BIOLOGY
Fall Semester
REVIEW

From smallest to largest…

Atoms→molecules/compounds→macromolecules

(O_2, H_2O, CO_2) (carbs, proteins, lipids, nucleic acids)

→organelles→cells→tissues→ organs →

(ribosomes, nucleus, mitochondria, etc)

Organ systems →organisms→ species→

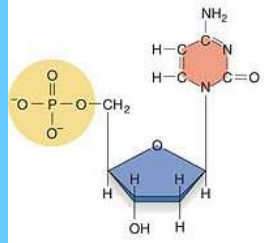
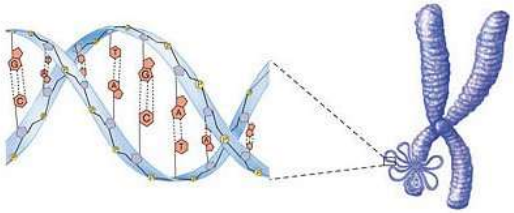
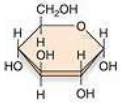
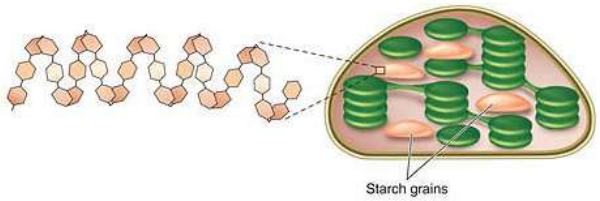
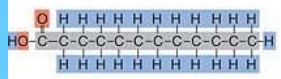
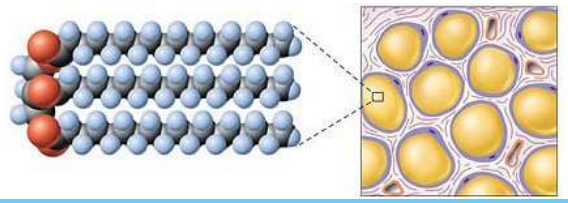
population →community →ecosystem→ biome→

biosphere

4 Major Macromolecules

Macromolecule	What is it made of? What are its building blocks?	How do we get it?	What is it used for?	Examples of how it is used in body
Proteins	Amino acid	Meat, dairy, bean products that you eat	**enzymes-** speed up rxns **hormones-** send messages thru body **structural-** hair, nails, skin	Amylase, insulin, hair, nails, every part of your cells!
Carbohydrates	Monosaccharides (glucose & other simple sugars)	Simple carbs- fruit Complex carbs- pasta	Short term energy use/storage	Polysaccharide- Glycogen Starch Cellulose
Lipids	Fatty acids and glycerol	Unsaturated fats- liquid @ room temp (oil) Saturated fats- solid @ room temp (steak fat)	Long term energy storage	Cholesterol, adipose tissue
Nucleic Acids	nucleotides	Eating any plant or animal that has DNA in it.	Storing genetic information & Protein synthesis	DNA, RNA

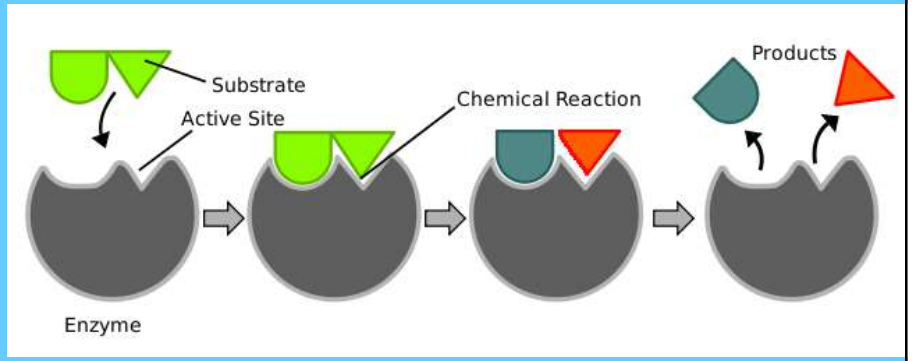
TABLE 4.1 MACROMOLECULES

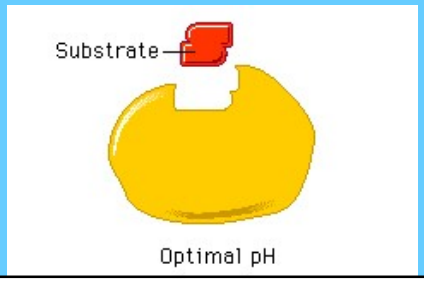
Monomer	Polymer	Cellular structure
Amino Acid	Polypeptide	Intermediate filament
 Alanine		
Nucleotide	DNA strand	Chromosome
		
Monosaccharide	Starch	Starch grains in a chloroplast
		
Fatty acid	Fat molecule	Adipose cells with fat droplets
		

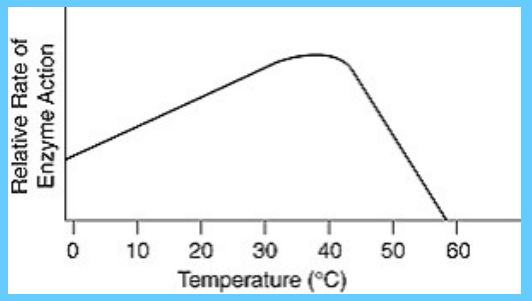
4 Major Macromolecules

Enzymes

- Proteins that speed up chemical reactions by lowering the amount of energy needed which makes the reaction happen faster- called **catalysts**
- If you didn't have enzymes, reactions would happen too slowly and you might die waiting for the rxn to occur.
- Enzymes are used to break down food in your body and to build new molecules & organelles.
- Enzymes are used over & over but are very SPECIFIC in the rxn they participate in.
- Enzymes can be **denatured** or destroyed by changes in temperature, pH or salt





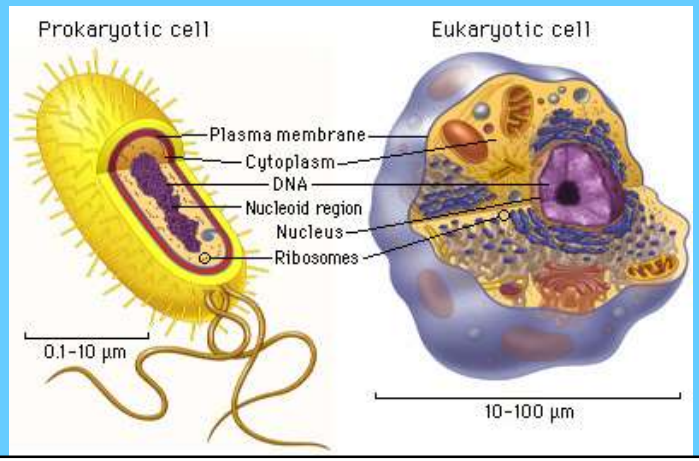


What is the optimum temperature for this enzyme? (Optimum means the best.)

