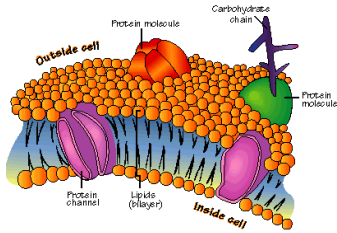
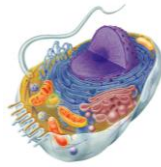


Biology



Cell Transport

Section 7.3

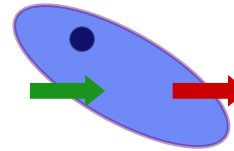


Cell (plasma) membrane

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

IN

- food**
- sugars
 - proteins
 - fats
- others**
- salts
 - O₂
 - H₂O



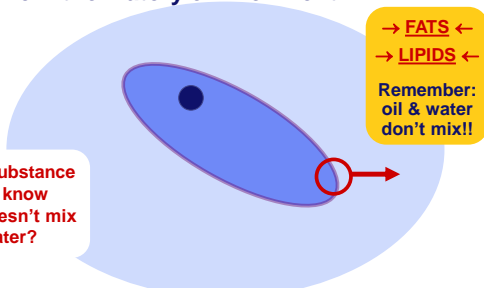
OUT

- waste**
- ammonia
 - salts
 - CO₂
 - H₂O
- products**
- proteins

cell needs materials in & products or waste out

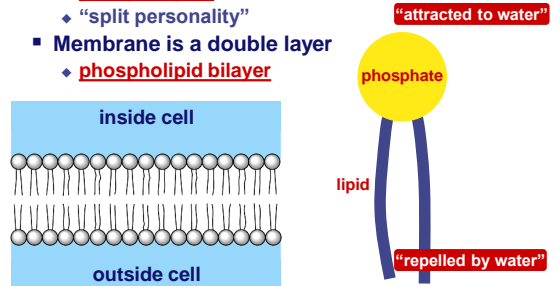
Building a membrane

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



Lipids of cell membrane

- Membrane is made of special kind of lipid
 - phospholipids**
 - "split personality"
- Membrane is a double layer
 - phospholipid bilayer**



Biology

Semi-permeable membrane

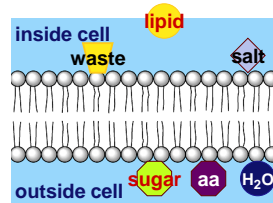
- Cell membrane controls what gets in or out
- Need to allow some materials — but not all — to pass through the membrane
 - semi-permeable
 - only some material can get in or out

So what needs to get across the membrane?



Crossing the cell membrane

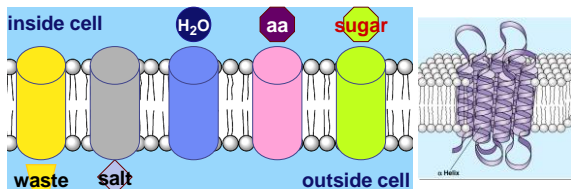
- What molecules can get through the cell membrane directly?
 - fats and oils can pass directly through



but...
what about
other stuff?

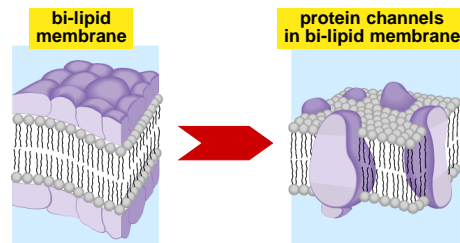
Cell membrane channels

- Need to make “doors” through membrane
 - protein channels allow substances in & out
 - specific channels allow specific material in & out
 - H₂O channel, salt channel, sugar channel, etc.



How do you build a semi-permeable cell membrane?

