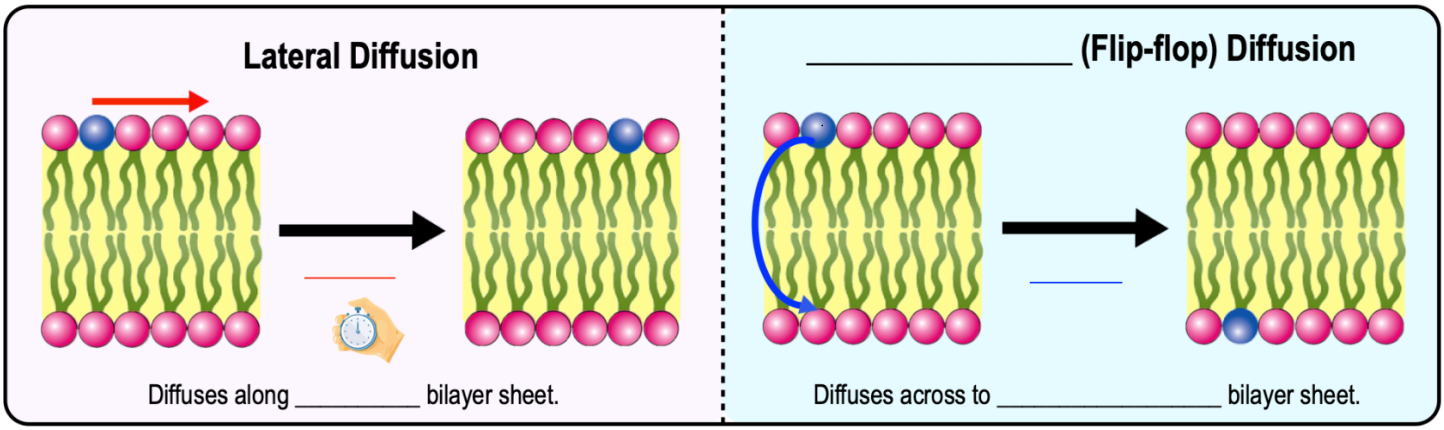
CONCEPT: PHYSICAL PROPERTIES OF BIOLOGICAL MEMBRANES

Lateral & Transverse Diffusion

- _____ types of lipid *diffusion* describe the *fluid-like* motion of lipids within a bilayer:
  1) _____ *Diffusion*: *uncatalyzed*, *lateral* movement of lipids along the *same* sheet of a lipid bilayer.
     - □ Extremely _____ lateral movement.
  2) *Transverse* (or "_____-*flop*") *Diffusion*: *catalyzed* transfer of lipids across to the *opposite* sheet of a lipid bilayer.
     - □ Extremely _____ process (could take *days* without an enzyme).
     - □ *Slow* rate allows inner & outer sheets of membranes to maintain _____ lipid *compositions*.

EXAMPLE: Lateral vs. Transverse Diffusion.

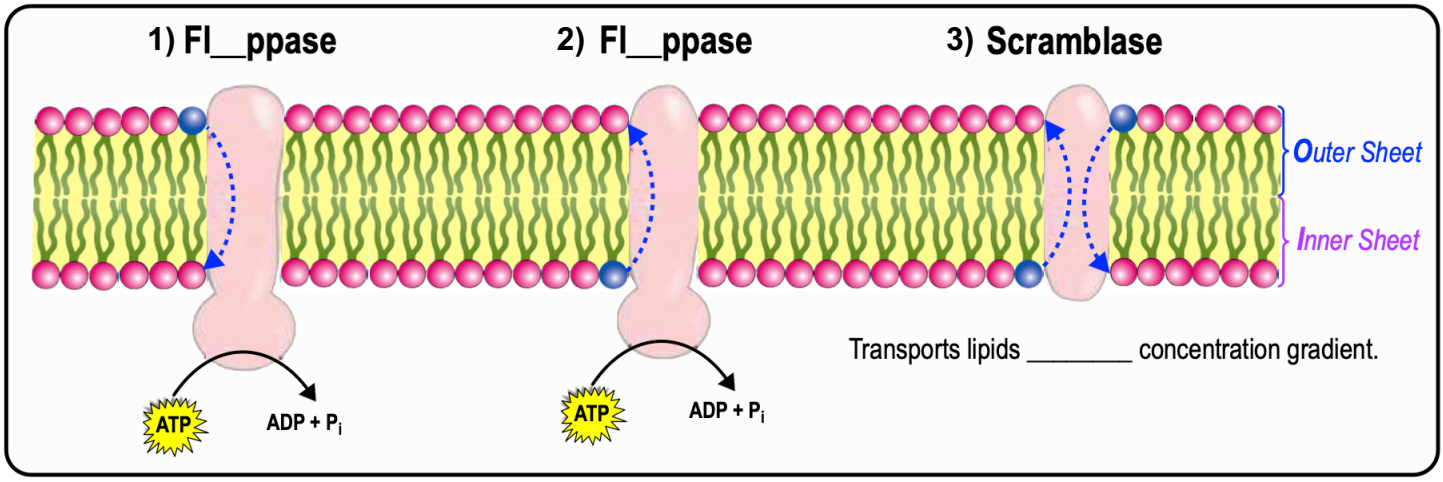


Enzymes Catalyzing Transverse Diffusion

- _____ types membrane-embedded-_____ catalyze *transverse* diffusion:

ATP
1) _____pase: *flips* lipids from the *outer sheet* to the _____ *sheet.*
2) _____pase: *flops* lipids from the *inner sheet* to the _____ *sheet.*

No ATP
3) _____ase: *scrambles* lipids in *either direction* across the bilayer, *down the concentration gradient*.



