 \times 1000000$

$1E\text{-}15$ L / BACTERIUM

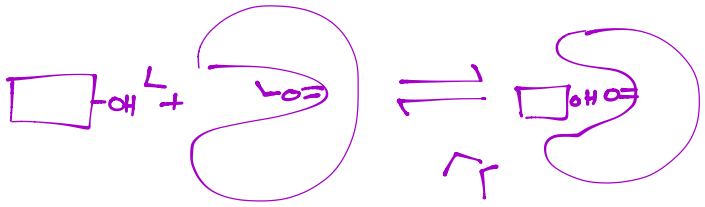
TOTAL H_2O

$1.4 \times 10^9\ km^3\ H_2O$. (USGS)

$1.4 \times 10^9\ km^3 \times \frac{(1000\ m/km)^3}{(km)} \times \frac{(100\ cm/m)^3}{m} \times \frac{mL}{cm^3} \times \frac{L}{1000\ mL}$

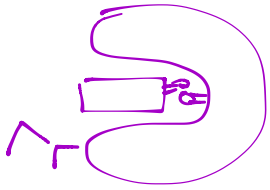
1.4×10^{21} L H_2O

http://www.nature.com/news/there-are-fewer-microbes-out-there-than-you-think-1.11275
http://www.nature.com/srep/2014/141006/srep06522/full/srep06522.html



#HBONDS: 2 #HBONDS: 2

$$-z_0 = -RT\ln(K_D)$$



#HBONDS: 2 #HBONDS: 1