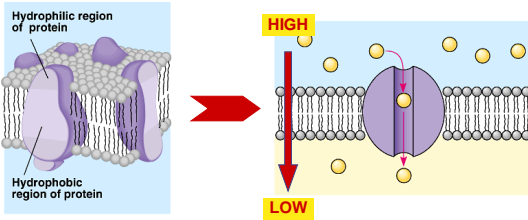
- Channels are made of proteins
 - proteins both “like” water & “like” lipids



Biology

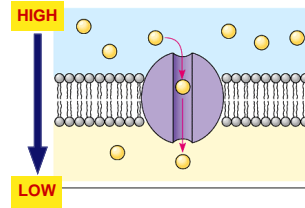
Protein channels

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



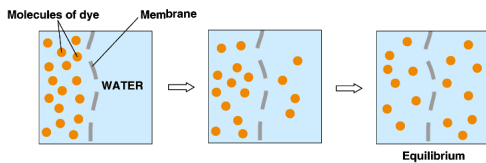
Movement through the channel

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



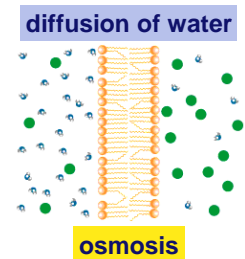
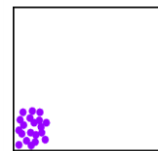
Molecules move from high to low

- Diffusion**
 - move from **HIGH** to **LOW** concentration



Diffusion

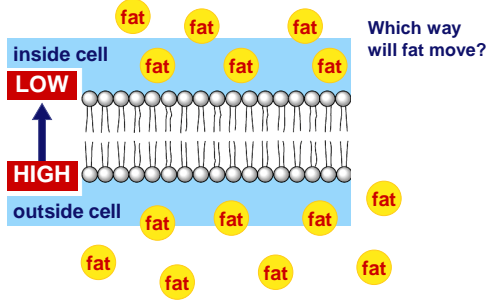
- Move from **HIGH** to **LOW** concentration
 - passive transport**
 - no energy needed**



Biology

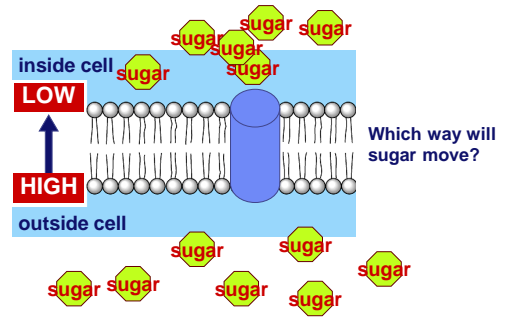
Simple Diffusion

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



Facilitated Diffusion

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



Diffusion

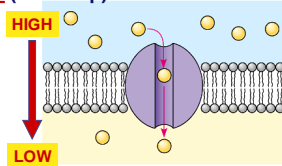
- Move from **HIGH** to **LOW** concentration

- directly through membrane

- simple diffusion
- no energy needed

- help through a protein channel

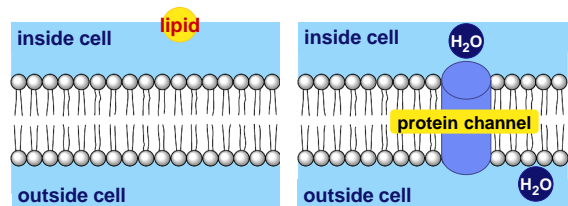
- facilitated diffusion (with help)
- no energy needed



Simple vs. facilitated diffusion

simple diffusion

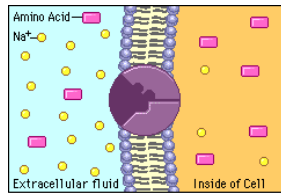
facilitated diffusion



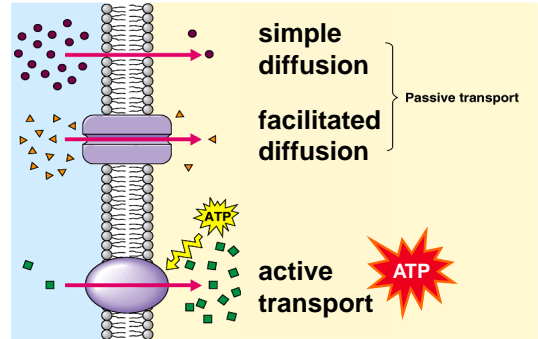
Biology

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**

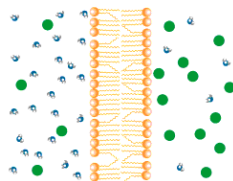
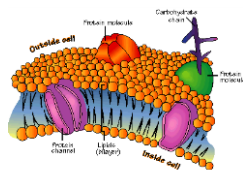


