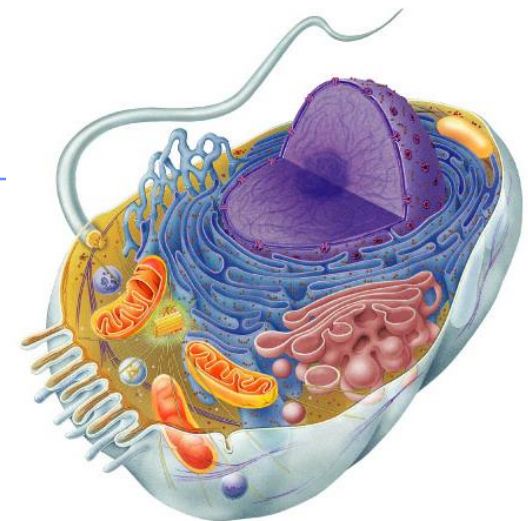


Cell Membranes & Movement Across Them



Cell (plasma) membrane

- Cells need an inside & an outside...
 - ◆ separate cell from its environment
 - ◆ cell membrane is the boundary

IN

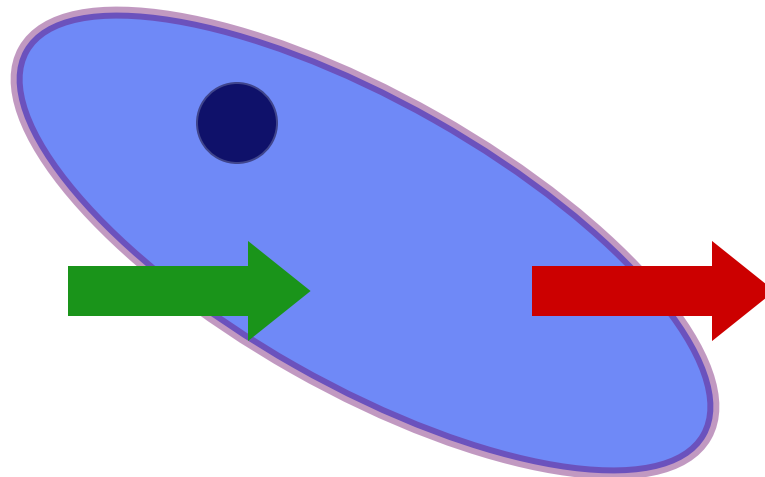
food

- sugars
- proteins
- fats

salts

O₂

H₂O



OUT

waste

- ammonia
- salts
- CO₂
- H₂O

products

- proteins

cell needs materials in & products or waste out

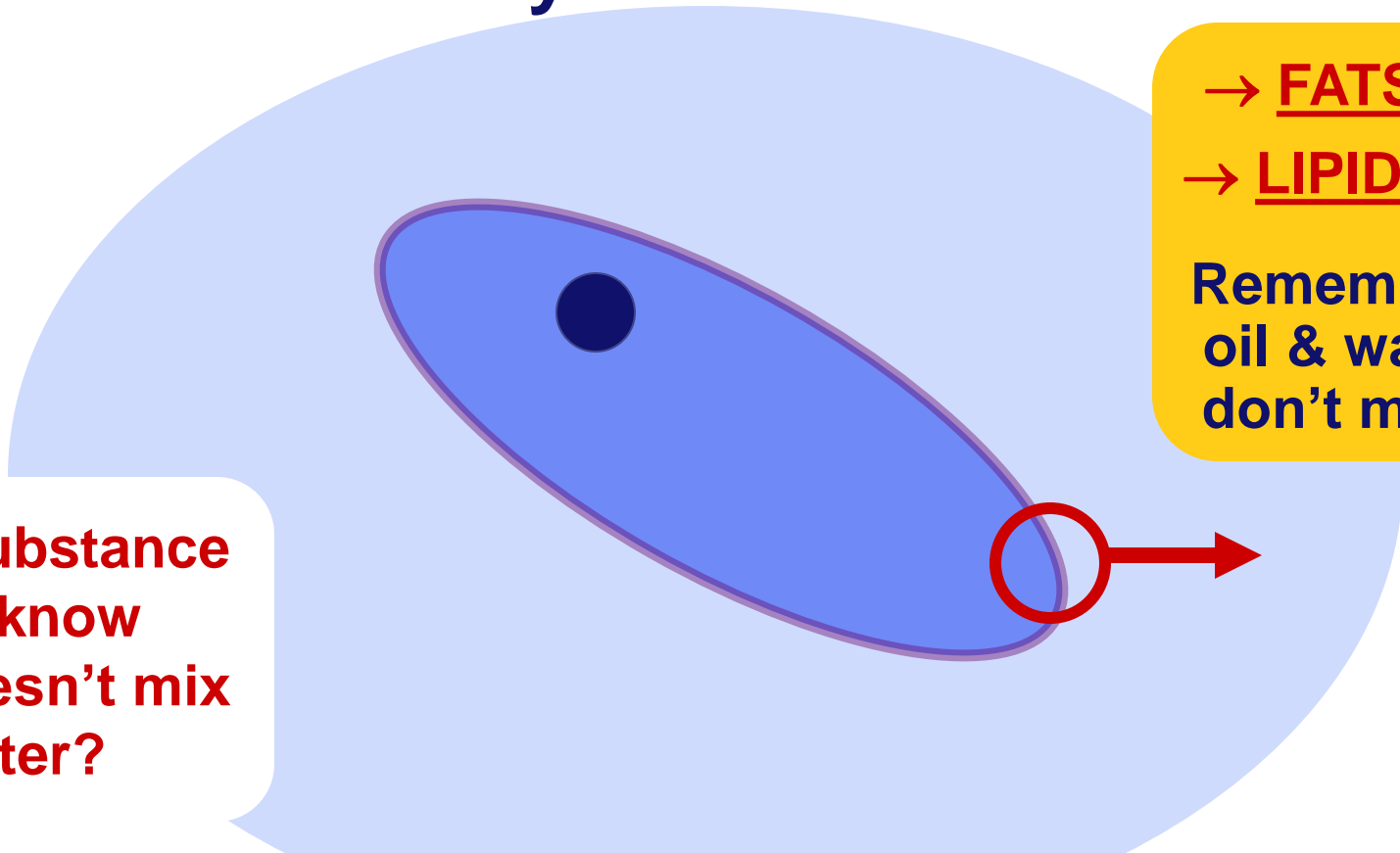
Building a membrane

- How do you build a barrier that keeps the watery contents of the cell separate from the watery environment?

