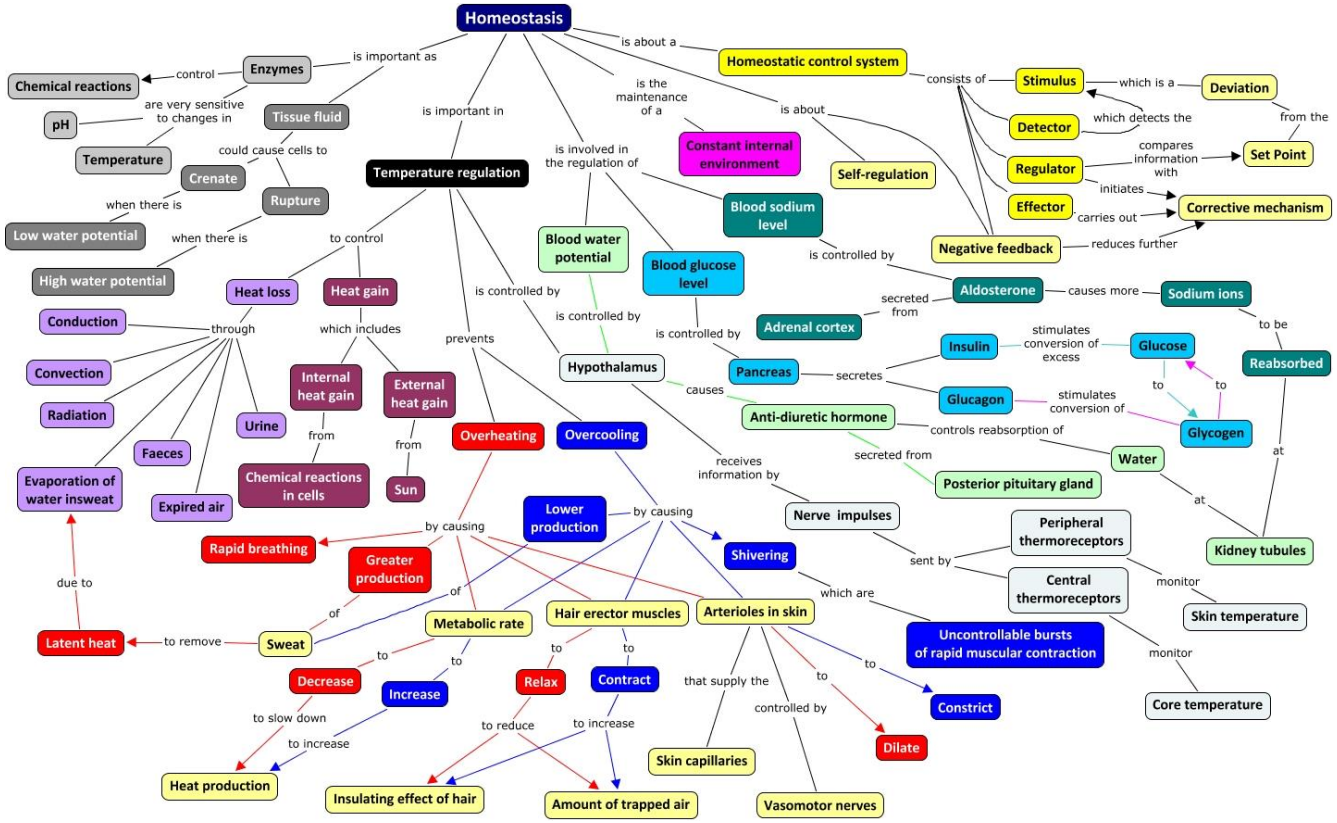
Transport in Cells

Organisms and Ecosystems

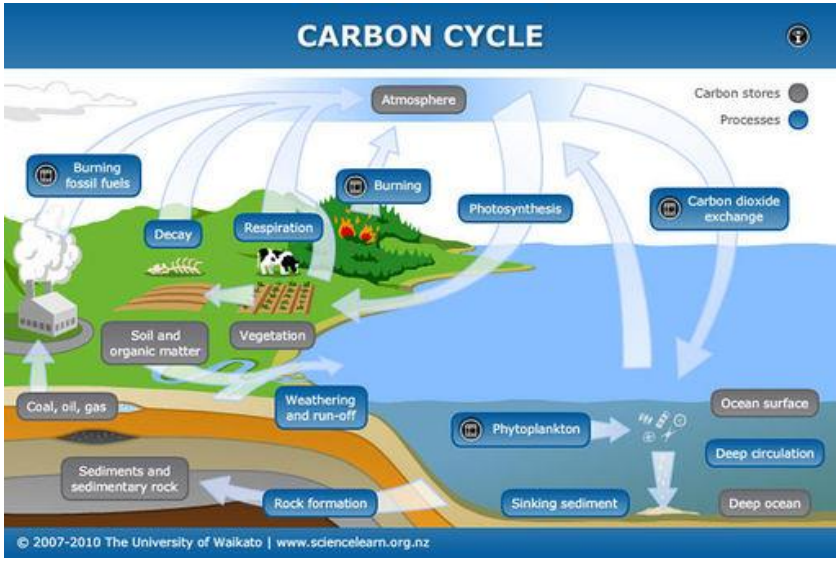

The Basics

Homeostasis allows organisms to regulate their body chemistry, water concentration and body temperature