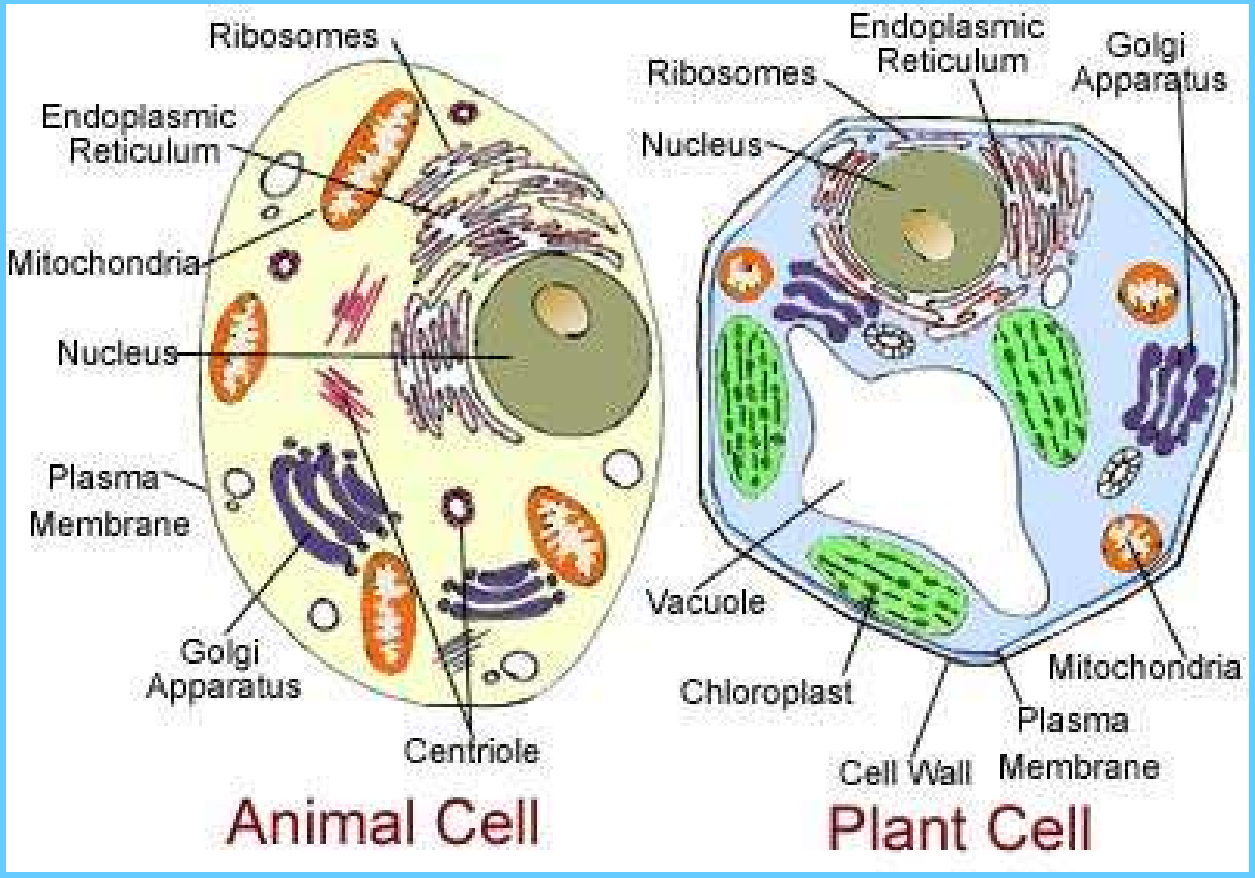
Two Types of Cells

- Prokaryotic
  - No nucleus or membrane bound organelles (chloroplast, mitochondria)
  - Simple & smaller than eukaryotic
  - Ex: all bacteria

- Eukaryotic
  - Has a nucleus & membrane bound organelles
  - More complex & larger than eukaryotic
  - All cells except bacteria



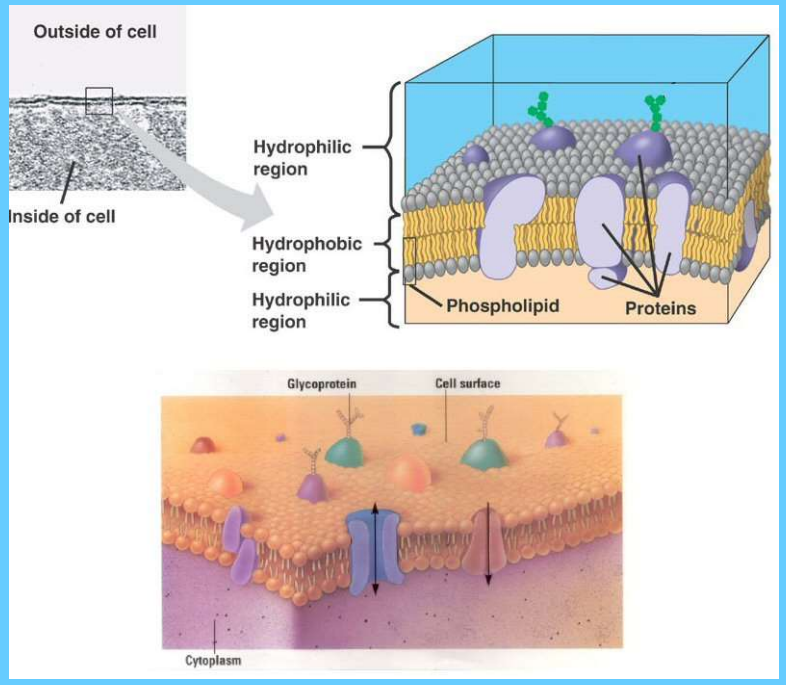
Difference between Plant and Animal Cells



Organelle Structure	Organelle Function	Plant, Animal, or Both?
Nucleus	Stores DNA, controls cell processes	Both
Nucleolus	Makes ribosomes	Both
Ribosomes	Smallest organelle, site of protein synthesis	Both
Endoplasmic reticulum	Long channels where ribosomes pass while they make proteins	Both
Golgi body	Takes proteins from ribosomes, reorganizes & repackages them to leave cell	Both
Lysosomes	Store digestive enzymes to clean up dead cell parts, bacteria, etc	Animal
Vacuole	Stores water, waste, food, etc	Both (Plant has 1 large vacuole)
Cell membrane	Controls what goes in & out of cell; maintains homeostasis	Both
Mitochondria	Makes ATP from food we eat & stores ATP (energy storage molecule); site of cellular respiration	Both
Chloroplast	Traps light and makes sugar for plant; site of photosynthesis	Plant
Cell Wall	Outermost boundary of plant cell; gives support & protection; made of cellulose	Plant
Centriole	Used in cell division	Animal

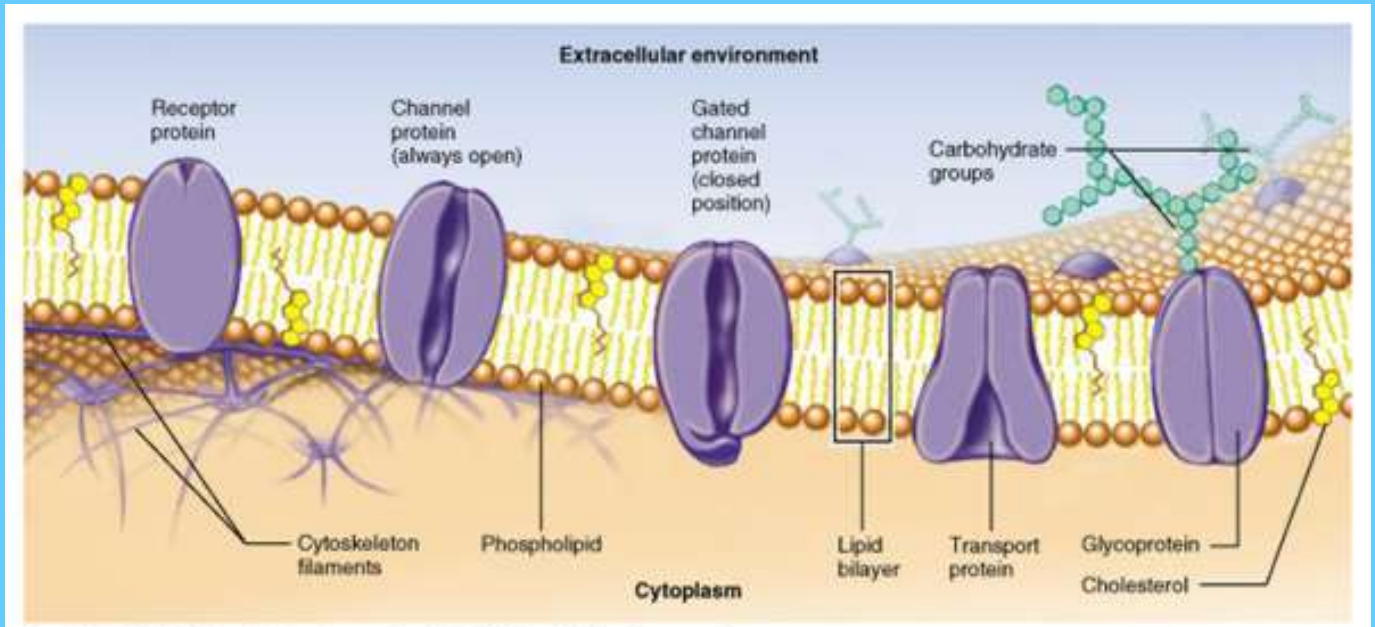
How do molecules get in and out of cell?