→ FATS ←
→ LIPIDS ←

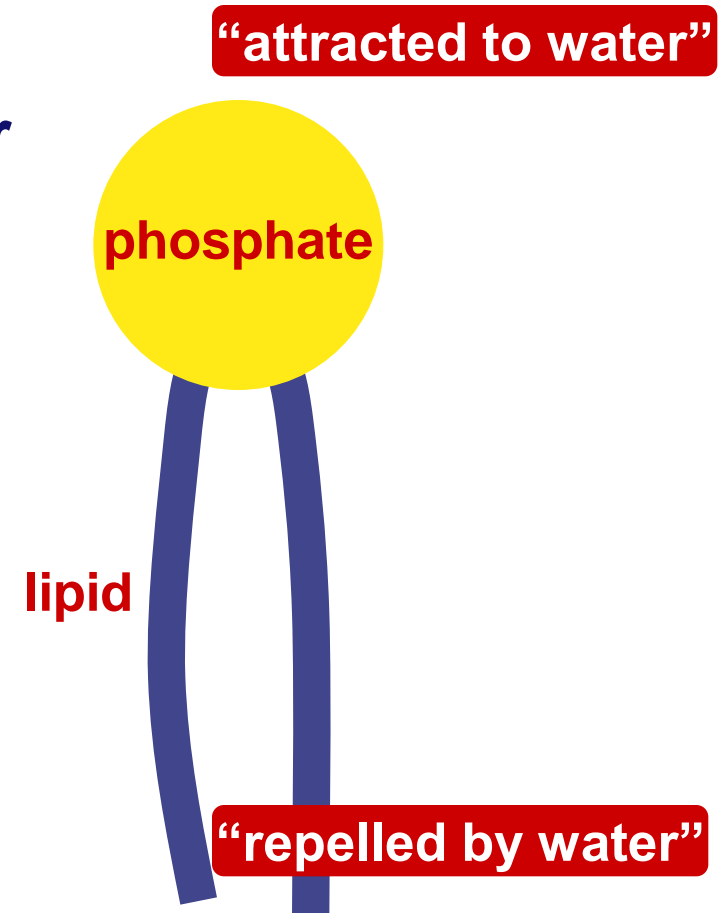
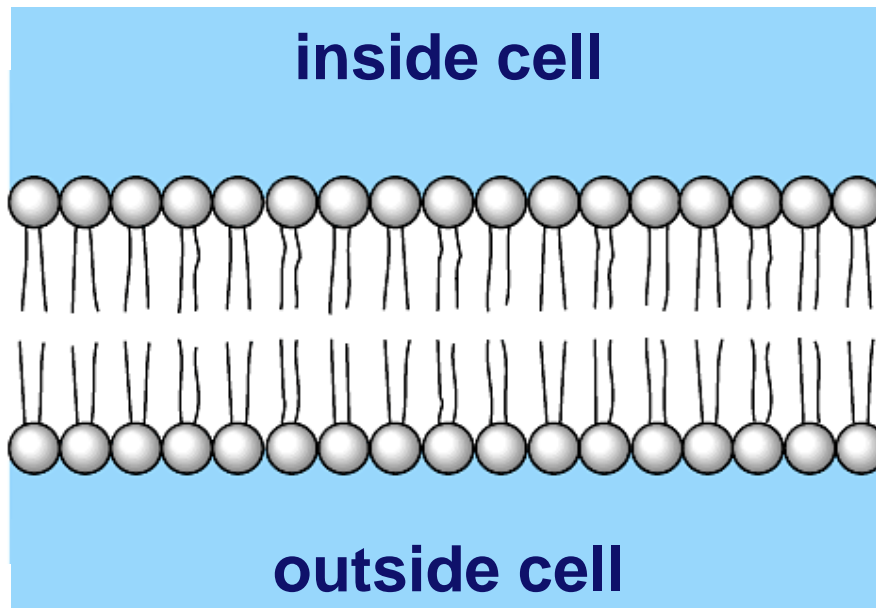
Remember:
oil & water
don't mix!!

What substance
do you know
that doesn't mix
with water?



Lipids of cell membrane

- Membrane is made of special kind of lipid
 - ◆ phospholipids
 - ◆ “split personality”
- Membrane is a double layer
 - ◆ phospholipid bilayer



Semi-permeable membrane

- Cell membrane controls what gets in or out
- Need to allow some materials — but not all — to pass through the membrane
 - ◆ semi-permeable
 - only some material can get in or out

So what needs to get across the membrane?

sugar

lipids

aa

O₂

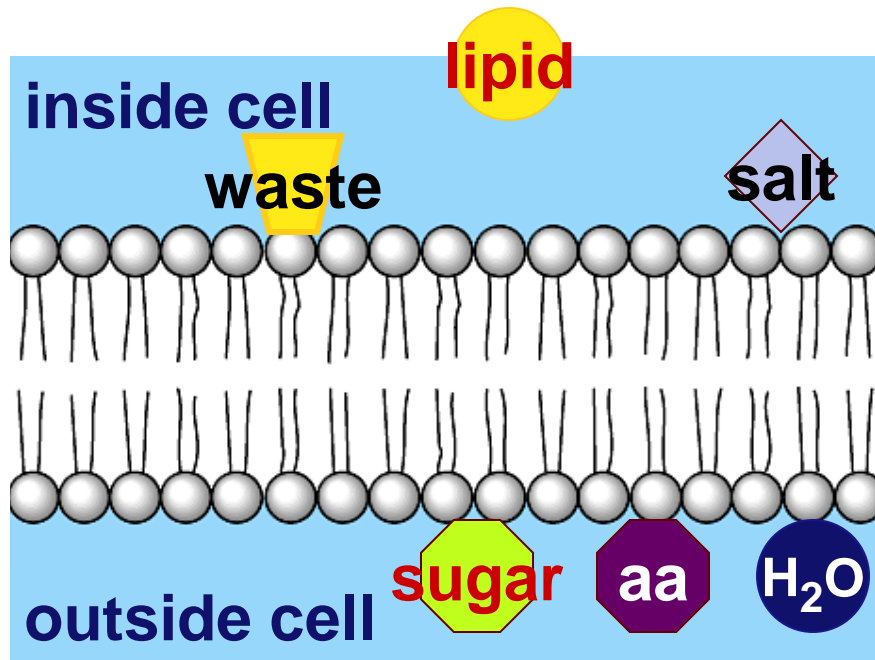
H₂O

salt

waste

Crossing the cell membrane

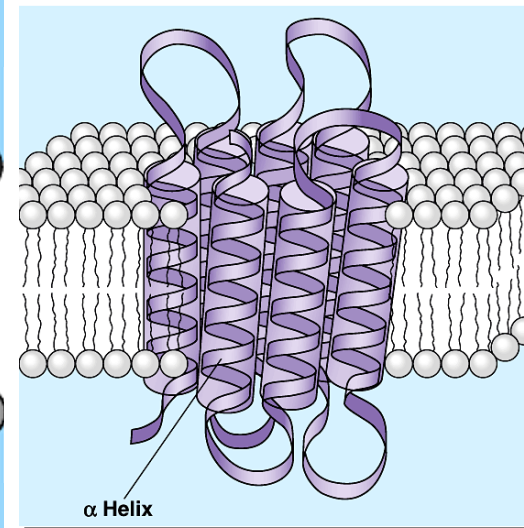
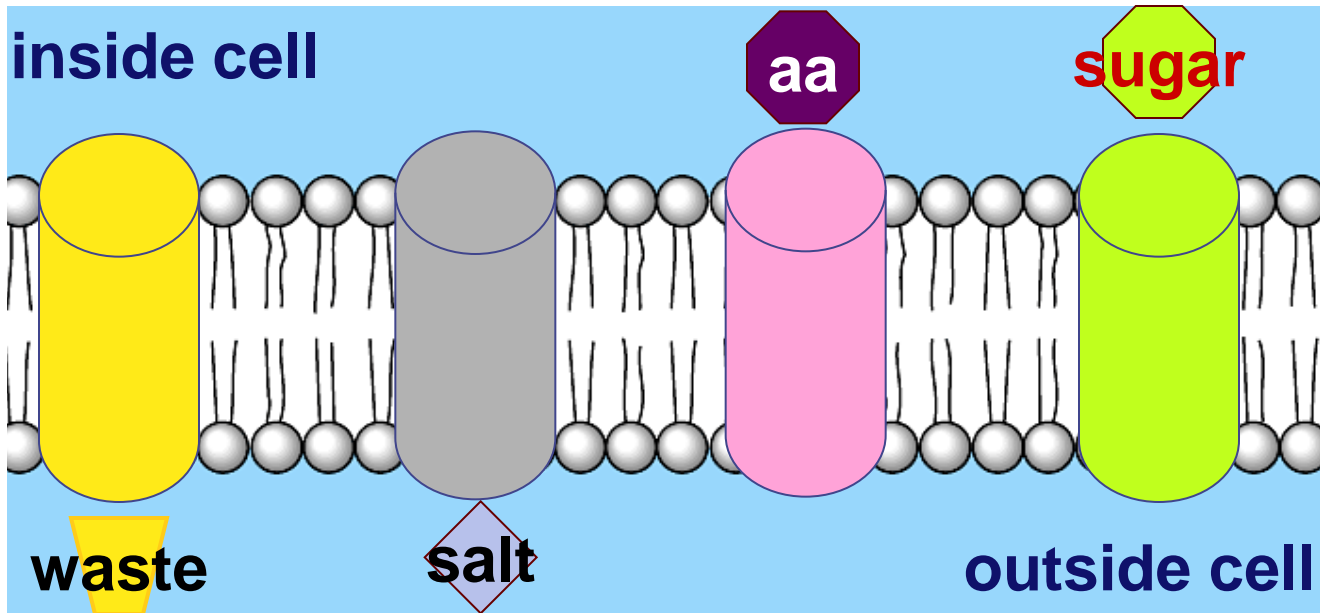
- What molecules can get through the cell membrane directly?
 - fats and oils can pass directly through



but...
what about
other stuff?