Amoeba Sisters: Homeostasis and Negative Feedback

Cycles move material through a system without actually losing that material

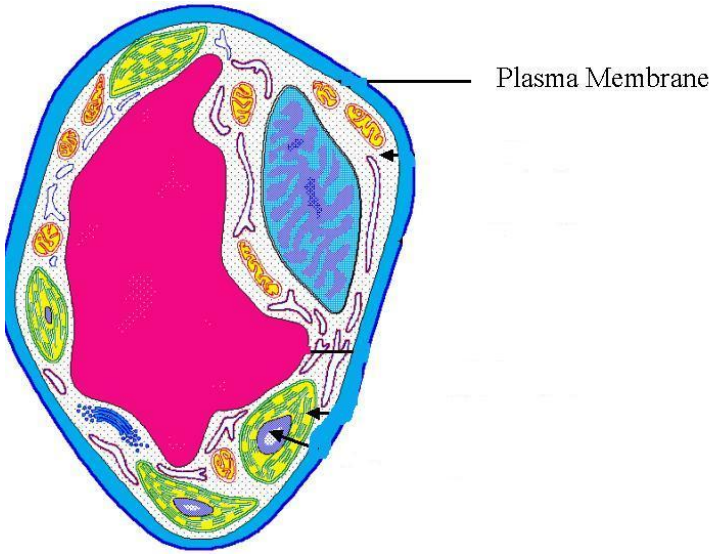


Systems are groups of things that work together to complete a function

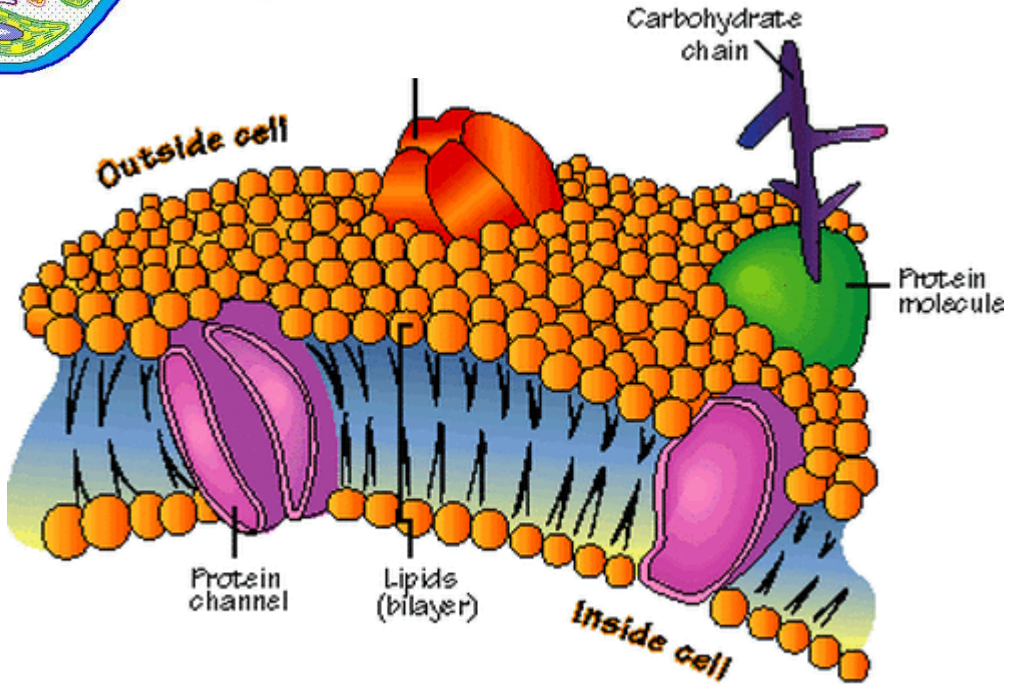
Movement of materials allows for different structures and functions in different parts of a cell, organism, and ecosystem


cells

The Cell (aka Plasma) Membrane

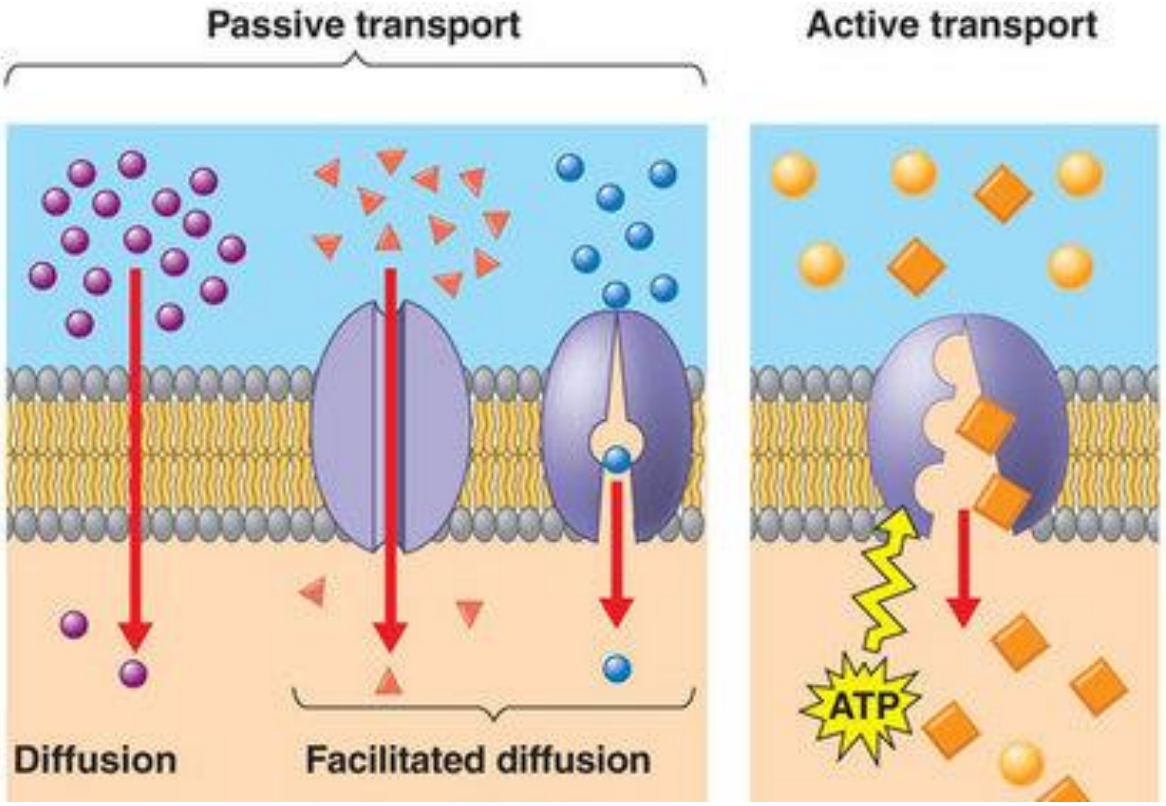


- Boundary between cell and environment
- Controls what enters and leaves the cell
- Phospholipid Bilayer
  - Lipid Outside
  - Phosphate Inside



Amoeba Sisters:
Cellular Transport

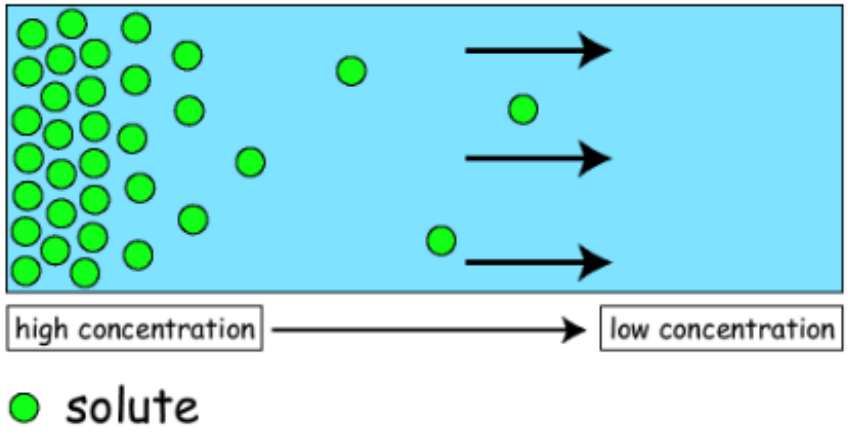
Passive and Active Transport



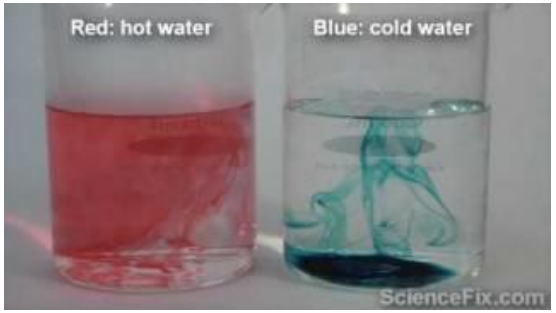
- No energy required
- Material moves with/down the concentration gradient

- Energy required
- Material moves up/against the concentration gradient
- Material is too large to pass through plasma membrane