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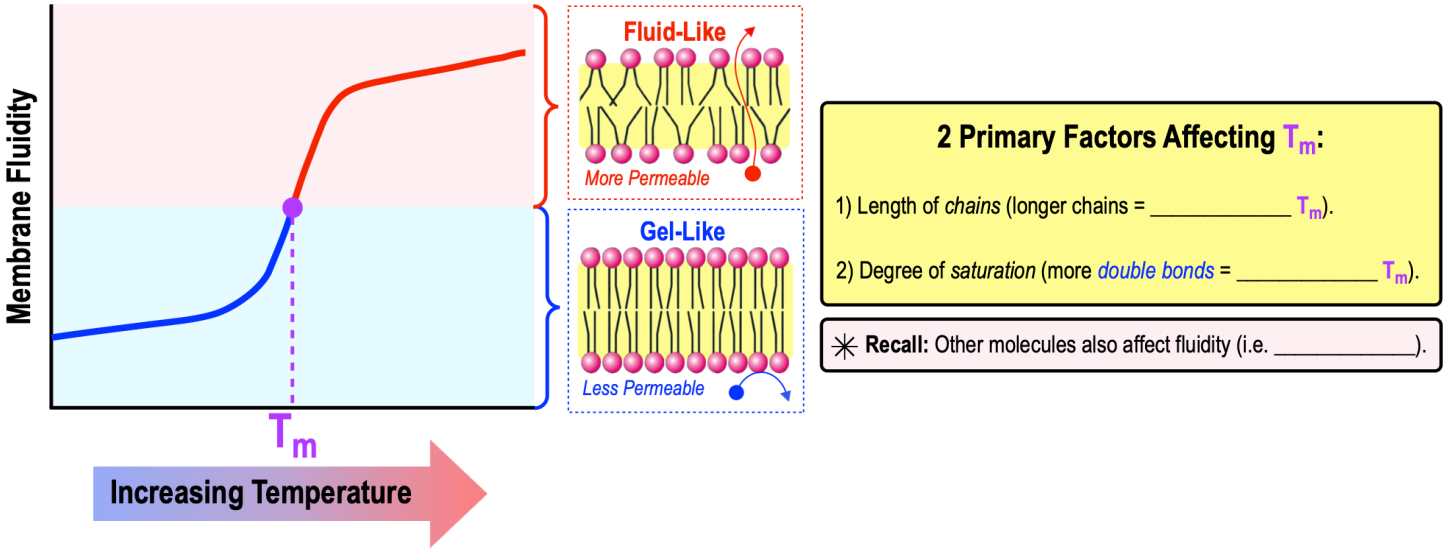
PRACTICE: The mobility of lipids in membranes is best described by:

a) Slow lateral diffusion and slow transverse diffusion.
b) Fast lateral diffusion and slow transverse diffusion.
c) Fast transverse diffusion and slow lateral diffusion.
d) Fast lateral diffusion and fast transverse diffusion.

Transition Temperature of Lipid Bilayers

- _____ (or *Melting*) *Temperature* (T_m): the temperature where a membrane loses/gains its _____.
  - □ At temps > T_m, membrane *transitions* from a thick, gel-like to a _____-*like* viscosity.
  - □ The *more* fluid-like, the _____ *permeable* the membrane is.
  - □ Membrane *transition temperatures* primarily dictated by *same* _____ factors affecting a fatty acid's *melting point*.



2 Primary Factors Affecting T_m:

1) Length of *chains* (longer chains = _____ T_m).

2) Degree of *saturation* (more *double bonds* = _____ T_m).

✳ **Recall:** Other molecules also affect fluidity (i.e. _____).

PRACTICE: The fluidity of a bilayer is generally increased by:

a) The binding of water to the fatty acyl side chains.
b) An increase in fatty acid chain length.
c) An increase in the number of double bonds in the fatty acid hydrocarbon chains.
d) A decrease in temperature.

PRACTICE: The transition temperature, Tm, for a sample cell's membrane was found to be much higher than a reference cell's membrane. What can be said about the membrane contents based on this experiment?

a) The sample cell is likely to have a higher cis-fatty acid content than the reference cell.
b) The sample cell is likely to have lower saturated fat content than the reference cell.
c) The sample cell is likely to have more polyunsaturated fatty acids than the reference cell.
d) The sample cell is likely to have higher saturated fat content than the reference cell.

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PRACTICE: Which of the following would increase the transition temperature of a membrane?

a) A decrease in the fatty acid tail length.

b) An increase in the number of double bonds in the fatty acid chains.

c) Loose packing of fatty acid tails.

d) Free fatty acids in the environment.

e) None of the above would increase the transition temperature.