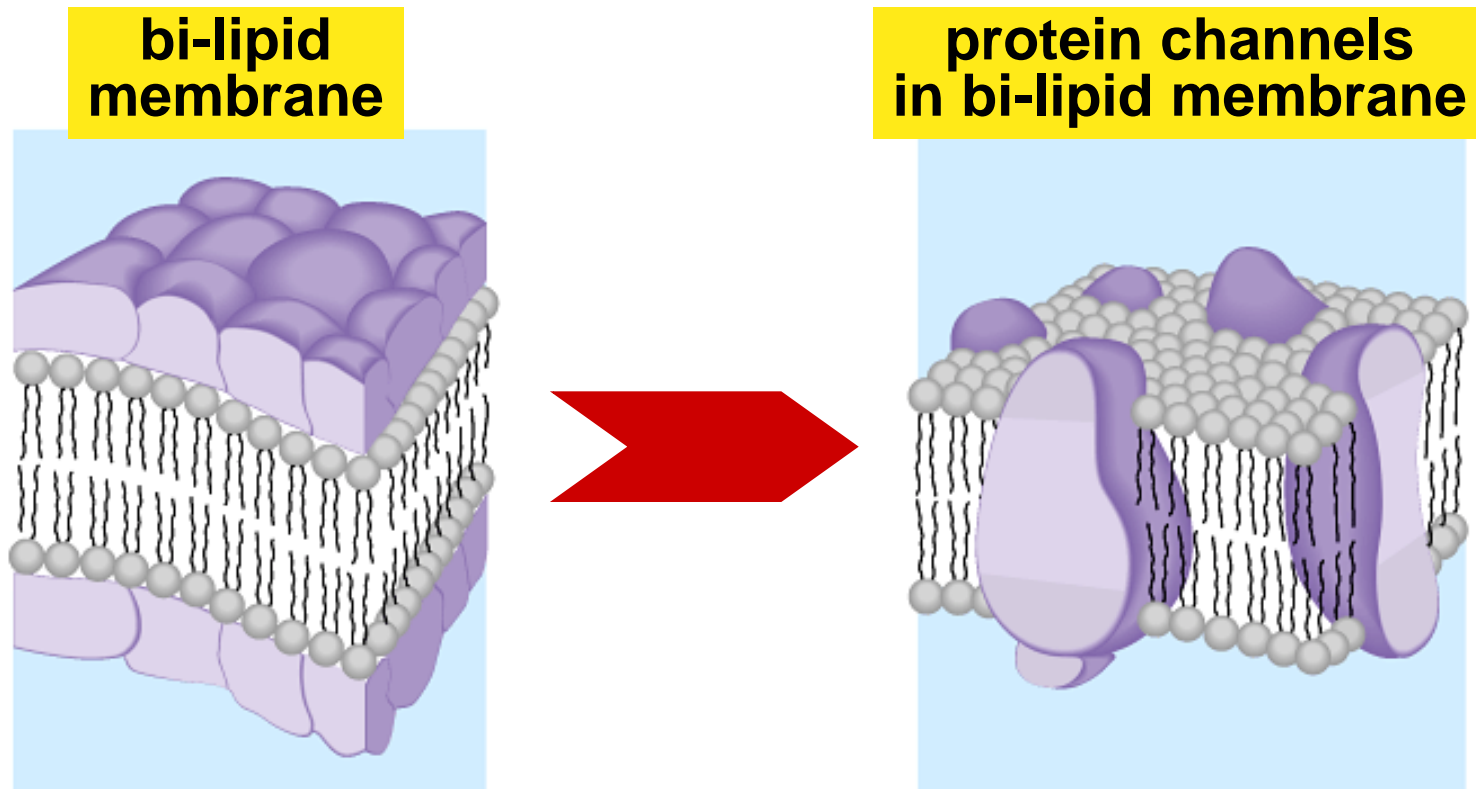
Cell membrane channels

- Need to make “doors” through membrane
 - ◆ protein channels allow substances in & out
 - specific channels allow specific material in & out
 - salt channel, sugar channel, etc.



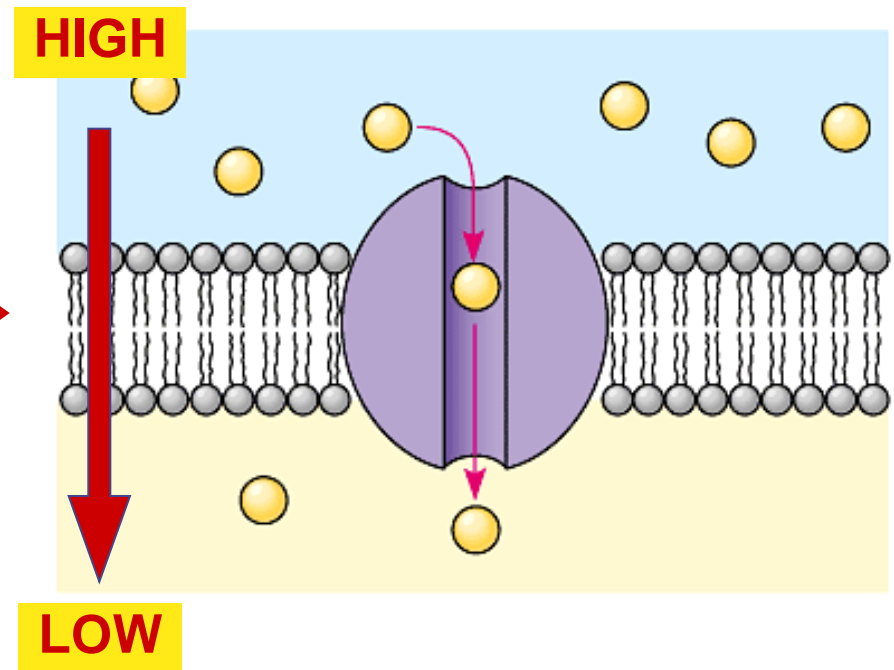
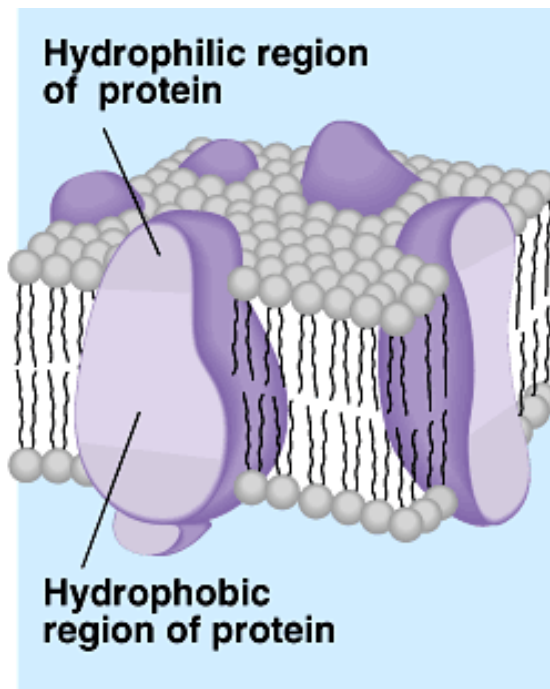
How do you build a semi-permeable cell membrane?