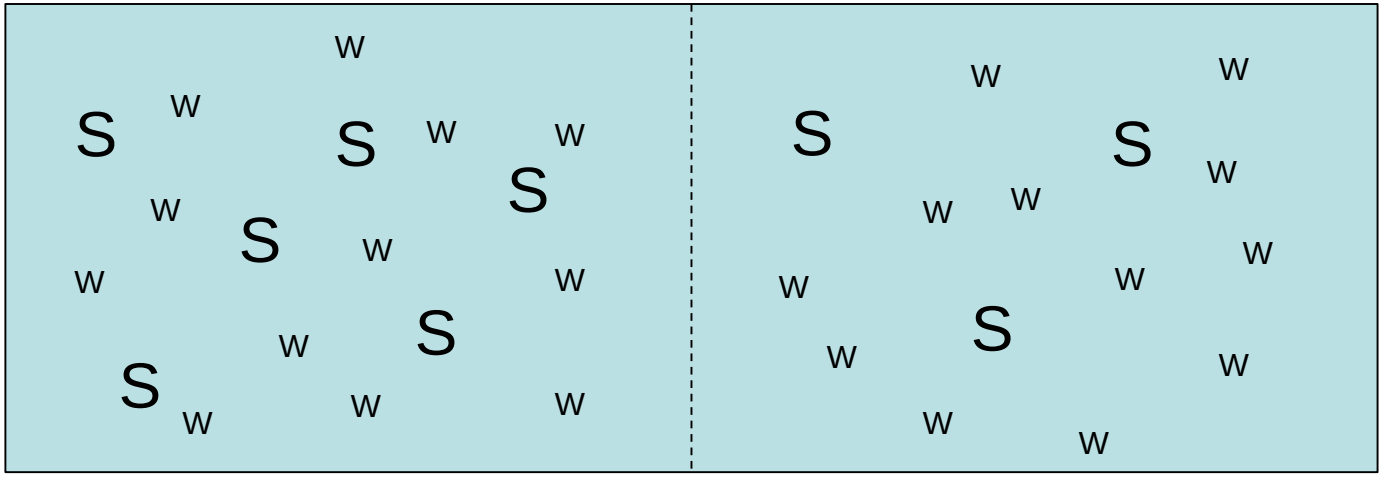
Diffusion and Osmosis



Diffusion is the movement of particles from high to low concentration



Osmosis – Diffusion of water across the cell membrane

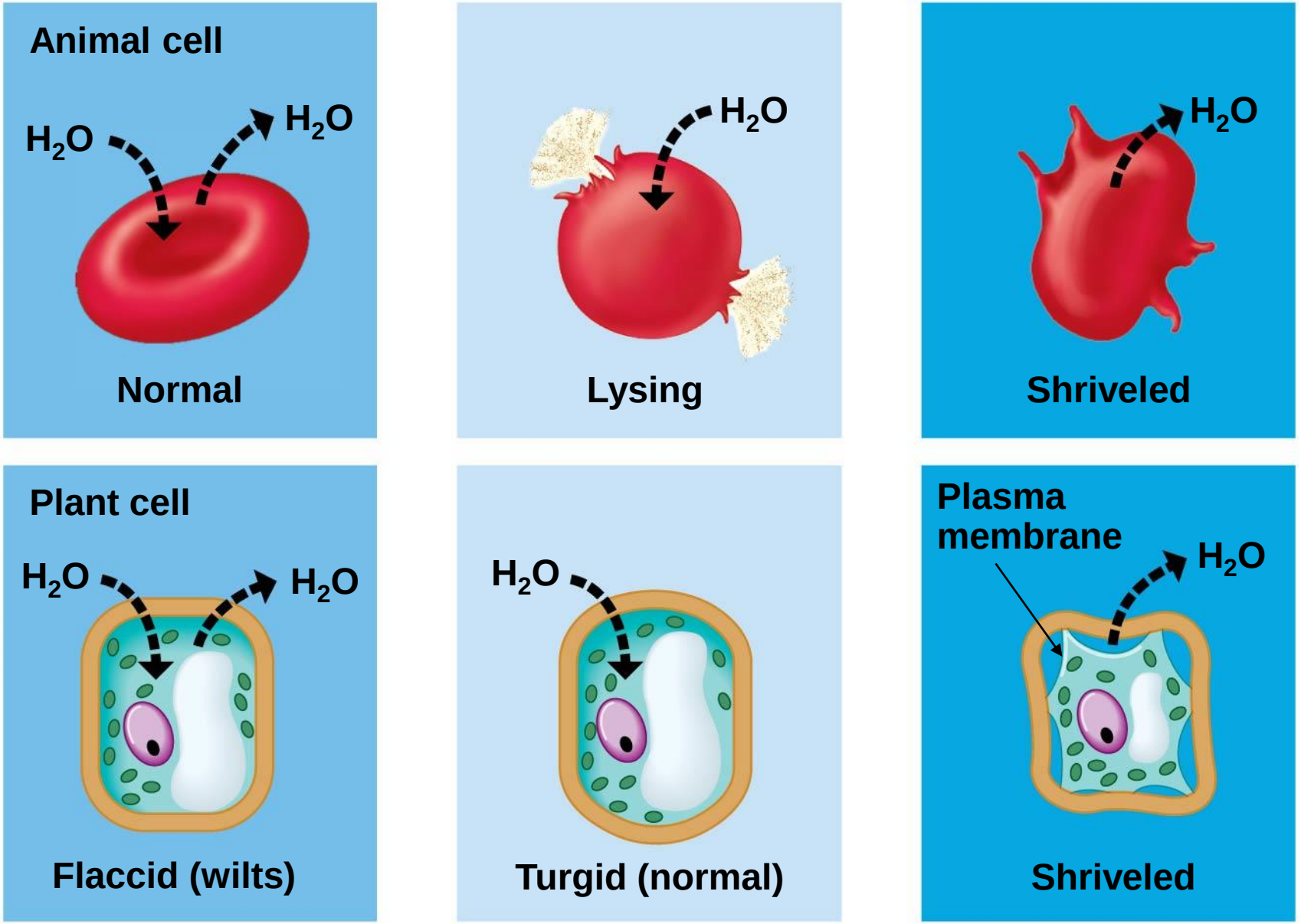


Isotonic – Equilibrium reached

Hypertonic – Less water, more solute

Hypotonic – More water, less solute

Figure 5.14



(a) Isotonic solution

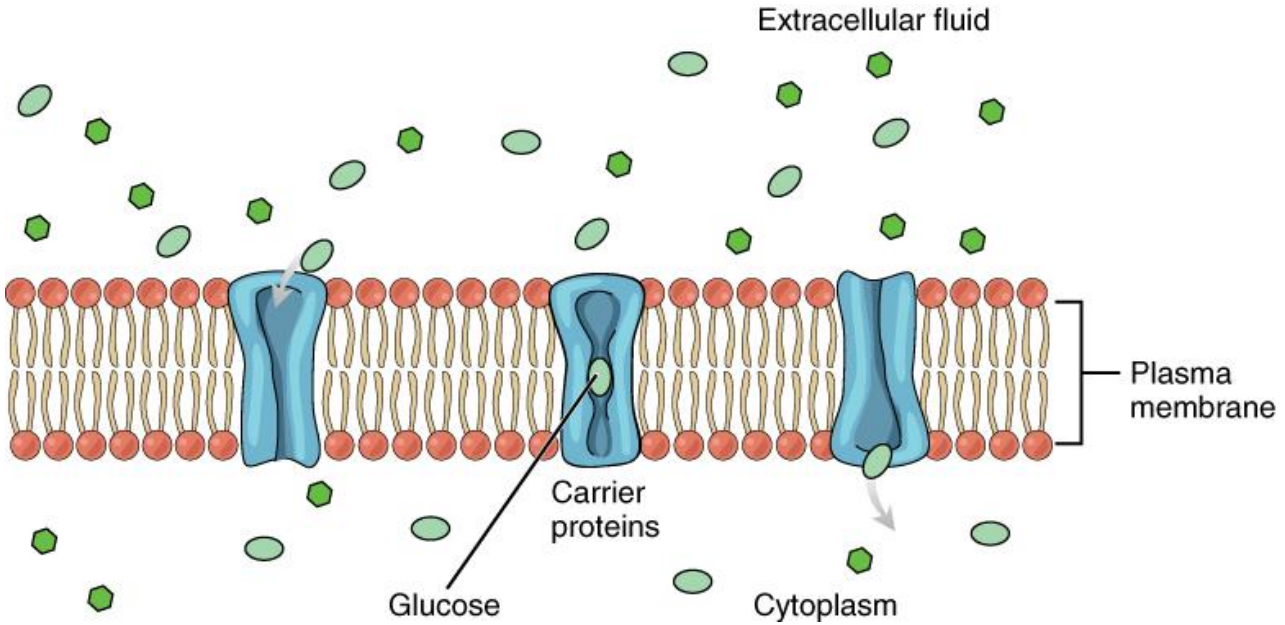
(b) Hypotonic solution

(c) Hypertonic solution

Facilitated Diffusion

Diffusion of large molecules through carrier proteins