- Cells need to be small so stuff can get in and out quick- otherwise cell would starve or enzymes needed by body would be too slow leaving cell.
- Molecules pass thru the cell membrane
- Cell membrane is **selectively permeable-** controls what substances can go in & out of the cell



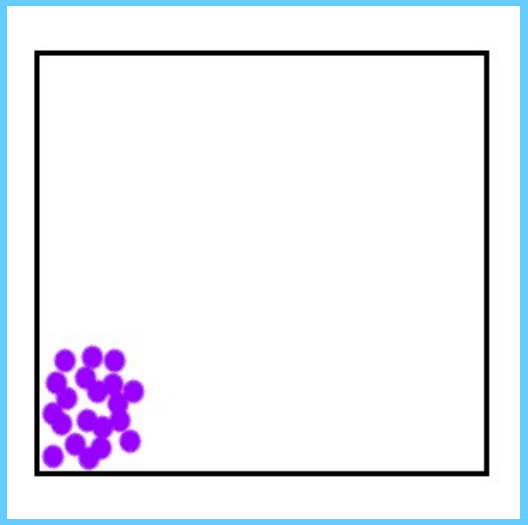
Structure of the Cell Membrane

- **Phospholipids-** phosphate head and 2 lipid tails that make up the majority of the cell membrane. Create a Bilayer with **hydrophilic** (water loving) heads on the outside and **hydrophobic** (water hating) tails on the inside.
- **Channel protein-** used in passive transport to let molecules thru.
- **Carrier protein-** opens and closes to let molecules thru.
- **Receptor proteins-** receive messages from the outside and sends them to the inside to create a response inside the cell.

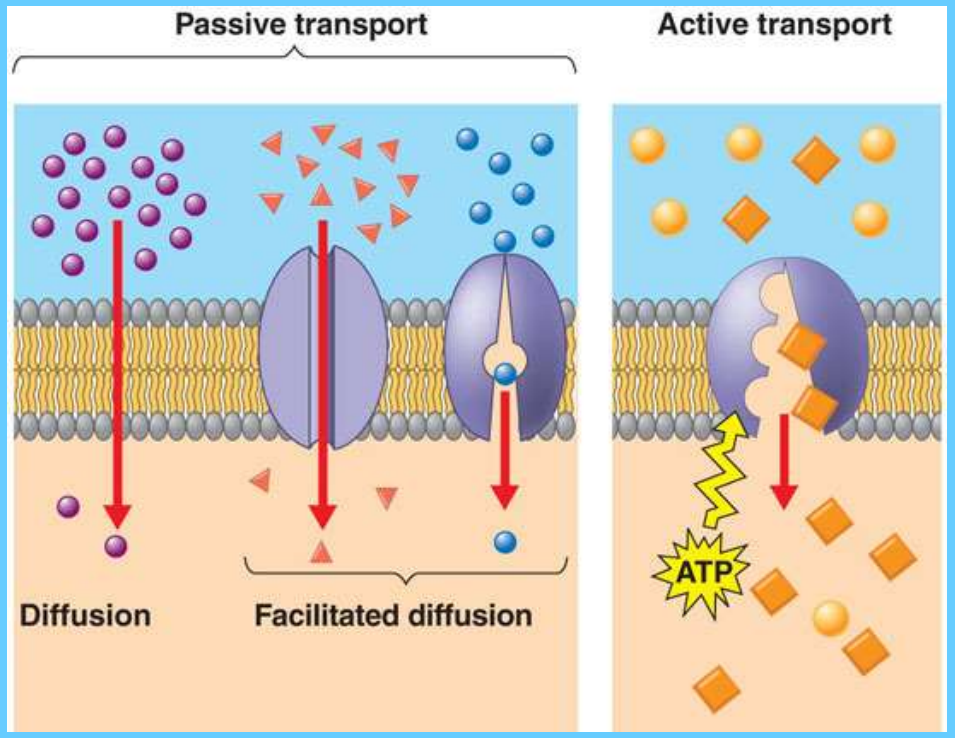


Diffusion

- Molecules move from high to low concentration with the concentration gradient (natural flow of molecules; like a river)
- Eventually molecules spread out evenly and reach **equilibrium**.