- Channels are made of proteins
 - ◆ proteins both “like” water & “like” lipids



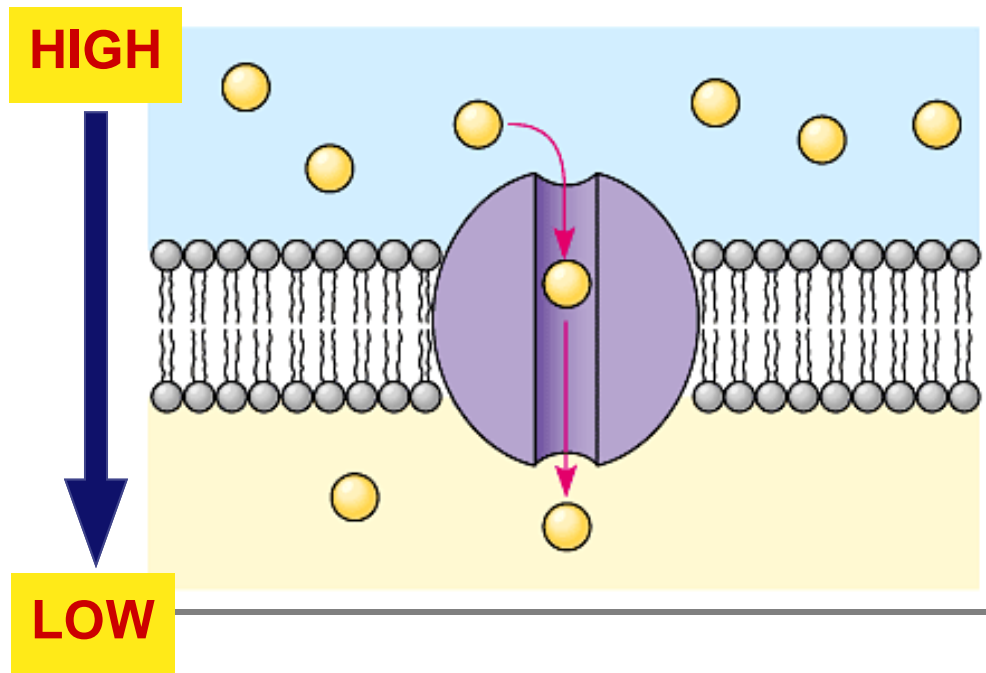
Protein channels

- Proteins act as doors in the membrane
 - ◆ channels to move specific molecules through cell membrane



Movement through the channel

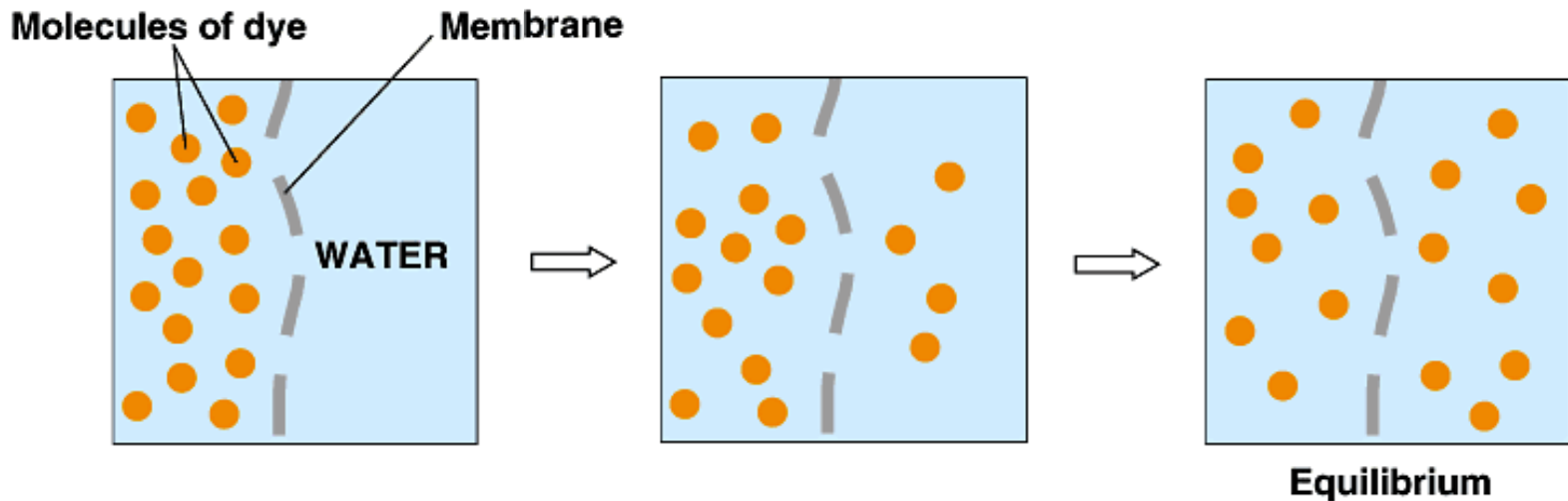
- Why do molecules move through membrane if you give them a channel?



Molecules move from high to low

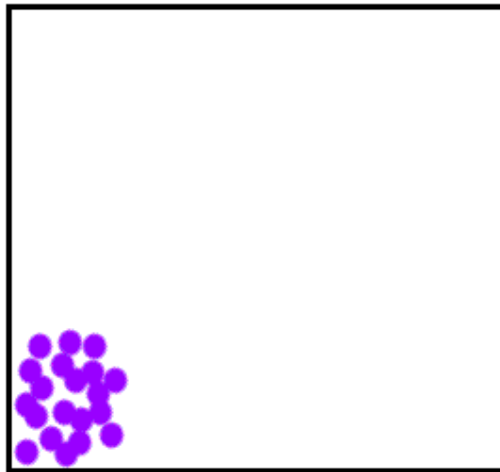
- Diffusion

- ◆ move from HIGH to LOW concentration



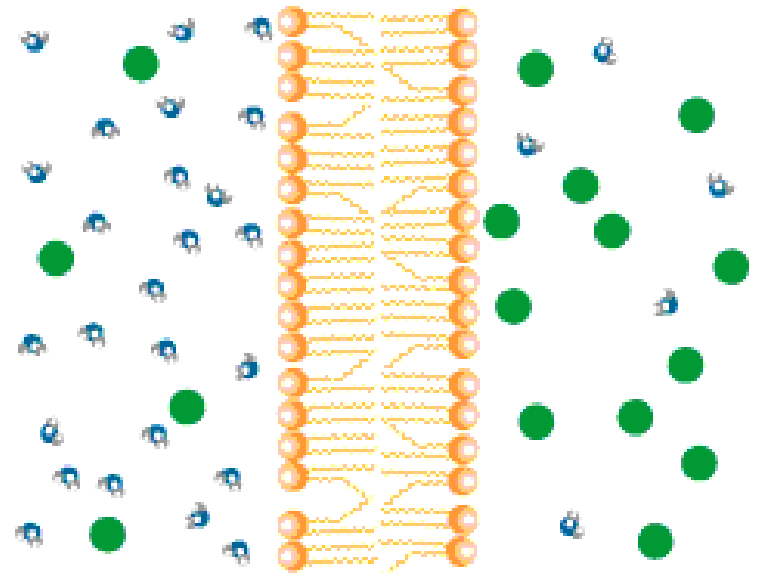
Diffusion

- Move from **HIGH** to **LOW** concentration
 - passive transport
 - no energy needed