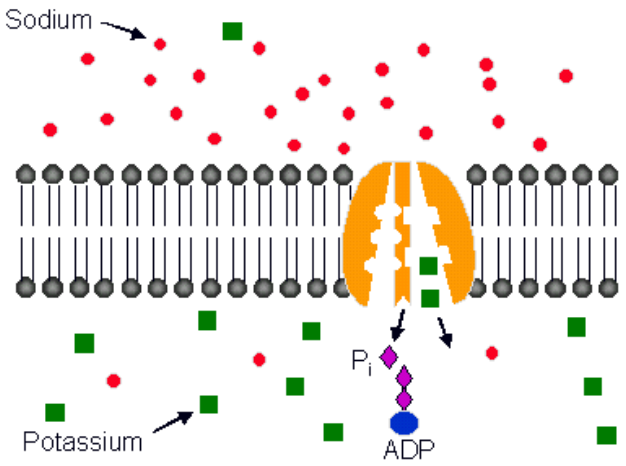
- Openings in the plasma membrane
- Molecules too large to pass through the plasma membrane (i.e. sugar)
- Carrier proteins are specific to material

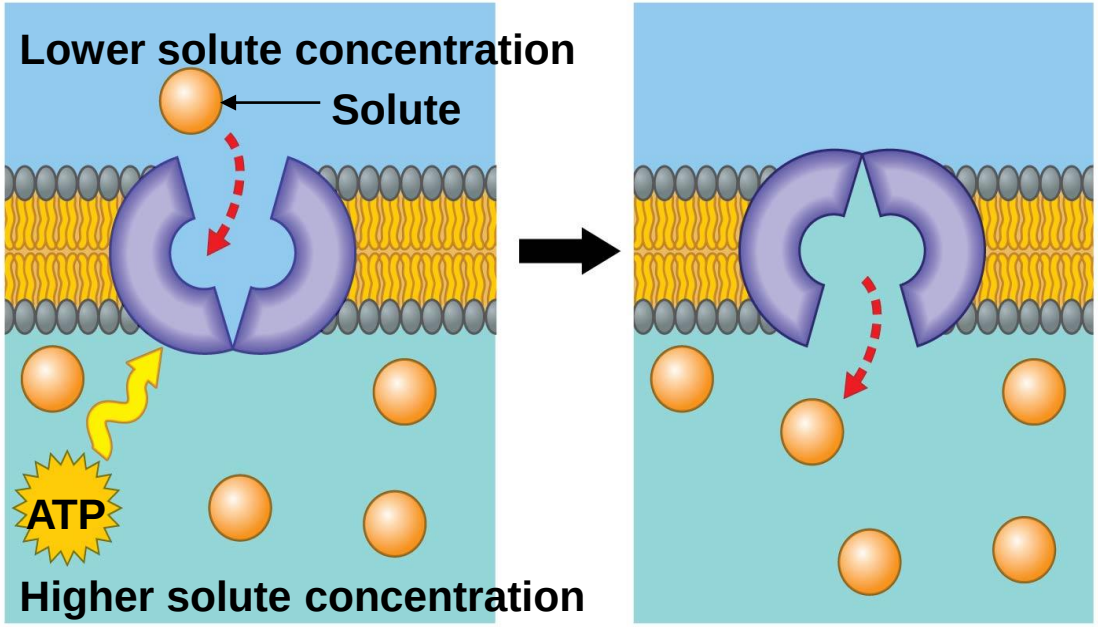


Molecular Pump

Pumps material across the plasma membrane

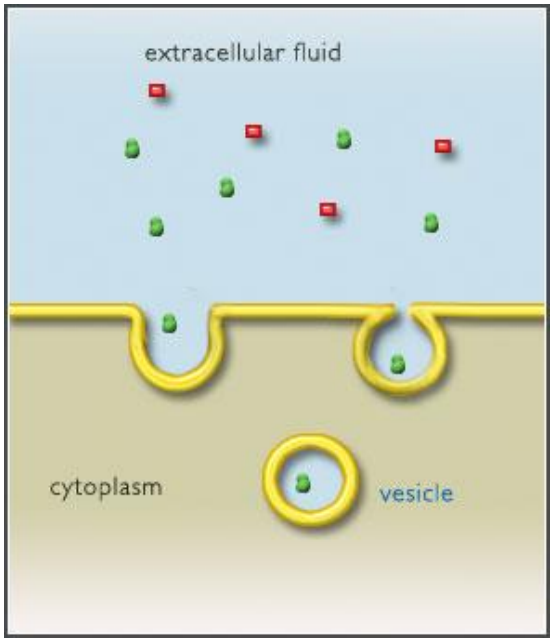
- Moves material “up” the concentration gradient
- Moves material through specific carrier proteins
- Requires energy to “pump”





Endo- & Exo- cytosis

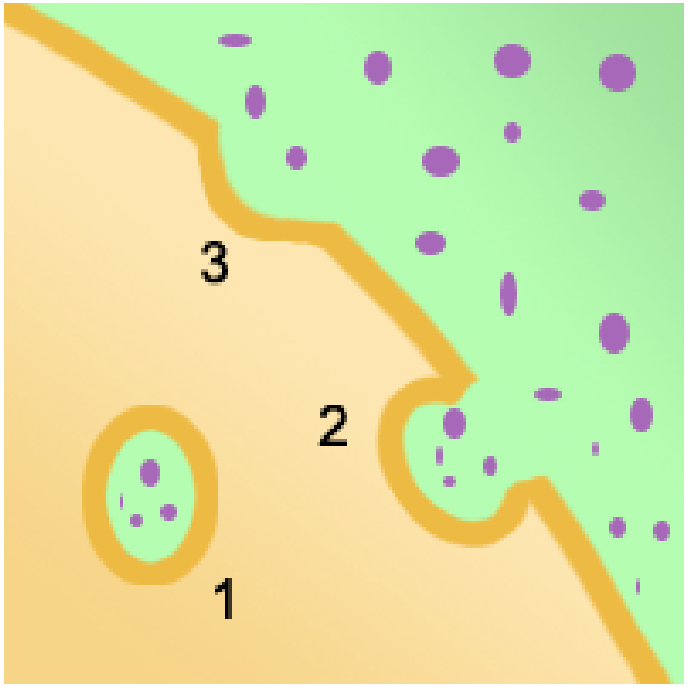
Endocytosis - material enters cell via transport vesicles