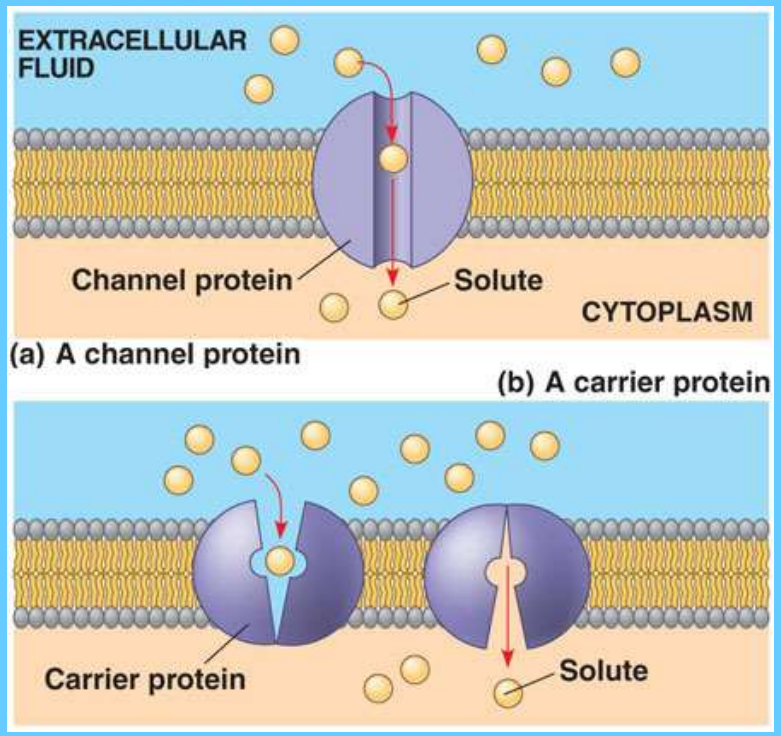


Two types of Transport thru Cell

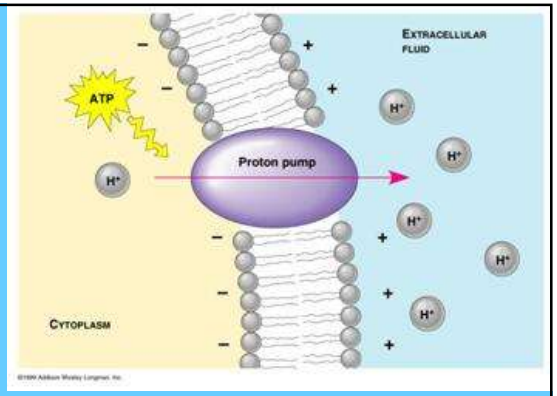


Passive transport

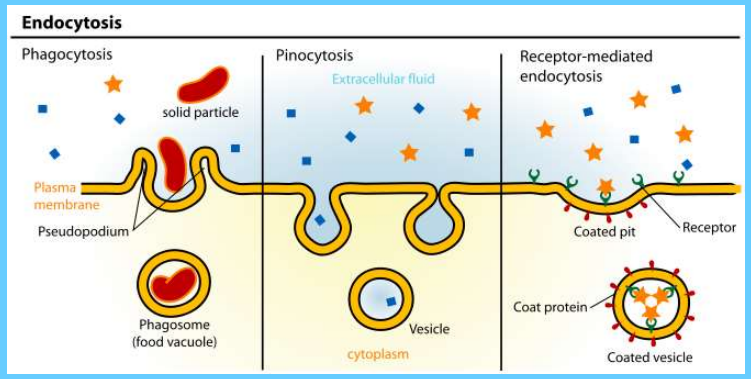
- Molecules move from high to low
- Goes WITH concentration gradient
- No energy needed
- EX:
  - Diffusion
  - Facilitated Diffusion (uses protein)



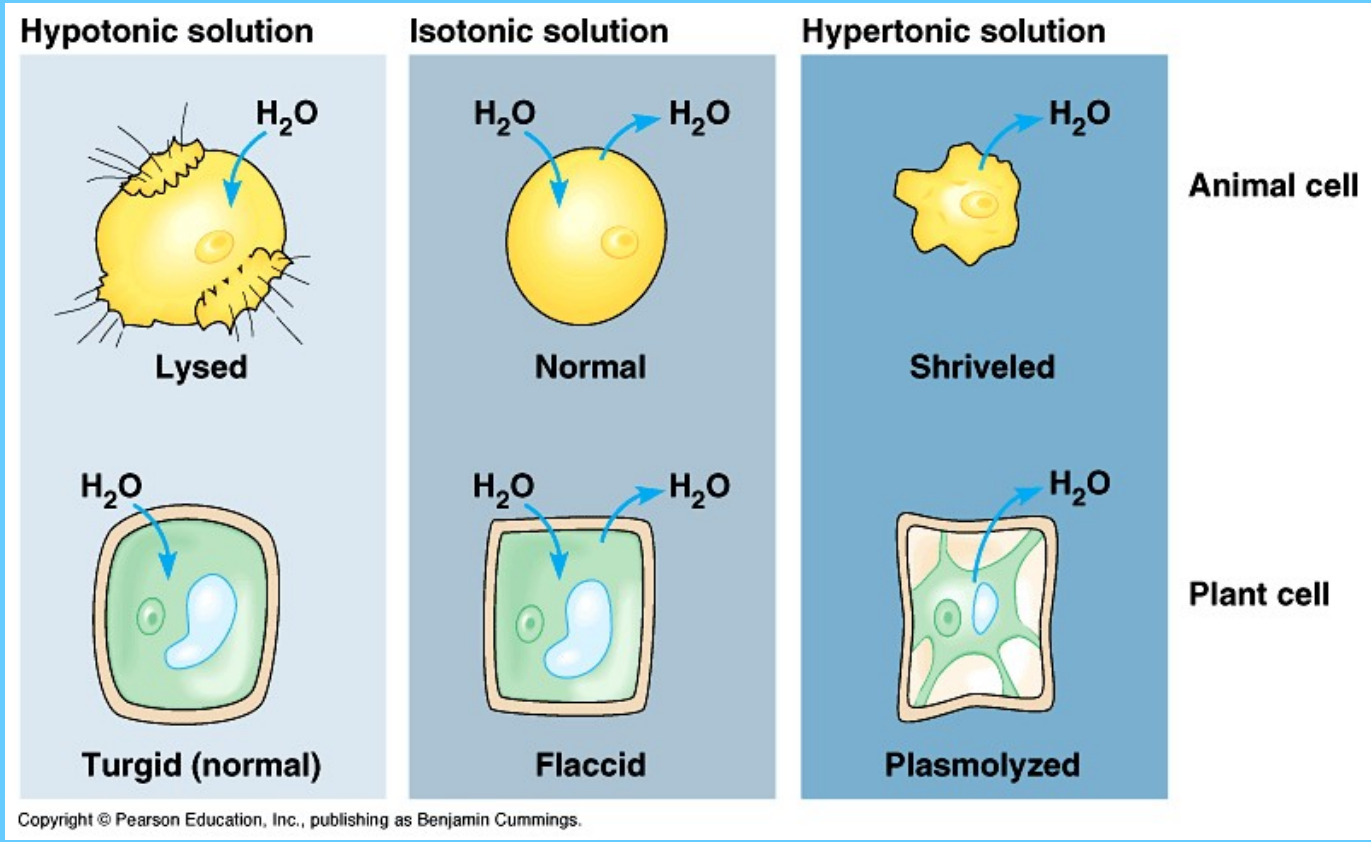
Active Transport



- From low to high concentration
- Goes AGAINST concentration gradient
- Requires energy
- Ex:
  - Endocytosis- bringing large molecules in
    - Phagocytosis- solid
    - Pinocytosis- liquid
  - Exocytosis- releases large molecules from cell

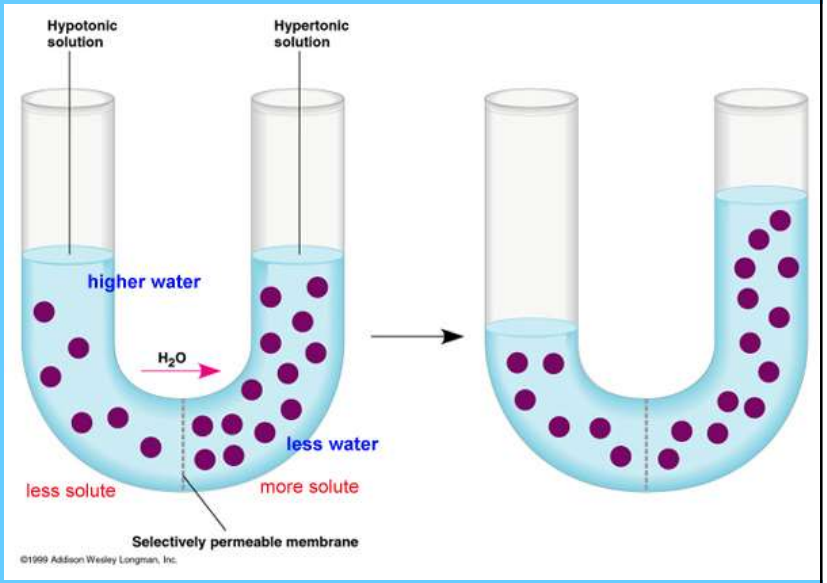


Osmosis- diffusion of water molecules from high to low concentration



Osmosis

- **Hypertonic** solution- "above strength"= too much solute (salt) outside cell. Water moves to salty side.
- **Hypotonic** solution- "below strength" = more salt inside cell so water follows and goes into cell
- **Isotonic-** "equal" strength of salt and water.