diffusion

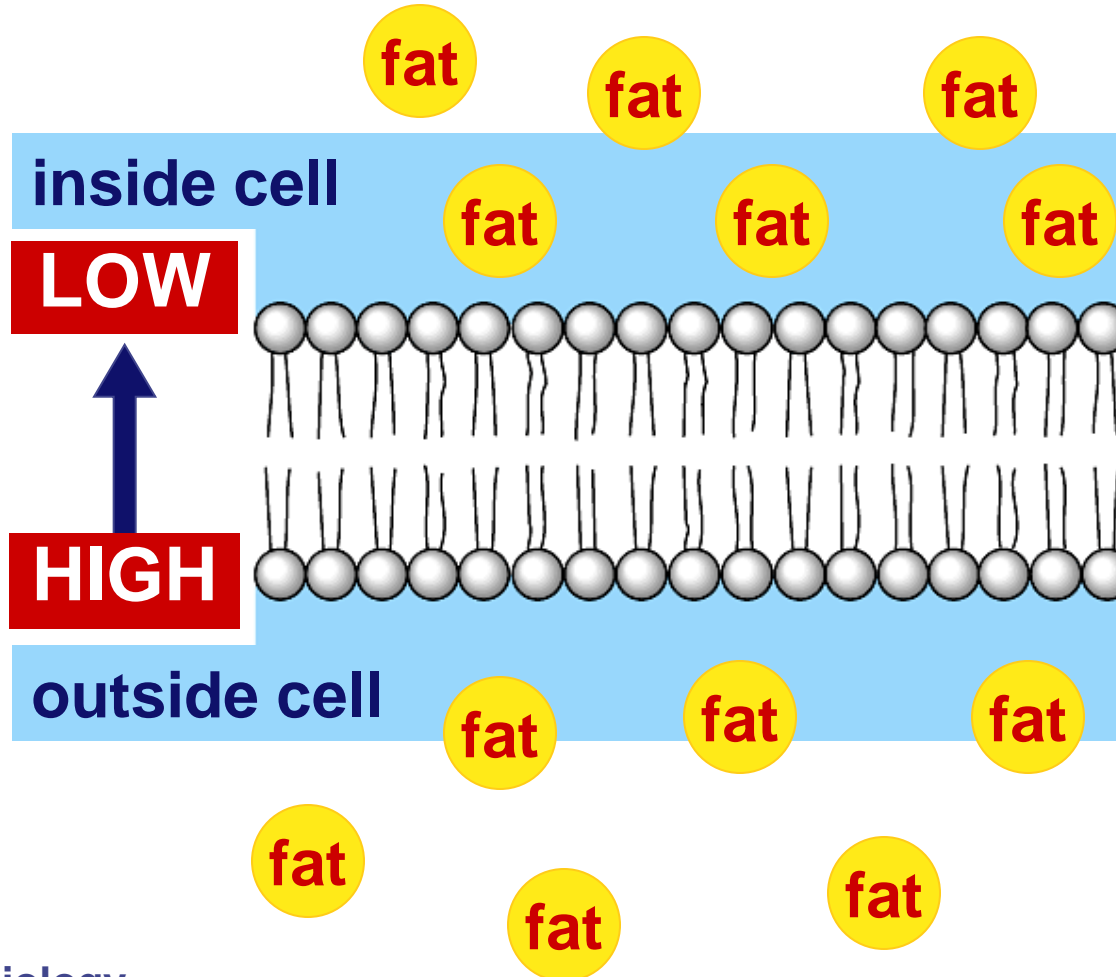
diffusion of water



osmosis

Simple Diffusion

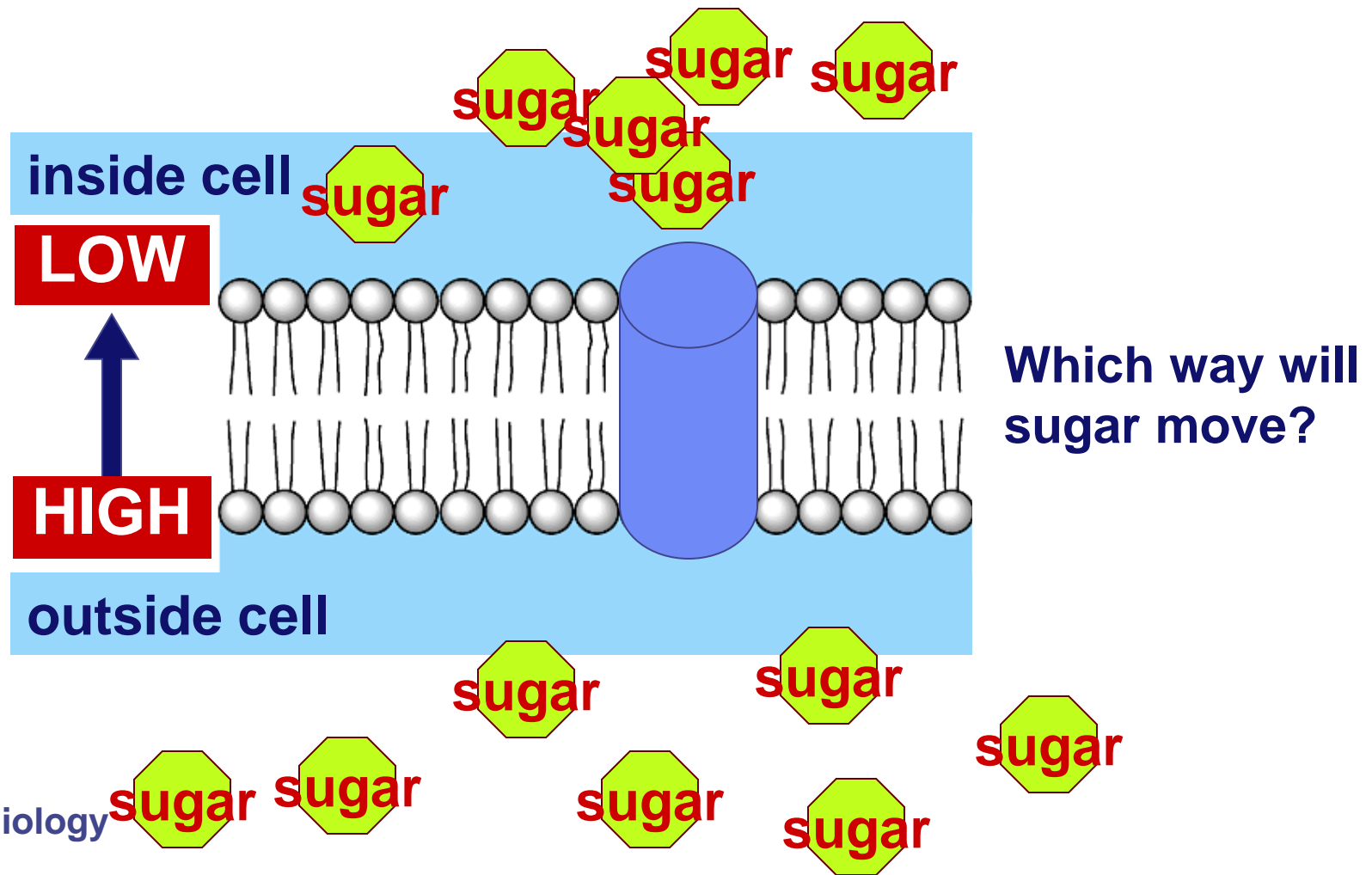
- Move from **HIGH** to **LOW**



Which way
will fat move?