http://www.psc.edu/science/2007/bardomain/images/endocytosis.jpg

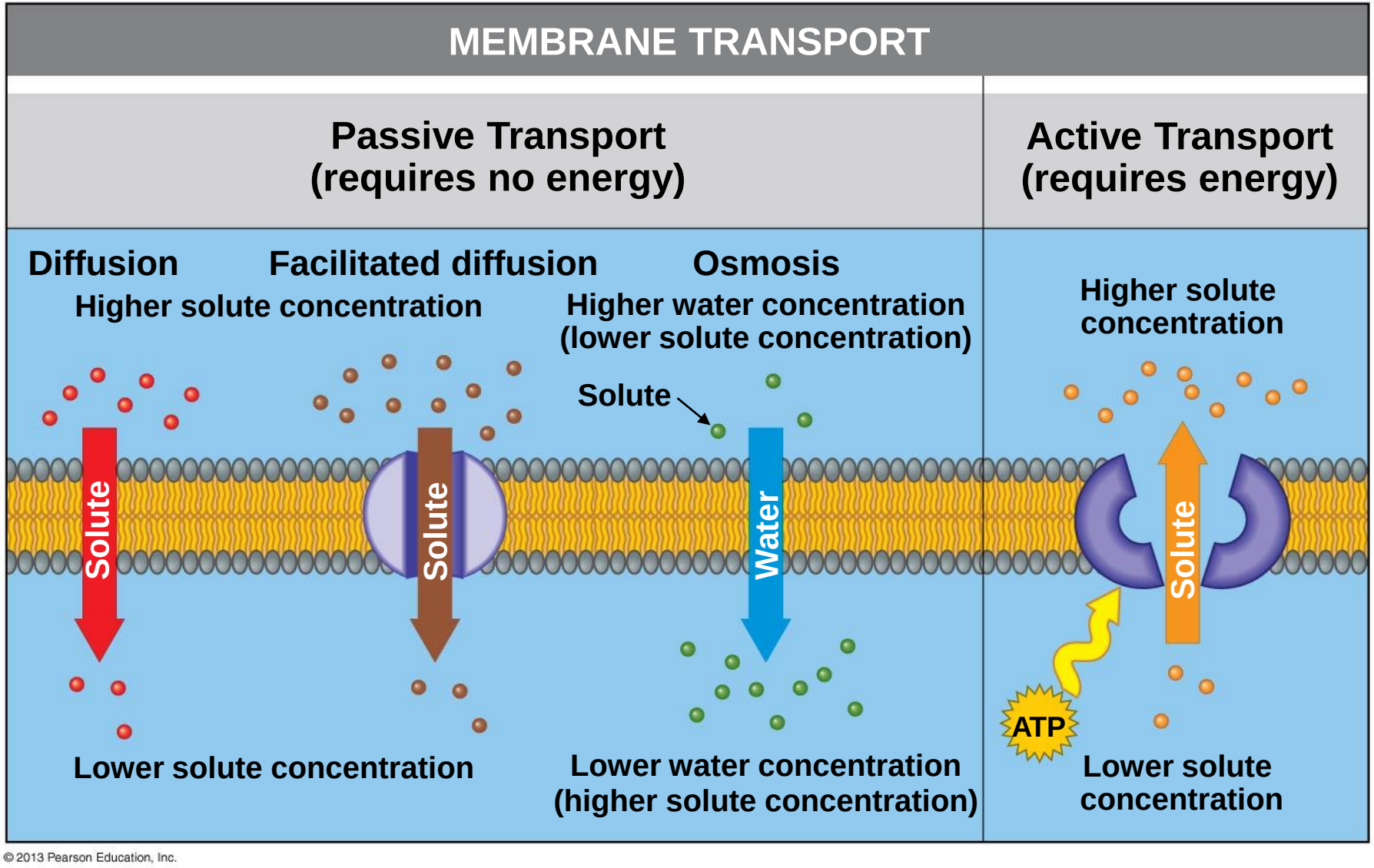
Movement of very large molecules

Exocytosis - material exits cell via transport vesicles



http://www.college-cram.com/study/biology/files/-1/113/exocytosis.gif

Figure 5.UN03



Homework

DUE Monday December 9

Osmosis Is Serious Business!

Troy R. Nash
Department of Biology
Presbyterian College, Clinton, SC

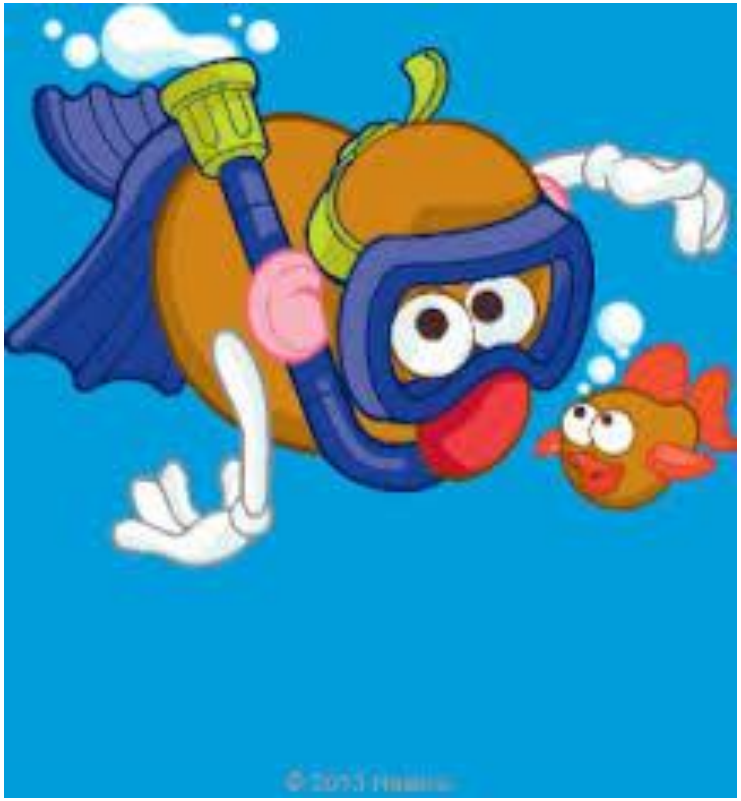
Part I—Too Much of a Good Thing

Times were difficult in Habersham County. The skyrocketing prices of fuel and food were threatening to bankrupt the Johnson family's small farm, which was no match for the multi-million-dollar mega-farms that had been popping up all over the southeast. Joseph, the family patriarch, was especially troubled by the farm's financial circumstances. He knew that this year's corn crop was his best chance to save the farm, and his distress was evident to his family as they sat around the dinner table.

"Michael, I'm going to need your help tomorrow," Joseph said to his eldest son. "I have to go into town to pick up a part for the combine so I can fix it before it's time to harvest in a few months. I need you to spread the potash and phosphate on the corn because we're expecting some rain by the end of the week."

