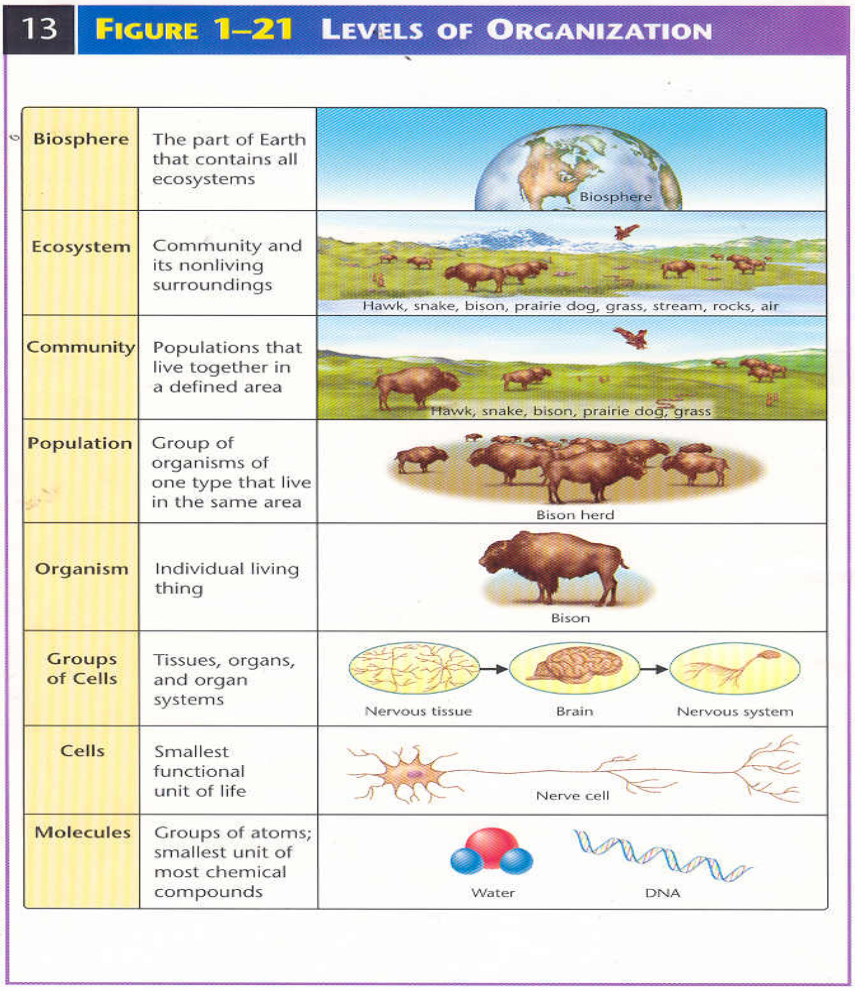
BIOLOGY EOC READING GUIDE

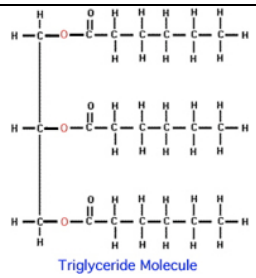
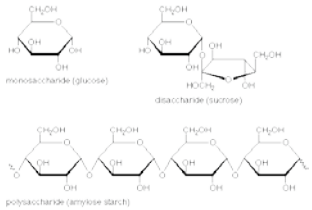
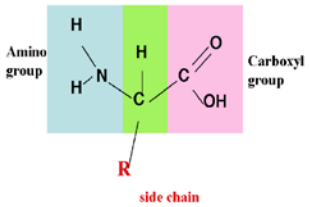
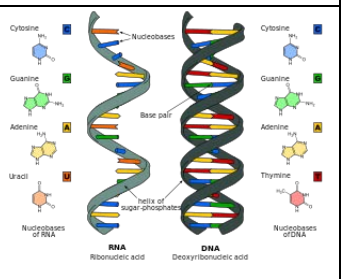
REPORTING CATEGORY 1: CELL STRUCTURE AND PROCESSES