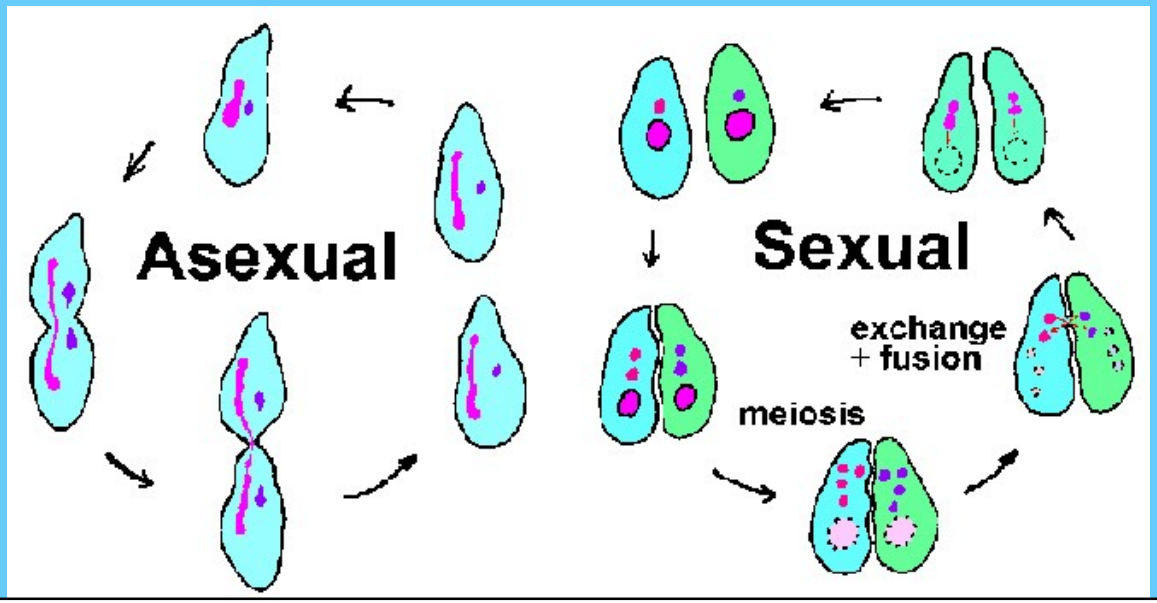
Asexual reproduction vs. Sexual reproduction

Asexual

- No sperm or egg are used
- Clones /identical
- No genetic variation
- Susceptible to disease
- Can reproduce quickly
- Ex: budding, binary fission

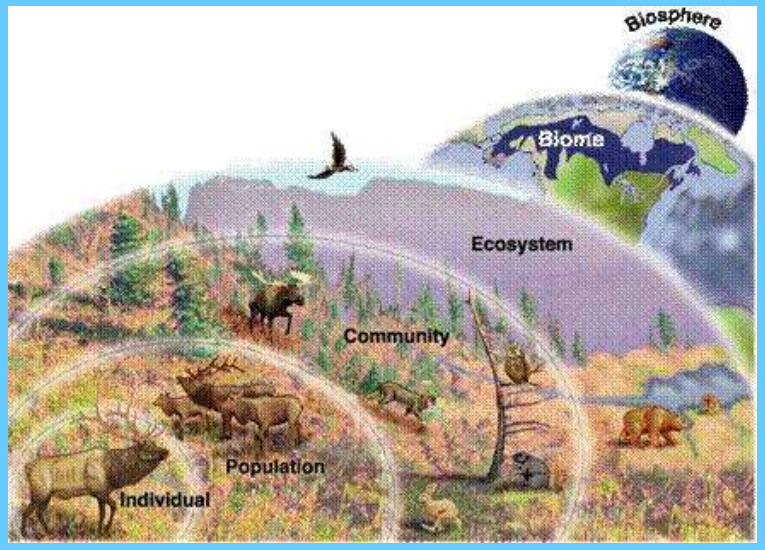
Sexual

- Sperm and egg are joined combining DNA
- Creates genetic variation/diversity
- Healthier
- Population can't reproduce as quickly b/c they have to search for a mate
- Ex: human egg (23) + human sperm (23) = zygote (46)



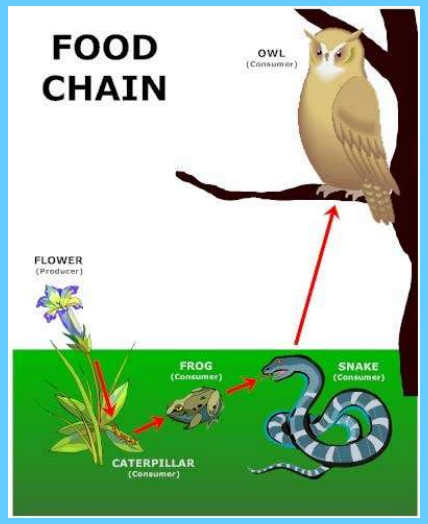
Levels of Organization in Ecology

- **Population-** group of same species in an area (ex: all grey squirrels)
- **Community-** group of many different populations (ex: grey squirrels, hawks, ants, pigeons, students)
- **Ecosystem-** interaction btwn organisms and the environment (ex: how squirrels use water, how plants remove nutrients from soil)
- **Biomes-** group of similar ecosystems; have similar climates, plants, animals (ex: desert, rainforest, grasslands)
- **Biosphere-** all of the biomes, plants, animals, on the planet

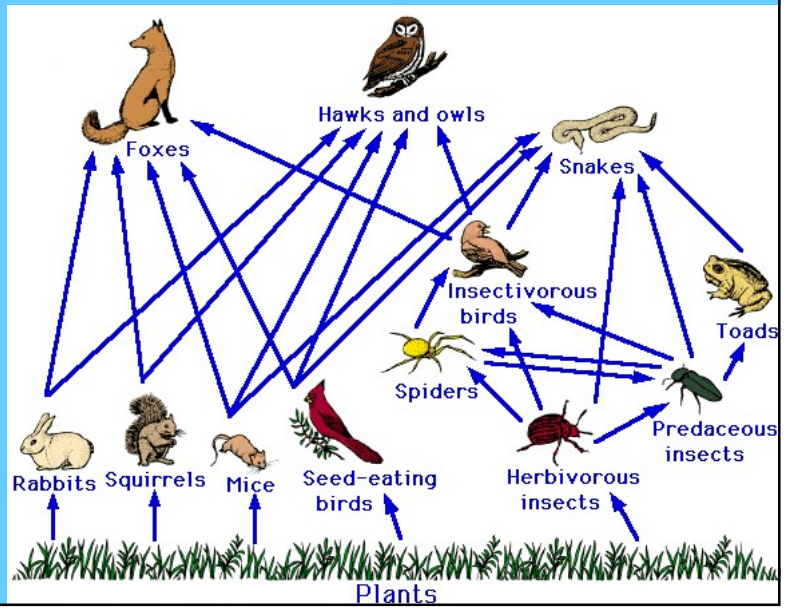


Food Chains and Webs

- Food chains show one simple relationship in an ecosystem
- Arrows show TRANSFER OF ENERGY!