Michael, his mouth full of fried chicken, nodded in agreement. He wasn't all that interested in farming, which over the years had been a point of contention between him and his father. At the moment Michael

Lab



Lab Instructions & Questions

Instructions

1. Record the mass of a piece of apple
2. Place the apple in the salt water (red)
3. Record the mass of a second piece of apple
4. Place the apple in the fresh water (blue)
5. Allow to sit
6. When instructed, pat dry and record the new masses of the apple pieces

Apple	Initial Mass	Final Mass
Freshwater (Blue)		
Saltwater (Red)		

Questions

1. Which solution is “saltiest”
2. Which solution is “wateriest”
3. Did the mass of the apple increase, decrease, or stay the same in the freshwater?
4. Did the mas of the apple increase, decrease, or stay the same in the saltwater?
5. Is the freshwater hypertonic, hypotonic, or isotonic compared to the apple?
6. Is the saltwater hypertonic, hypotonic, or isotonic compared to the apple?


organism

Thermoregulation

Organisms maintain a specific body temperature

- Optimum body temperature for the chemical reactions and biological processes that allow the organism to survive

Two ways that chordates maintain body temperature

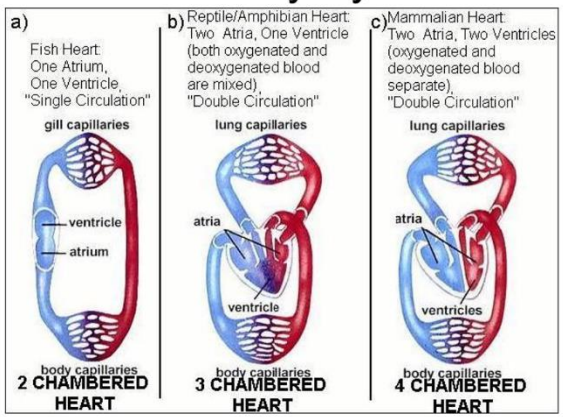
- Endothermic – aka warm blooded, metabolism makes excess energy
- Ectothermic – aka cold blooded, metabolism is supplemented with energy from environment

Maintaining the body temperature

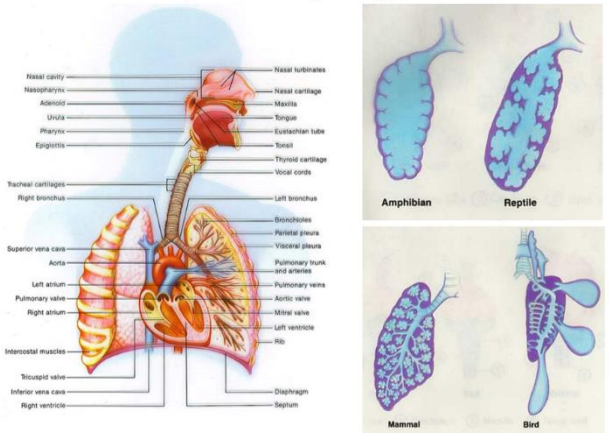
Thermoregulation in Animals 4:07

Type of Adaptation	Endotherm Examples	Ectotherm Examples
Behavioral	• Reduced activity • Huddling in groups • Spray with water • Panting	• Basking in sun • Move to shade • Swimming in cool water • Huddling in groups • Orientation to sun
Structural	• Fat provides insulation • Increased skin area • Downy feathers/Fur	• Increased skin area
Physiological	• Increased blood flow to skin • Increased sweat secretion • Shivering • Brown adipose tissue (in hibernators) • Heat Exchange	• Mucus secretion • Heat Exchange • Torpor (similar to hibernation)