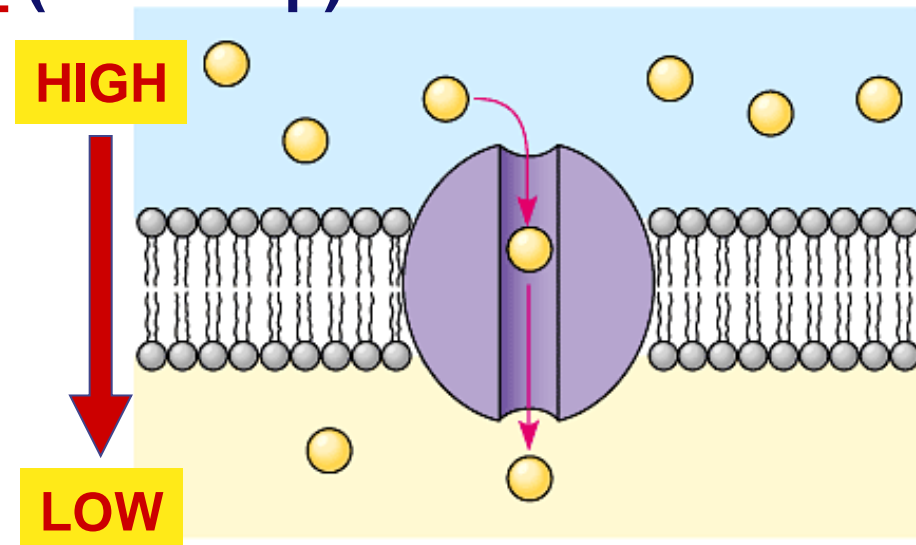
Facilitated Diffusion

- Move from **HIGH** to **LOW** through a channel



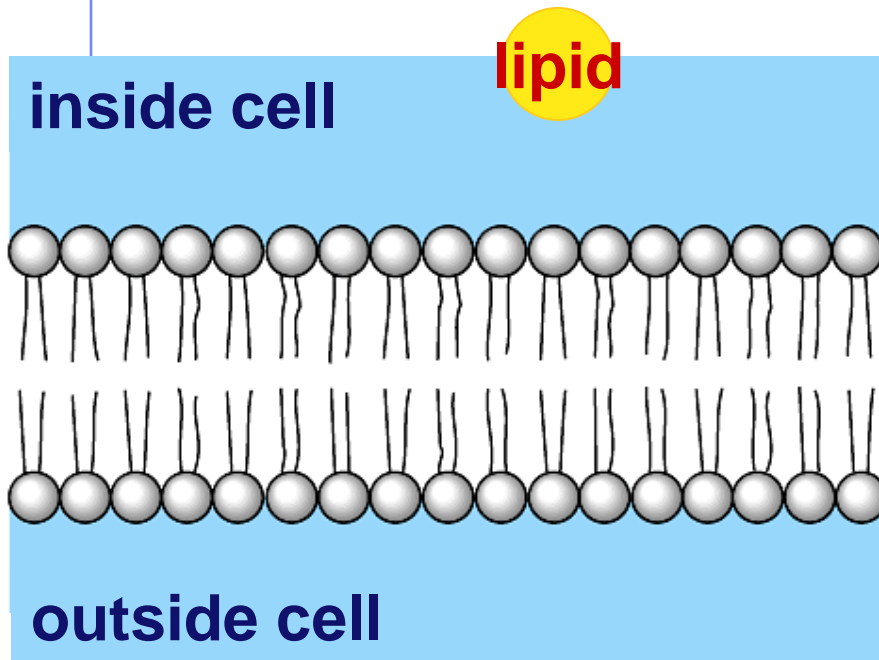
Diffusion

- Move from **HIGH** to **LOW** concentration
 - ◆ directly through membrane
 - simple diffusion
 - no energy needed
 - ◆ help through a protein channel
 - facilitated diffusion (with help)
 - no energy needed