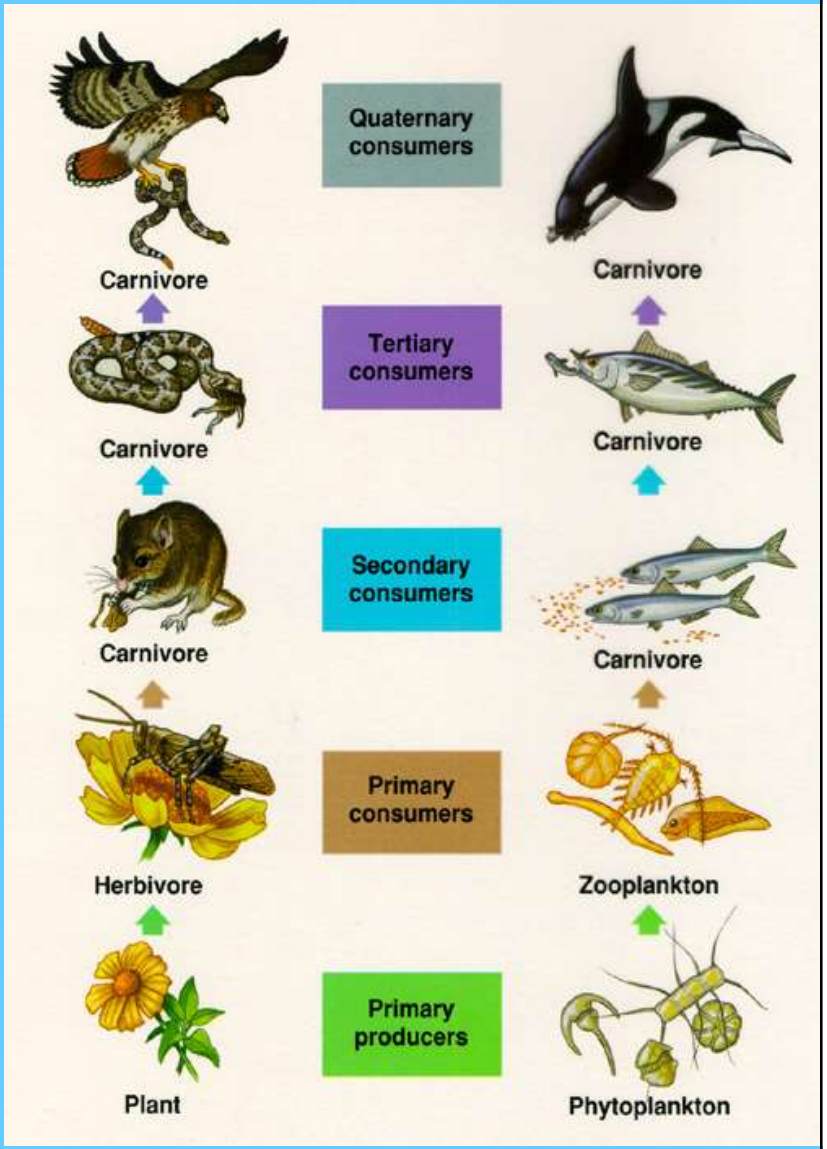


- Food webs show many (but not all) relationships in an ecosystem



Trophic Levels

- Every organism occupies a trophic level in a food chain/web
- **Producers-** make their own food (autotrophs); bottom of food chain
- **Primary consumers-** herbivores that get energy from producer
- **Secondary consumer-** carnivore that gets energy from herbivore
- **Tertiary consumer-** carnivore or omnivore that gets energy from secondary consumer; top of the food chain



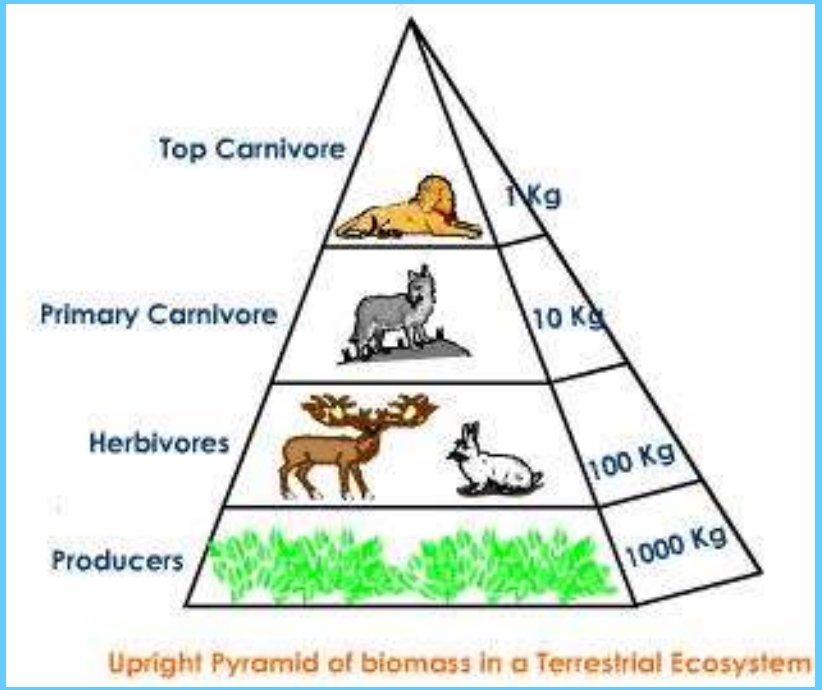
Decomposers vs. Scavengers

- Secrete enzymes onto food and absorb nutrients thru cell wall
- Recycle nutrients back to soil
- EX: bacteria, fungi

- Sometimes steal food from others b/c they are usually too weak to kill themselves
- Eat with mouth
- EX: vultures, worms, ants

Ecological Pyramids

- **Energy pyramids-** show that energy decreases as you go up food chain
- **Biomass pyramids-** show that mass of available food/organisms decrease as you go up food chain