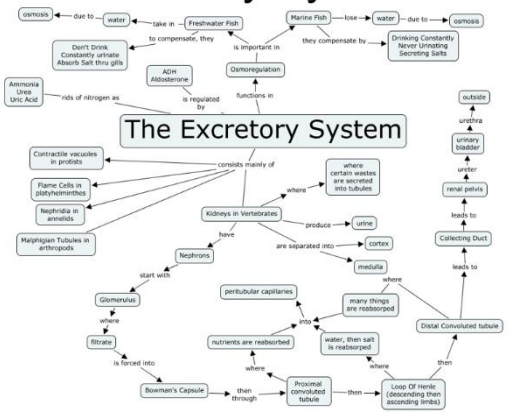
Circulatory System



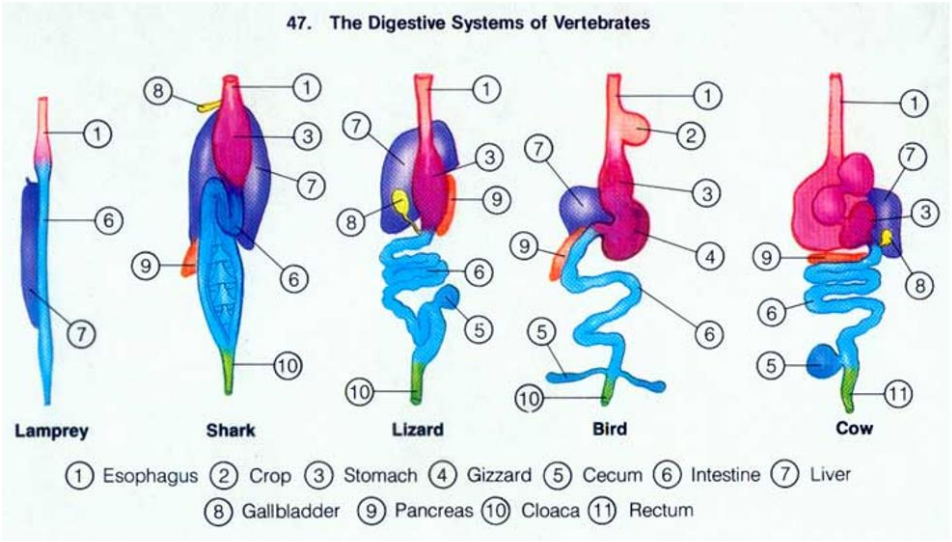
Respiratory System



Excretory System

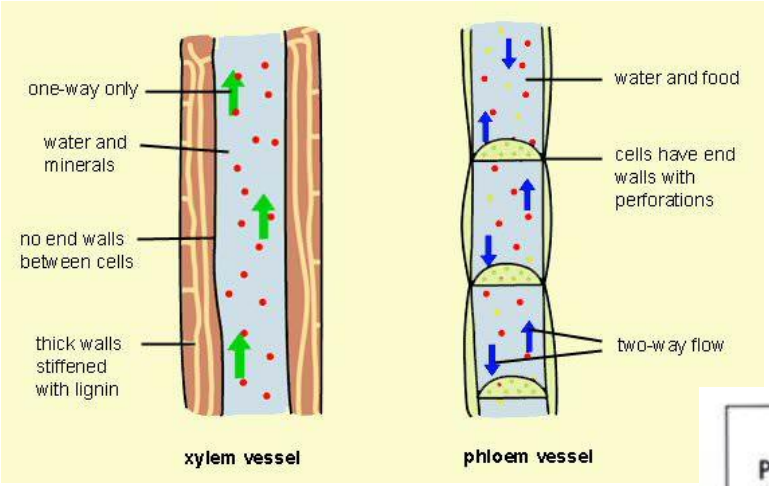


Digestive System



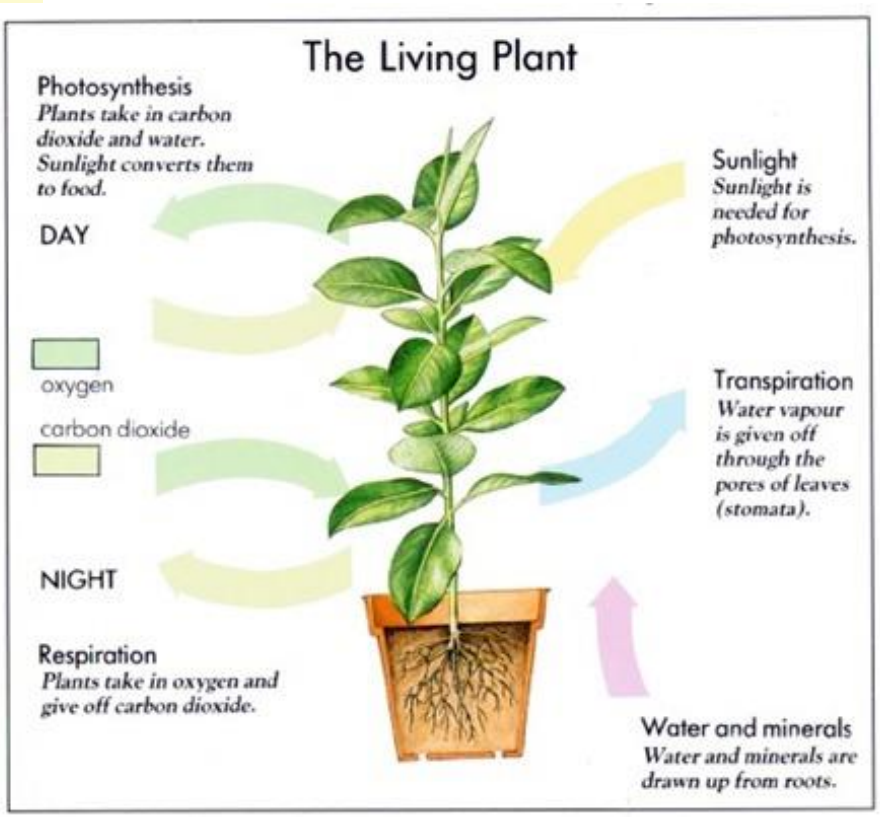
- Organism systems have become more complex
- The more complex a system is the more likely it will:
  - Adapt to changes in environment
  - Become specialized

So What About Plants?