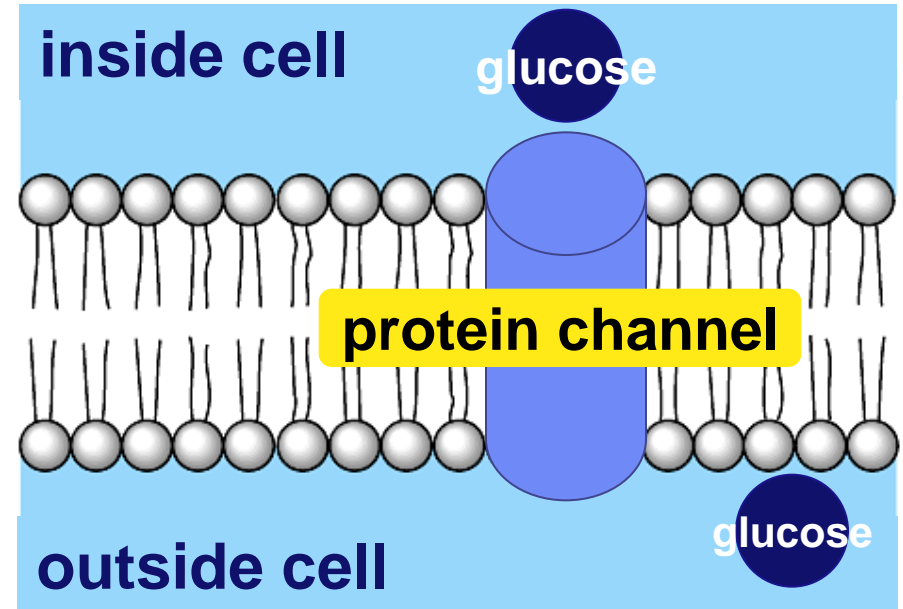


Simple vs. facilitated diffusion

simple diffusion

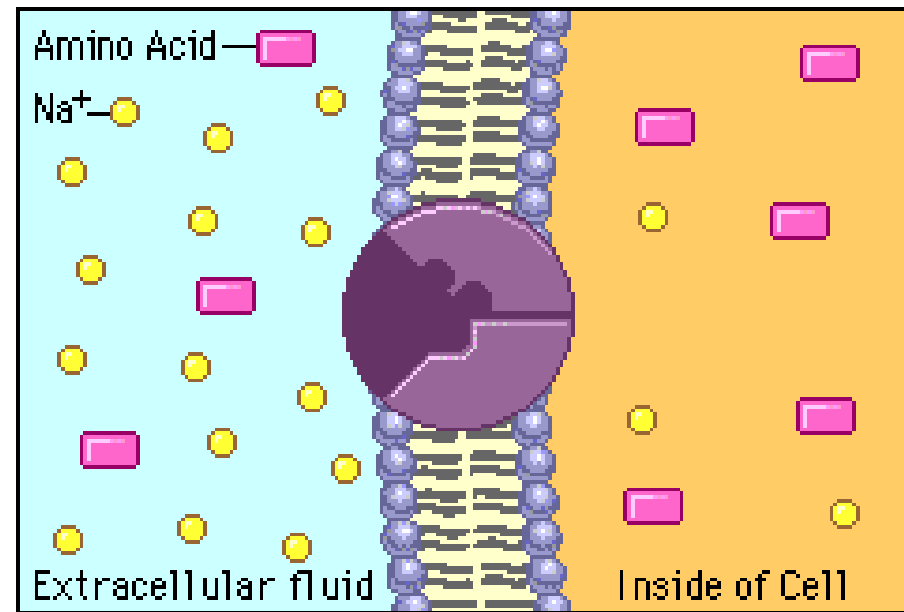


facilitated diffusion

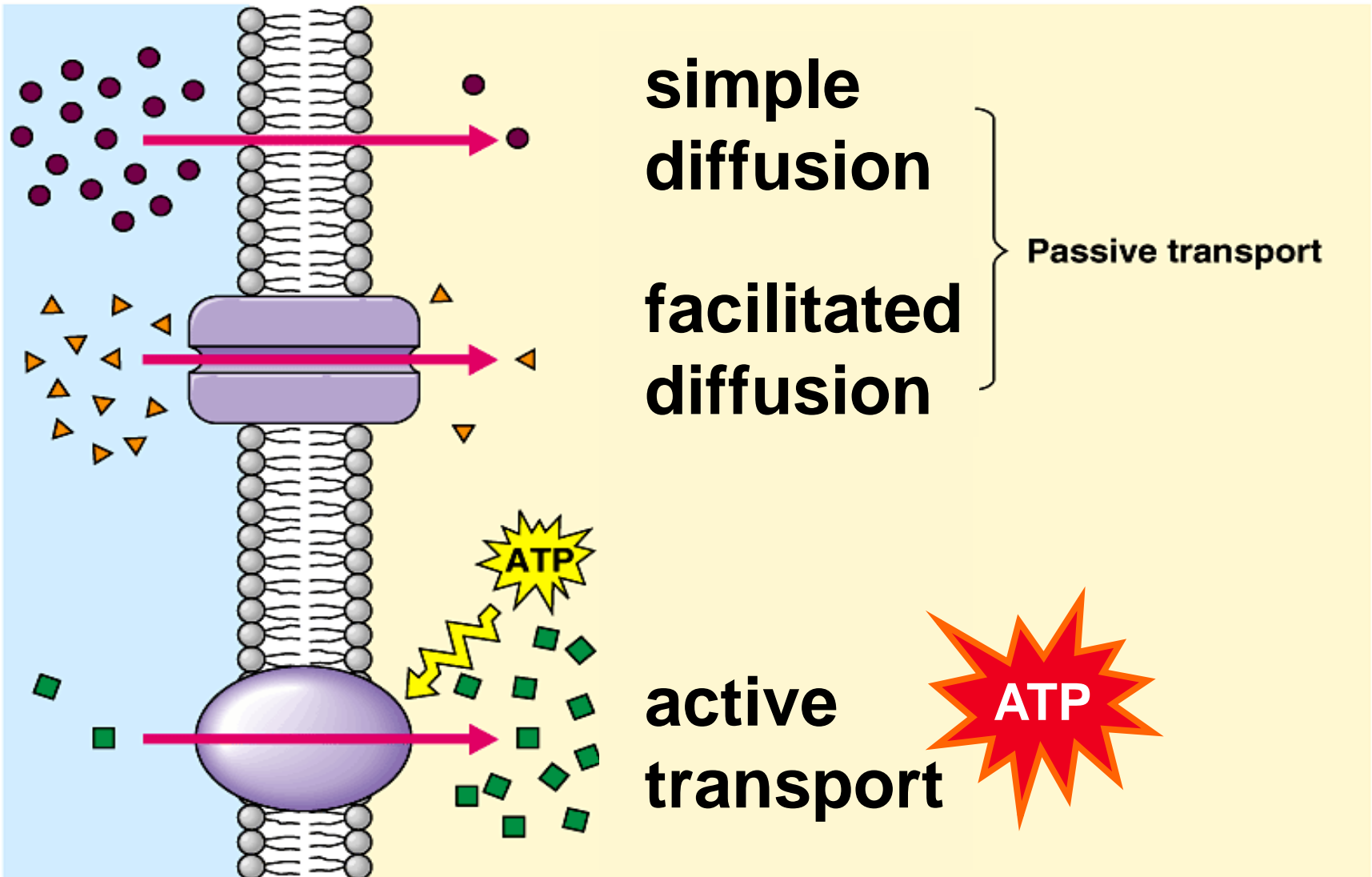


Active transport

- Cells may need molecules to move **against** concentration “hill”
 - ◆ need to pump “uphill”
 - from **LOW** to **HIGH** using energy
 - ◆ **protein pump**
 - ◆ **requires energy**
 - **ATP**

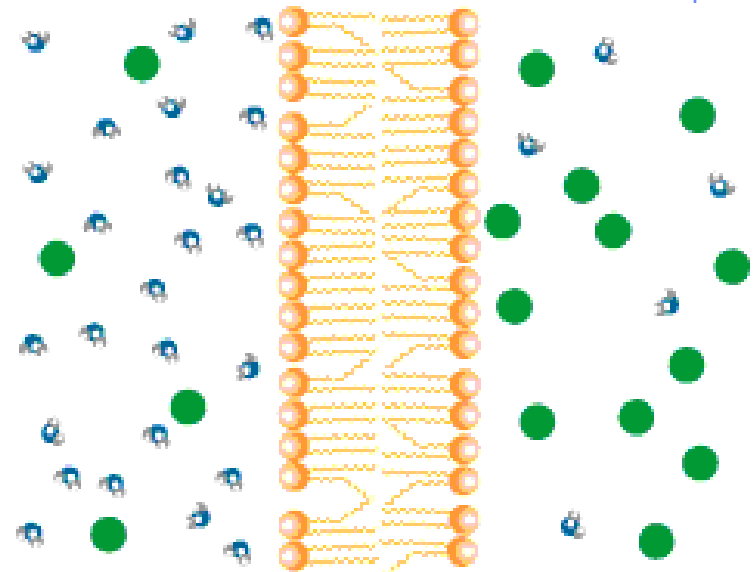
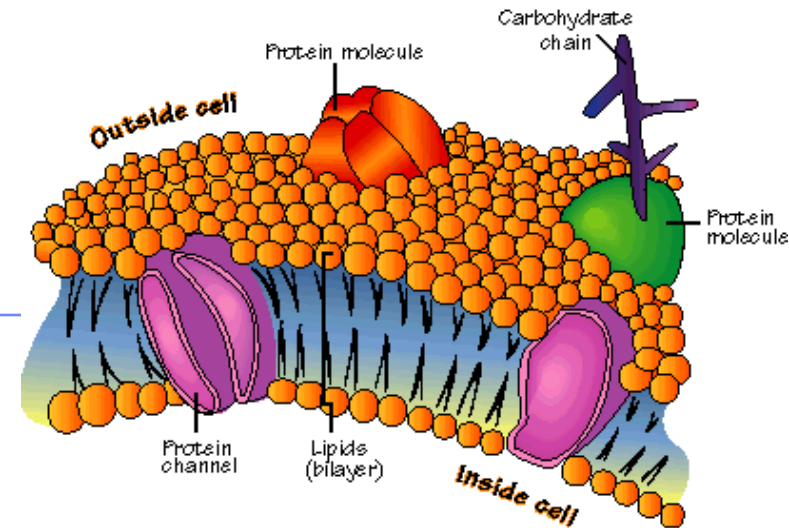


Transport summary



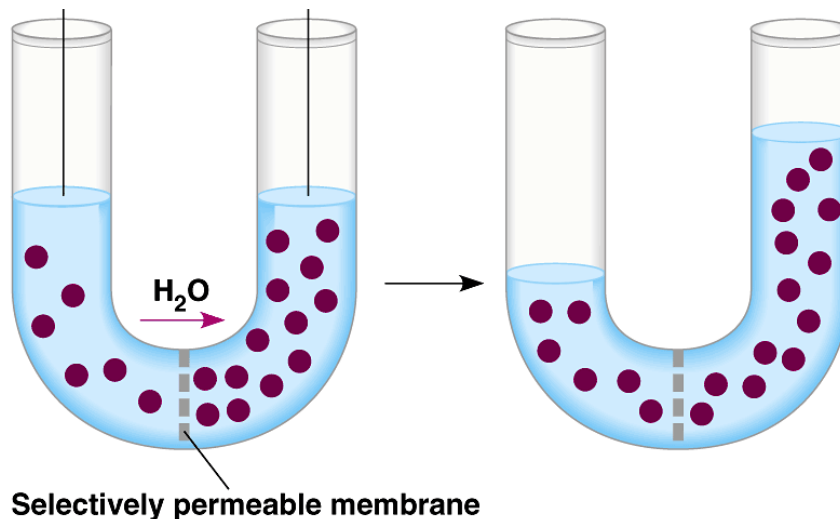
Osmosis

Movement of Water Across Cell Membrane



Osmosis

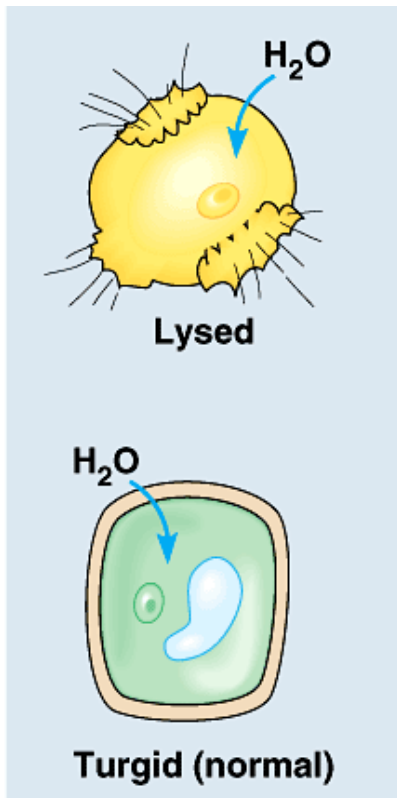
- Water is very important, so we talk about water separately
- **Osmosis**
 - ◆ **diffusion of water from HIGH concentration of water to LOW concentration of water**
 - across a semi-permeable membrane