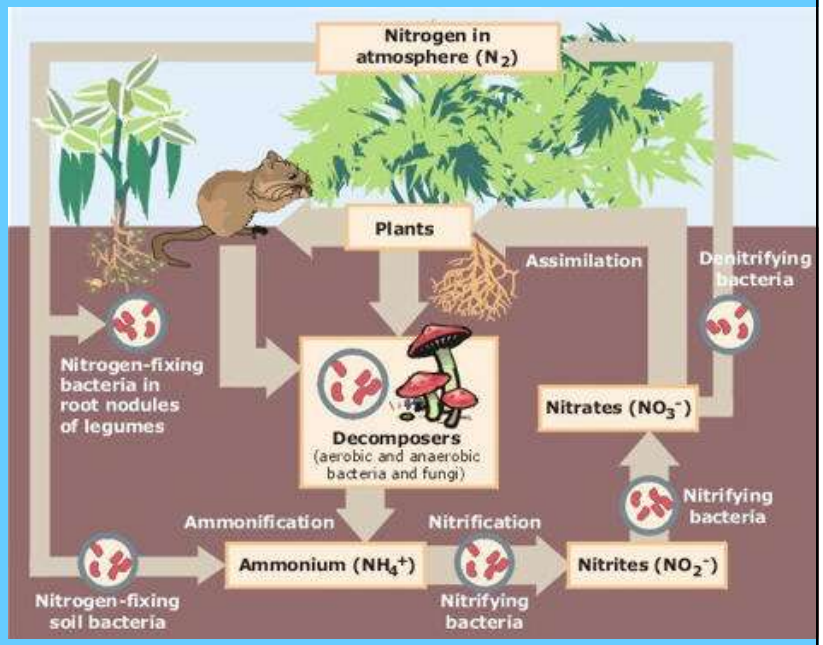


Upright Pyramid of biomass in a Terrestrial Ecosystem

Biogeochemical cycles

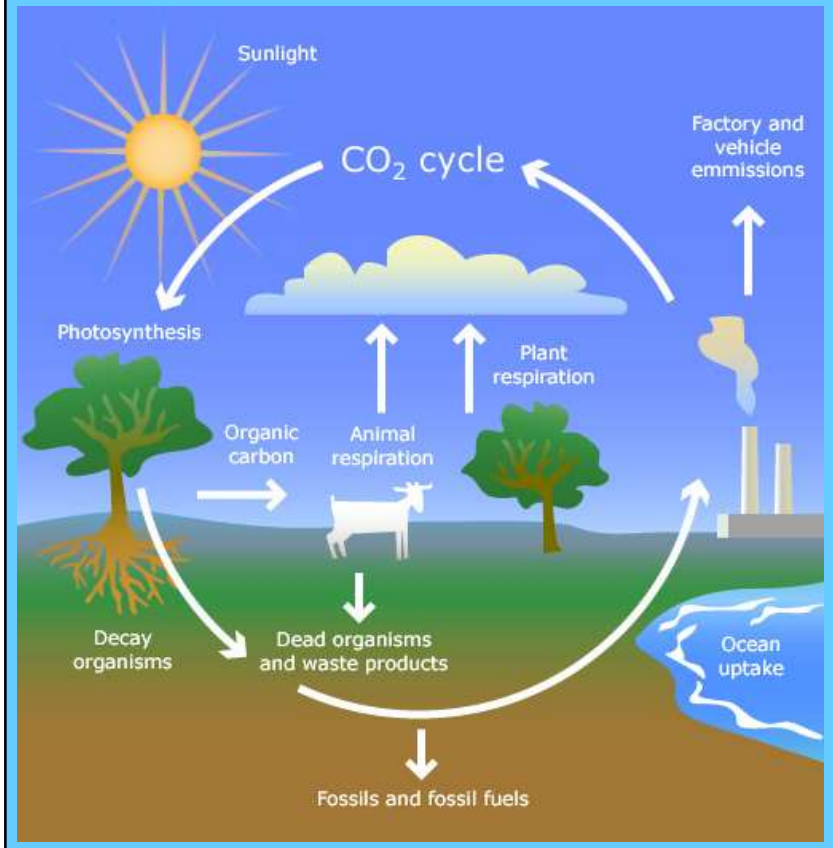
- Carbon, Nitrogen, Oxygen, Phosphorus, Water all must be recycled so new organisms can grow
- Basic steps:
  - Plants absorb nutrient from soil (nitrogen, sulfur) or air (carbon, oxygen)
  - Animal eats plant
  - Animal dies, defecates, respires and bacteria return nutrient back to soil or air