Transport summary



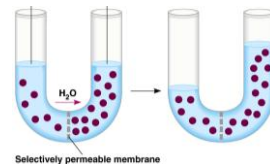
Osmosis

Movement of Water Across Cell Membrane



Osmosis

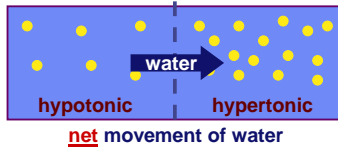
- Water is very important, so we talk about water separately
- **Osmosis**
 - ◆ **diffusion of water from HIGH concentration of water to LOW concentration of water**
 - across a semi-permeable membrane



Biology

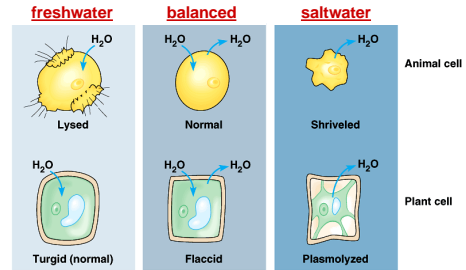
Concentration of water

- Direction of osmosis is determined by comparing total solute concentrations
 - Hypertonic** - more solute, less water
 - Hypotonic** - less solute, more water
 - Isotonic** - equal solute, equal water



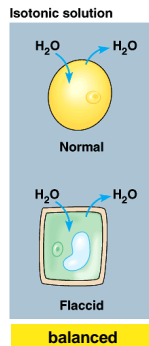
Keeping water balance

- Cell survival depends on balancing water uptake & water loss



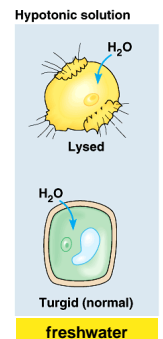
Managing water balance

- Isotonic**
 - animal cell immersed in **mild salt** solution
 - example:** blood cells in blood plasma
 - problem:** none
 - no net movement** of water
 - flows across membrane equally, in both directions
 - volume of cell is stable



Managing water balance

- Hypotonic**
 - a cell in **fresh water**
 - example:** Paramecium
 - problem:** **gains water, swells & can burst**
 - water continually enters *Paramecium* cell
 - solution:** contractile vacuole
 - pumps water out of cell
 - ATP
 - plant cells**
 - turgid



Controlling water

- Contractile vacuole in *Paramecium*



Managing water balance

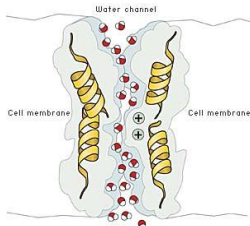
- Hypertonic**
 - a cell in **salt water**
 - example:** shellfish
 - problem:** lose water & die
 - solution:** take up water or pump out salt
 - plant cells**
 - plasmolysis** = wilt



Aquaporins

1991 | 2003

- Water moves rapidly into & out of cells
 - evidence that there were water channels



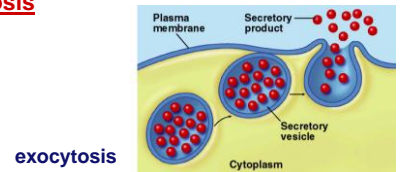
Peter Agre
John Hopkins



Roderick MacKinnon
Rockefeller

How about large molecules?

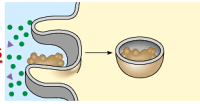
- Moving large molecules into & out of cell
 - through vesicles & vacuoles
 - endocytosis**
 - phagocytosis** = “cellular eating”
 - pinocytosis** = “cellular drinking”
 - exocytosis**



Biology

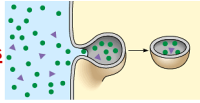
Endocytosis

phagocytosis



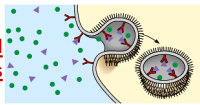
fuse with lysosome for digestion

pinocytosis



non-specific process

receptor-mediated endocytosis



triggered by molecular signal

Ice Fishing in Barrow

[Video](#)

Regents Biology