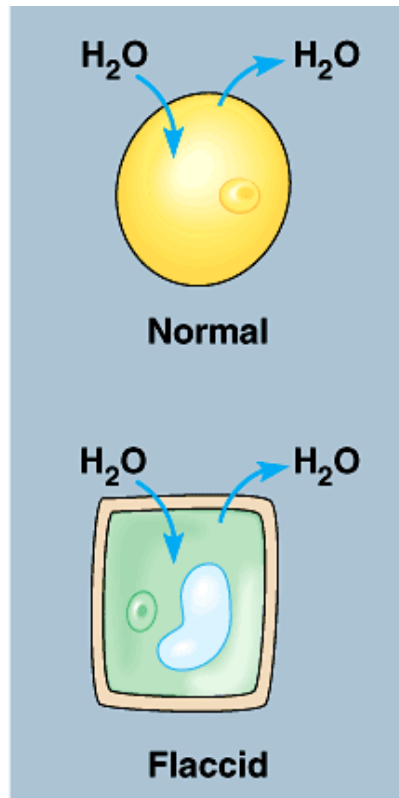
Keeping water balance

- Cell survival depends on balancing water uptake & water loss

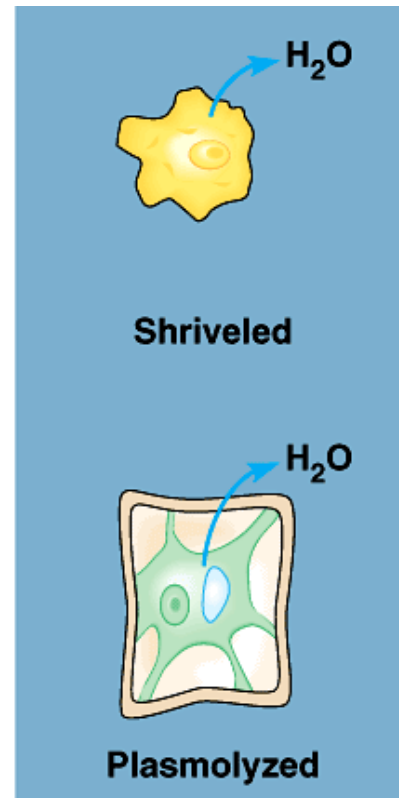
freshwater



balanced



saltwater



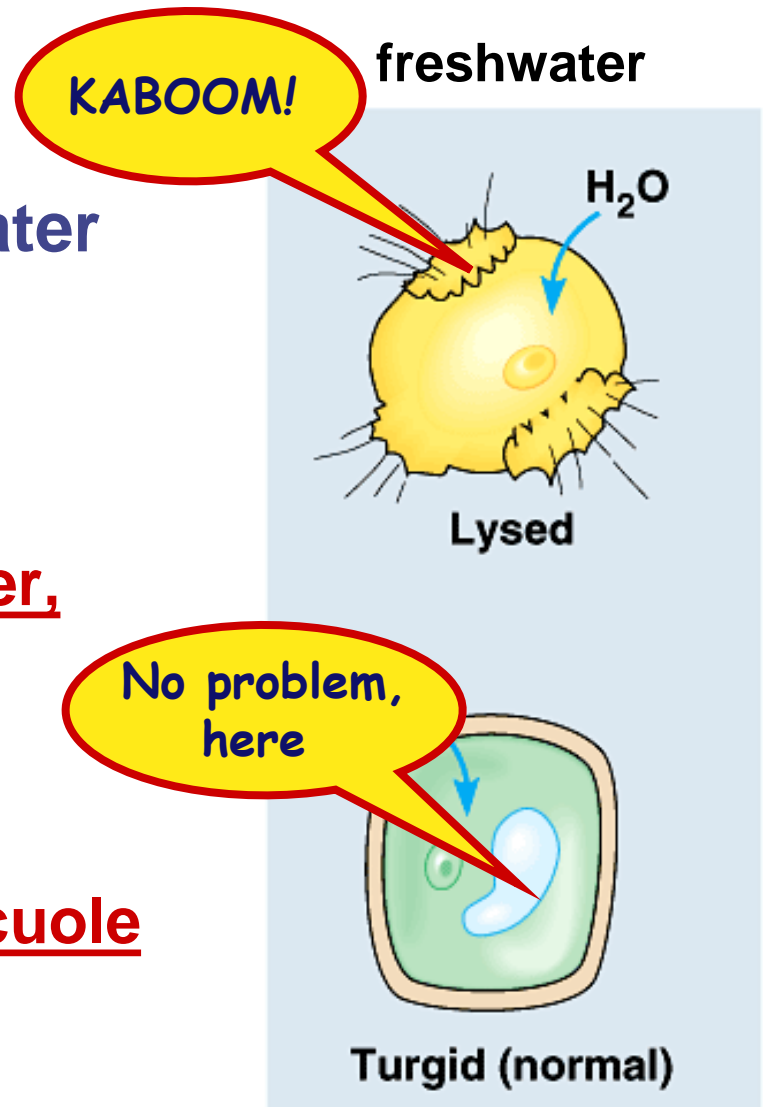
Animal cell

Plant cell

Keeping right amount of water in cell

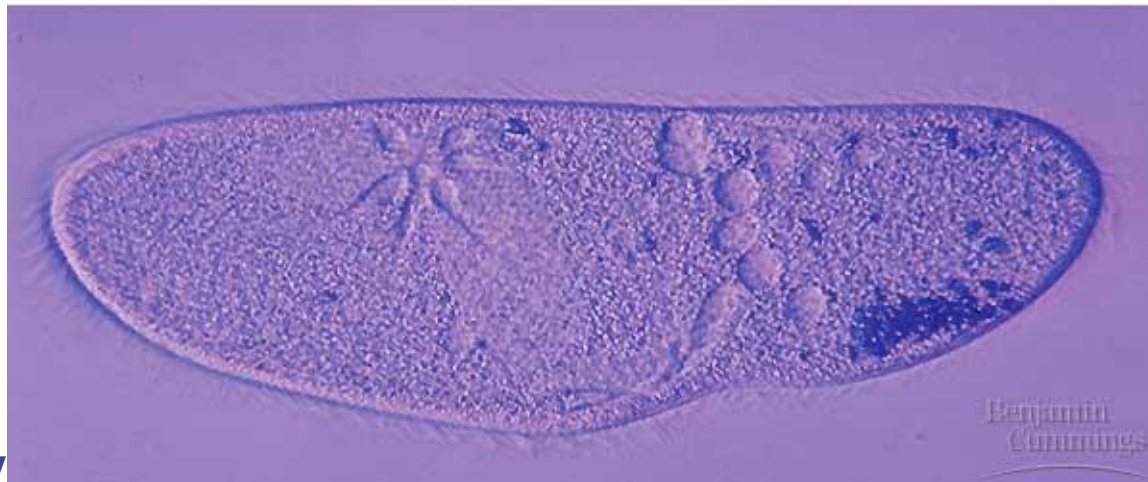
■ Freshwater

- ◆ a cell in fresh water
- ◆ high concentration of water around cell
 - cell gains water
 - example: *Paramecium*
 - problem: cells gain water, swell & can burst
 - ◆ water continually enters *Paramecium* cell
 - solution: *contractile vacuole*
 - ◆ pumps water out of cell



Controlling water

- Contractile vacuole in *Paramecium*



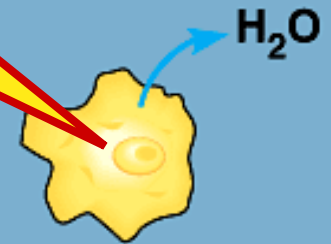
Keeping right amount of water in cell

■ Saltwater

- ◆ a cell in salt water
- ◆ low concentration of water around cell
 - cell loses water
- ◆ example: shellfish
- ◆ problem: cell loses water
 - in plants: plasmolysis
 - in animals: shrinking cell
- ◆ solution: take up water

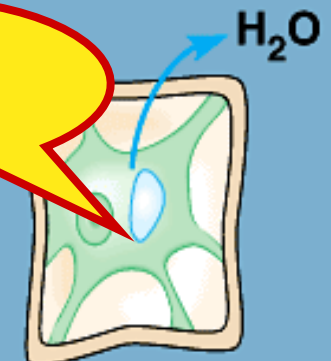
I'm shrinking,
I'm shrinking!

saltwater



Shriveled

I will
survive!



Plasmolyzed

Keeping right amount of water in cell

■ Balanced conditions

- ◆ no difference in concentration of water between cell & environment

- cell in equilibrium

- example: blood

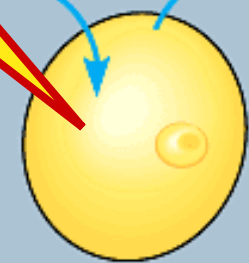
- problem: none

- ◆ water flows across membrane equally, in both directions
- ◆ volume of cell doesn't change

That's better!

balanced

H₂O H₂O



Normal

I could be better...

H₂O



Flaccid