Nitrogen Cycle

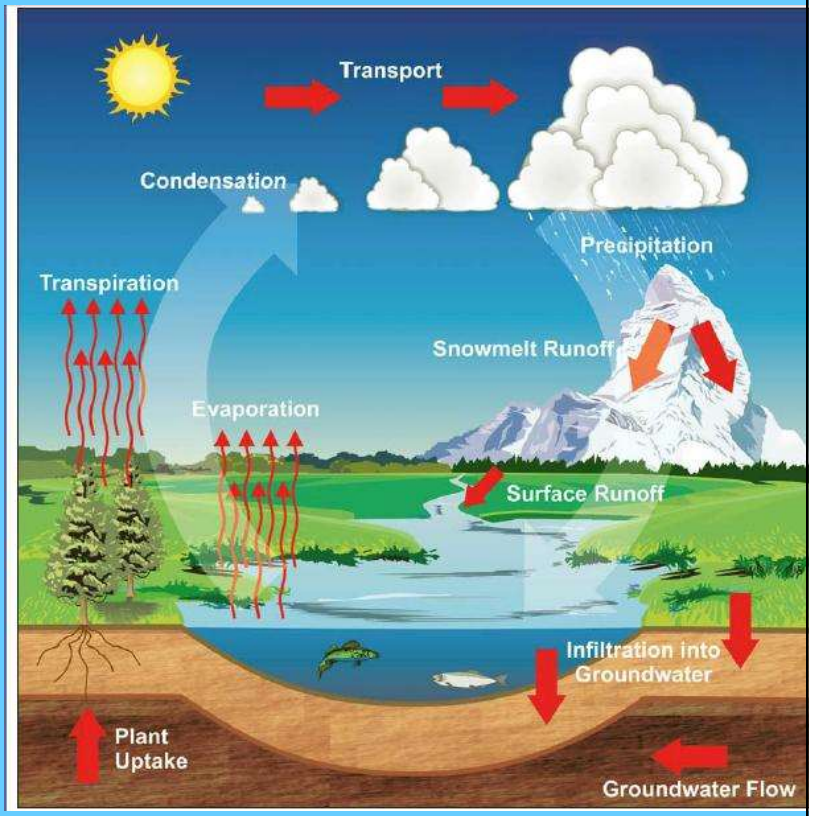


Biogeochemical cycles

- Carbon Cycle

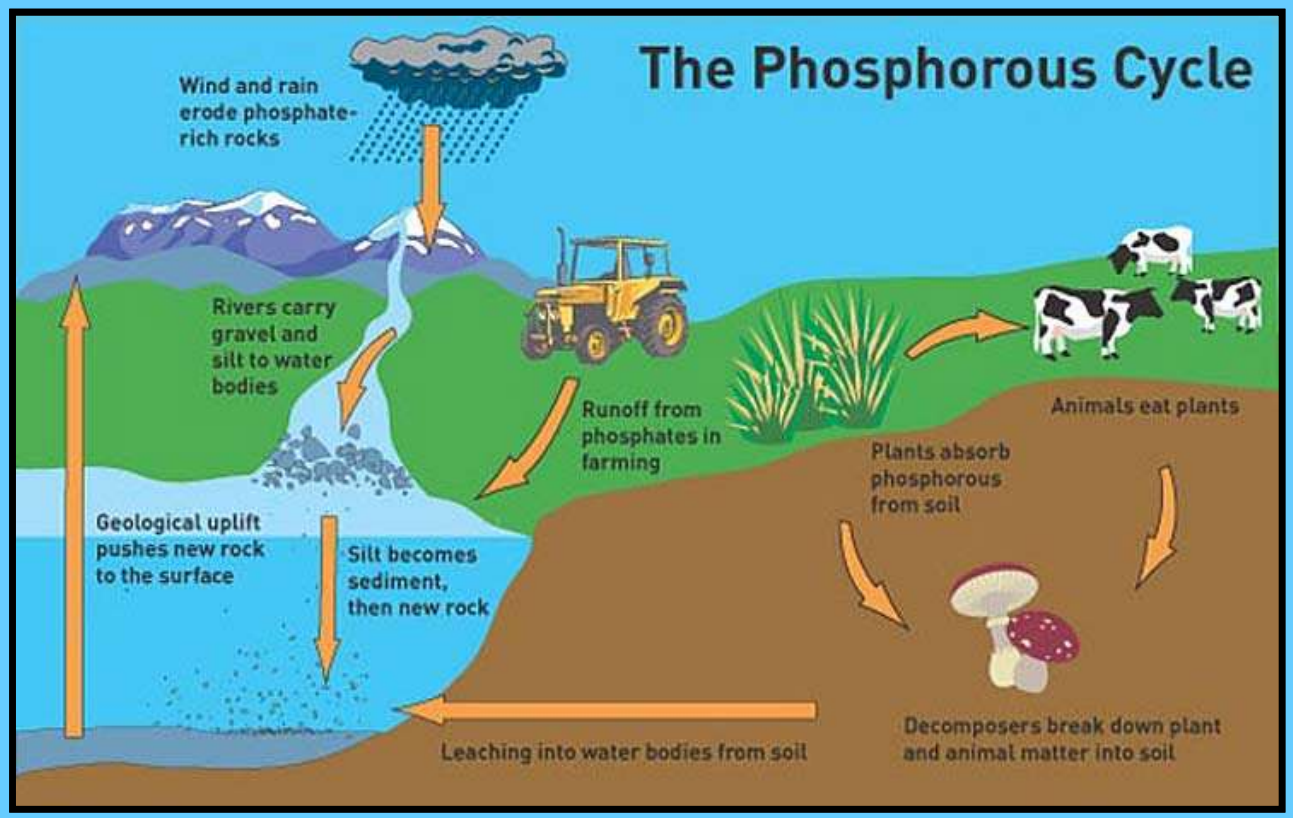


- Water Cycle



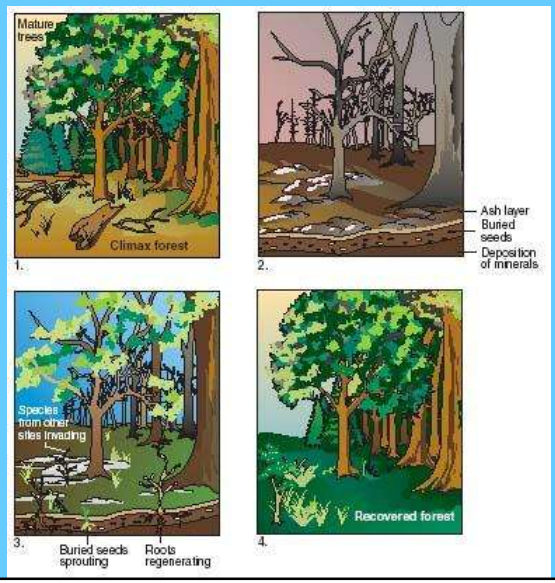
Biogeochemical cycles

- Phosphorus Cycle



Succession

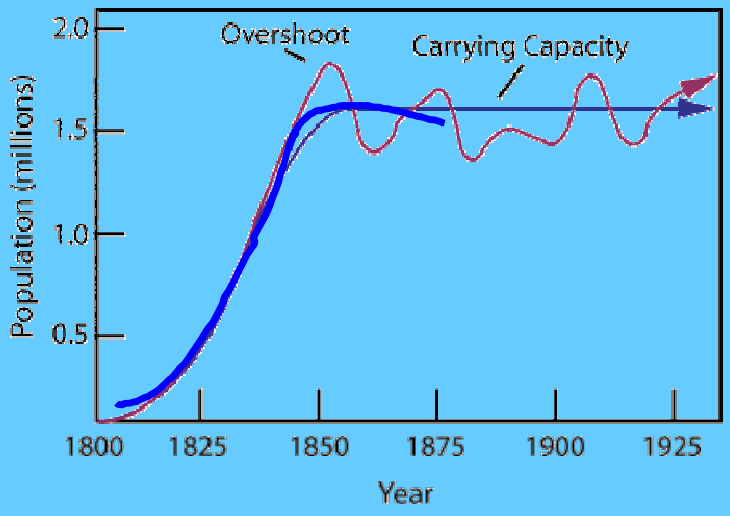
- Primary- happens in an environment for the first time; pioneer species= lichens & moss; ex: after new volcanic island formed
- Secondary- happens in an environment after a disturbance; pioneer species = weeds/grass; ex: after forest fire, farm left fallow, pond fills in and becomes forest.



Population Growth

logistics growth

- Most populations grow exponentially when there's plenty of food, water shelter (1800-1850 on this graph)
- Eventually those limiting factors start to dwindle and population growth slows and levels off. (1850-1925)
- Population might oscillate around carrying capacity- # of organisms that can be supported by an area.



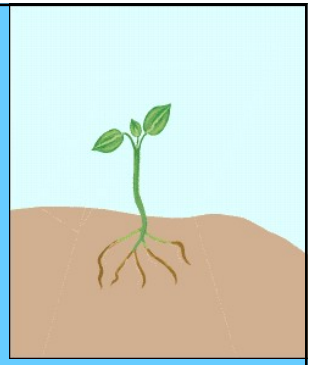
What is the carrying capacity of this population? 1.5 million

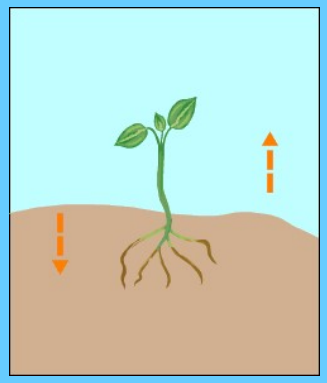
BIOME	CLIMATE	PLANT ADAPTATIONS	ANIMAL ADAPTATIONS
Tropical rainforest	Warm all year round Gets most precip.	Layered forest Broad, big leaves to capture sunlight in understory; variety of seed adaptations	Arboreal (live in trees); long prehensile tails, gliders; insects, monkeys
Desert	High temperatures Low precipitation	Succulents- store water; spines for protection and decreased transpiration; cacti, aloe	Large ears to dissipate heat; burrowers; nocturnal; insects, reptiles, coyotes, jack rabbits
Grasslands **Savanna- Africa** **Prairie- U.S.**	High temperatures Moderate precipitation Savanna's get more rainfall than prairies Frequent fires	Tall grasses; a few trees near sources of water	Grazing animals Feed at different levels to avoid competition Burrowing animals
Temperate Deciduous Forest	Moderate temperature Moderate precipitation	Deciduous trees- lose leaves in winter to conserve water Oaks, hickory, maple, sweetgum	Hibernate in winter Dull colors to blend in with tree trunks or dead leaves in fall/winter Deer, raccoons, squirrels, snakes
Taiga/Coniferous forest	Long, cold winters Short cool summers	Evergreen/coniferous trees- wax on needles prevents water loss so they keep leaves all year; thick bark; pyramid shaped tree to slough snow; shallow roots	Broad hooves/feet to walk on snow; thick fur/blubber; moose, elk, wolverines, insects
Tundra	Long cold winters Short cool summers	Small plants to prevent water loss, grow close to ground to get maximum sun/warmth; lichens, moss, small flowering plants	Broad hooves/ feet to walk on snow; thick fur/blubber; hibernate; polar bears, caribou/reindeer, seals

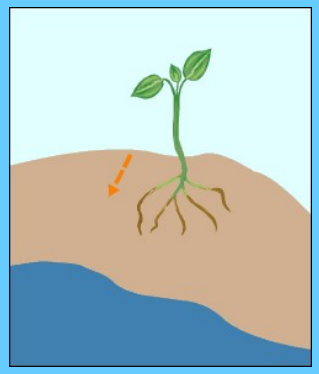
POLLUTANT/ ENVIRONMENTAL PROBLEM	CAUSE OF POLLUTANT	EFFECT OF POLLUTANT
Sulfur dioxide (SO_2)	Burning coal in power plants and diesel fuel in trucks	Increases air pollution which can cause respiratory problems; causes acid rain
Carbon dioxide (CO_2)	Deforestation- fewer trees to remove CO_2; increasing population = increasing use of fossil fuels	Increases greenhouse gases in atmosphere which trap heat and lead to global climate change
Nitrogen (N_2)	Fertilizers used on yards, golf courses; animal waste from livestock (cows, pigs); raw sewage from broken pipes	N_2 flows into lakes/ponds, algae grow, die, decompose, oxygen levels in water decrease due to too many bacteria, fish die due to lack of oxygen. This process is called EUTROPHICATION
Ozone depletion	Use of ChloroFluoroCarbons (CFCs) in spray cans (now banned) and CFCs in refrigerants in air conditioners (still used)	Thinning of the ozone layer in the stratosphere over Antarctica; increase in UV rays reaching Earth; increased skin cancer rates
Global warming	Increased use of fossil fuels (mostly attributed to CO_2 and methane release) Intensifies the greenhouse effect (Greenhouse effect is a good thing b/c otherwise it would be too cold- but too much of a good thing can be bad!)	Sea levels rise due to icecaps/glaciers melting; flooding along coast; climate change in some areas- dry areas become wet, wet become dry; will affect ability to grow crops; animal migration/hibernation is disrupted

PLANT "BEHAVIORS"

- Tropisms- plant movements
  - Positive- moves toward the stimulus
  - Negative- moves away from the stimulus
- **Phototropism-** response to light
- **Geotropism-** response to gravity
- **Hydrotropism-** response to water
- **Thigmotropism-** response to touch







ANIMAL BEHAVIORS

- **Innate-** instinctive behavior- born with this; sea turtle babies move toward ocean when they hatch
- **Learned-** not born with this; gorillas can learn to communicate w/computers
- **Hibernation-** body systems slow during cold months to conserve energy
- **Migration**- move with rainfall to keep up with food/water source; wildebeest migration across savanna in Africa
- **Territoriality**- defend a territory/mates
- **Estivation**- hibernate during dry season