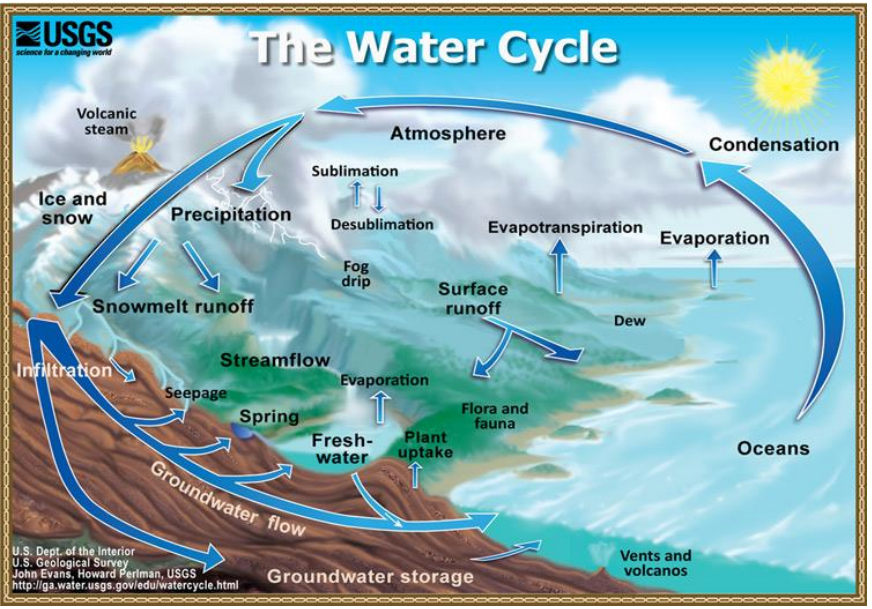


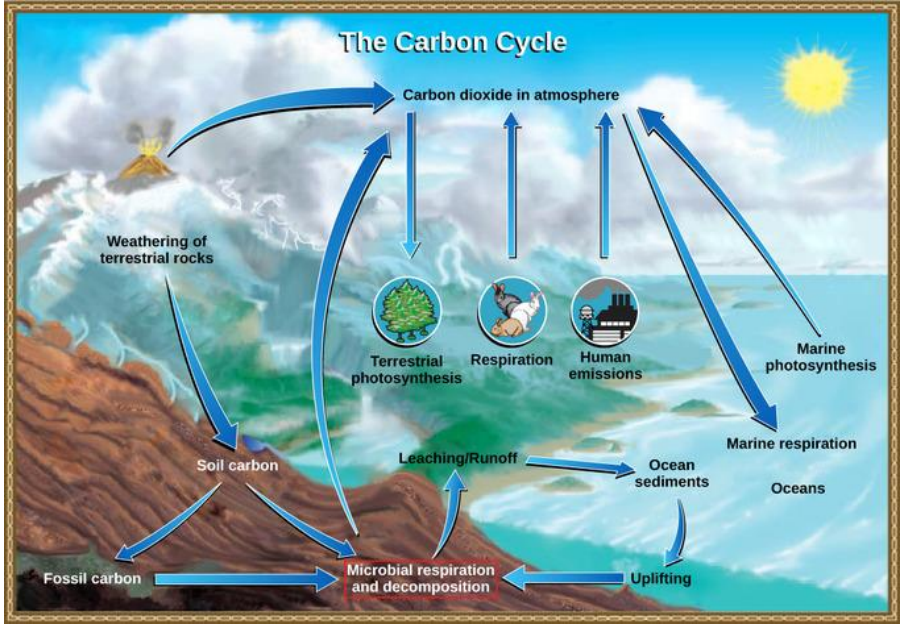
Phloem – Conducts food

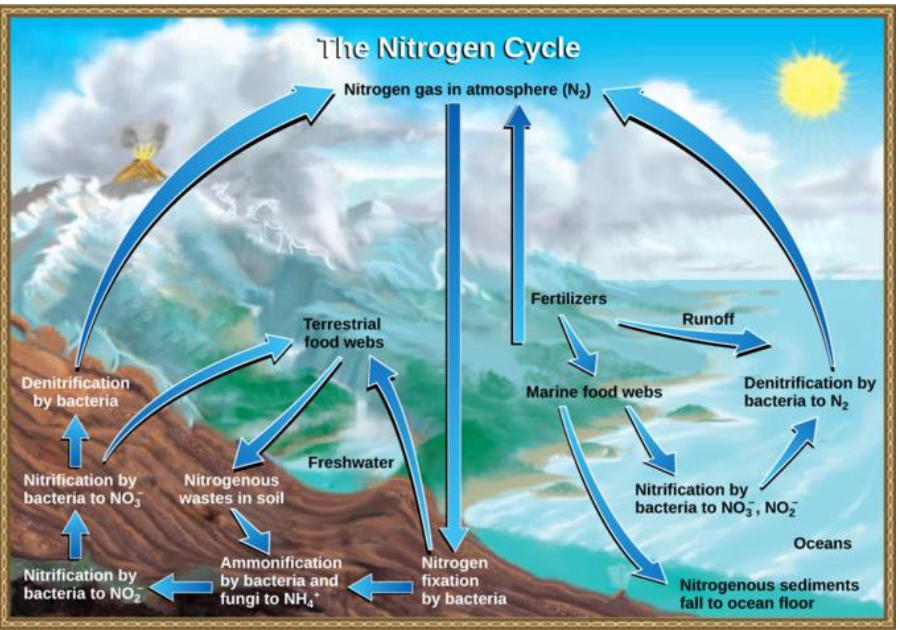
Xylem – Conducts water

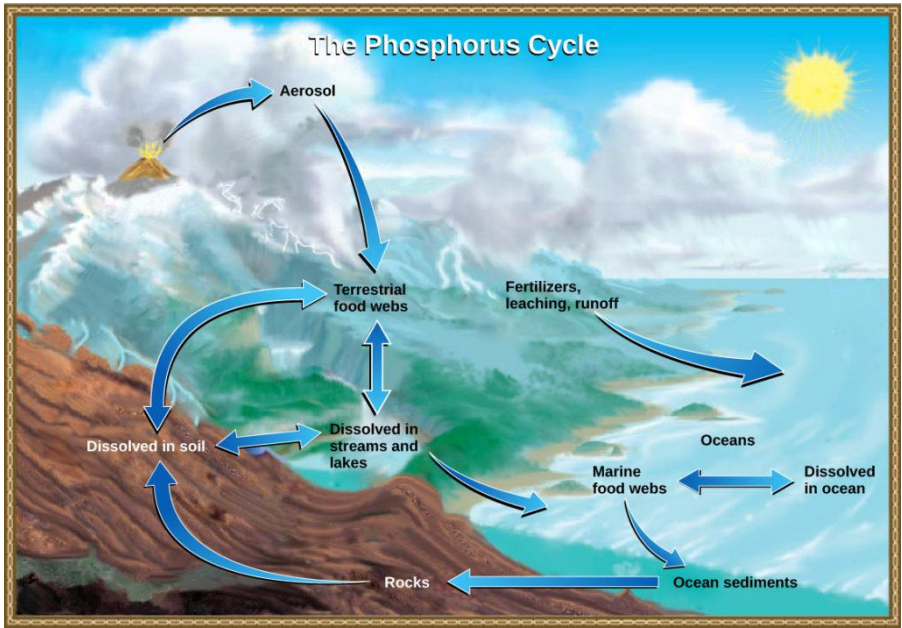


Ecosystems


USGS
science for a changing world
The Water Cycle
Volcanic steam
Atmosphere
Condensation
Sublimation
Desublimation
Ice and snow
Precipitation
Evapotranspiration
Evaporation
Fog drip
Surface runoff
Dew
Snowmelt runoff
Streamflow
Infiltration
Evaporation
Seepage
Spring
Flora and fauna
Fresh-water
Plant uptake
Oceans
Groundwater flow
Vents and volcanos
Groundwater storage
U.S. Dept. of the Interior
U.S. Geological Survey
John Evans, Howard Perlman, USGS
http://ga.water.usgs.gov/edu/watercycle.html


The Carbon Cycle
Carbon dioxide in atmosphere
Weathering of terrestrial rocks
Terrestrial photosynthesis
Respiration
Human emissions
Marine photosynthesis
Marine respiration
Soil carbon
Leaching/Runoff
Ocean sediments
Oceans
Fossil carbon
Microbial respiration and decomposition
Uplifting


The Nitrogen Cycle
Nitrogen gas in atmosphere (N_2)
Fertilizers
Runoff
Terrestrial food webs
Denitrification by bacteria
Marine food webs
Denitrification by bacteria to N_2
Freshwater
Nitrification by bacteria to NO_3^-
Nitrogenous wastes in soil
Nitrification by bacteria to NO_3^-, NO_2^-
Oceans
Nitrification by bacteria to NO_2^-
Ammonification by bacteria and fungi to NH_4^+
Nitrogen fixation by bacteria
Nitrogenous sediments fall to ocean floor


The Phosphorus Cycle
Aerosol
Terrestrial food webs
Fertilizers, leaching, runoff
Dissolved in soil
Dissolved in streams and lakes
Oceans
Marine food webs
Dissolved in ocean
Rocks
Ocean sediments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Media Playback Audio Video Tools View Help
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The atmosphere is full of oxygen and every water molecule contains an oxygen atom. How is possible for aquatic systems to be anoxic?

- Oxygen that is part of a water molecule is chemically unavailable to living things.
- Only dissolved oxygen can be used by living things.
- Water temperature effects how much water can hold
  - Cold, running water has more oxygen than warm, still water.

The Relationship Between Temperature and Oxygen Solubility	
Temperature (degrees C)	Oxygen Solubility (mg/L)
0	14.6
5	12.8
10	11.3
15	10.2
20	9.2
25	8.6
100 boiling	0

What is eutrophication?

- Eutrophication is the over-enrichment of aquatic systems.
- Nutrients cause algae to bloom and grow.
- Temporary high oxygen conditions and lots of growth.
- When living things die the dead organisms require oxygen to decompose.
- This results in anaerobic conditions and fish kills.

Hypoxia – Low oxygen

Anoxia – No oxygen

How have hypoxic conditions developed in the Gulf of Mexico?

Agricultural runoff
Wastewater treatment
Industrial waste
Burning of fossil fuels
Urban runoff
Factory dumping
Air pollution

What are some of the affects of these hypoxic conditions?

Dead organisms result in more oxygen depletion
Organisms that can leave, leave, reducing fishing opportunities
Odors and dead fish affect recreation and aesthetics

Homework

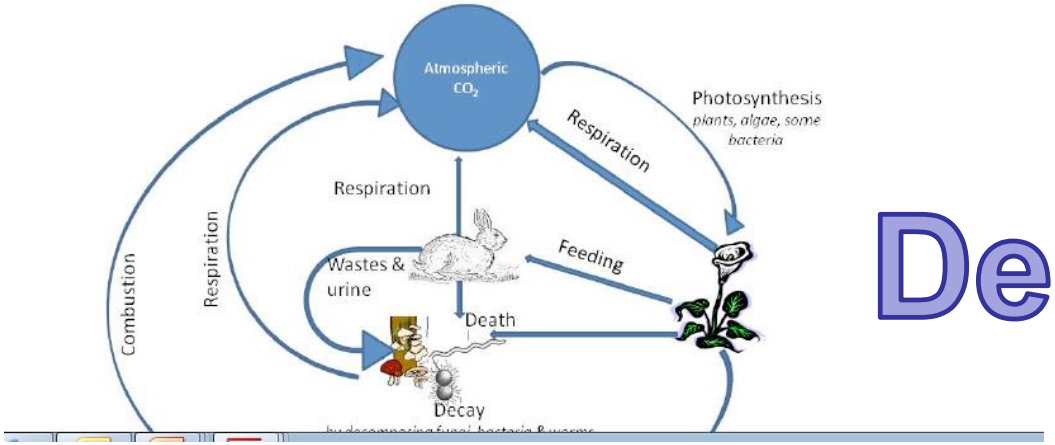
NUTRIENT CYCLES

(How are nutrients recycled through ecosystems?)

Why?

We have learned the importance of recycling our trash. It allows us to use something again for another purpose and prevents the loss of natural resources. But what happens to the waste in nature? Why aren't we up to our necks in poop? Why is there always a supply of water? Why is there oxygen to breathe and carbon dioxide for photosynthesis? Organic compounds in nature are also recycled. This recycling process converts the complex organic compounds to simple, inorganic compounds, which then can be returned to the nutrient cycle and be used in nature again and again.

Model 1: The Carbon Cycle



DUE Friday December 13