Levels of Organization



Biomolecules: 4 macromolecules that make up living organisms

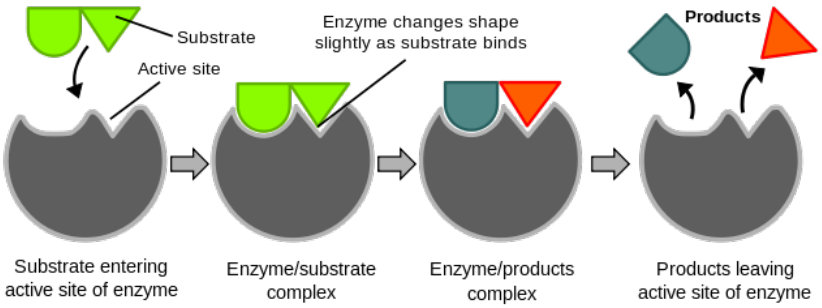
1. Biomolecules are macromolecules

	Lipids	Carbohydrates	Proteins	Nucleic Acids
What is it? Function?	Stores long-term energy	Provides fast, immediate energy	Most multifunctional molecule—makes bones, muscles, enzymes	Carries and transmit genetic code
Picture				
Elements	C, H, O	C, H, O	C, H, O, N	C, H, O, N, P
Monomers	No mono/polymer, but it's made up of 3 fatty acid chains	Monosaccharide	Amino Acid	Nucleotide
Polymers		Polysaccharide	Polypeptide; Protein	Nucleic Acid, DNA, RNA
Examples	Fats Oils	Simple and complex sugars (like candy) and starches (like pasta)	Muscles → Meat Hormones Enzymes	DNA RNA

Enzymes: are types of proteins that are catalysts that speed up chemical reactions

1. Enzymes speed up chemical reactions – like chemically digesting your food.

Reactants → Products
Things you need → What you make



Parts of the Enzyme Reaction

1. Enzyme – protein that speeds up chemical reactions
2. Substrate – Food; what you're trying to break down
3. Active Site- enzymes are specific so only the correct substrate will fit into the enzyme's active site
4. Enzyme/Substrate Complex – Enzymes and substrates combined
5. Products – the substrate broken apart

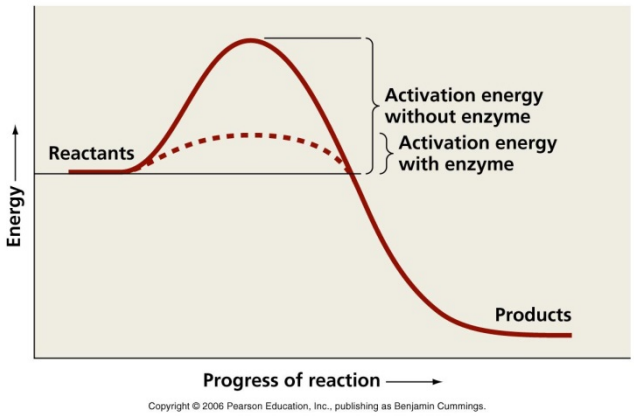
2. Example:
   i. Amylase + Sucrose (dissacharride) → Glucose + Glucose

3. Enzymes are specific to what they break down and Usually ends in "-ase"
   i. Amylase- found in saliva, breaks down carbohydrates
   ii. Protease- found in stomach, breaks down proteins
   iii. Lipase- found in small intestines, breaks down lipids

4. Enzymes are "reusable."

5. Enzymes work by reducing the amount of energy needed to complete a chemical reaction so it occurs faster.

6. Activation Energy Graph



Enzymes reduce the amount of activation needed to complete a chemical reaction.

Activation energy is the amount of energy needed to complete a reaction by using reactants (ingredients- substrate/food + enzyme) to create a product (broken down substrate/food).

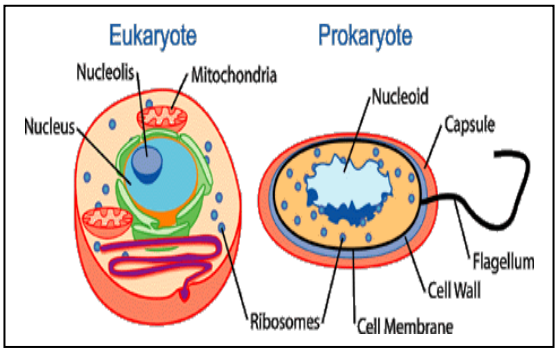
7. Other factors can affect how enzymes work—
   i. Temperature
   ii. Number of substrates
   iii. pH level

Cell Structure: Prokaryotic and Eukaryotic Cells

1. Cells are the smallest units of life.

2. Comparing Prokaryotic and Eukaryotic Cells – Pro No [Nucleus], Eu Do [have a nucleus]
   a. Prokaryotic Cells: bacteria
   b. Eukaryotic Cells: animal cells, plant cells

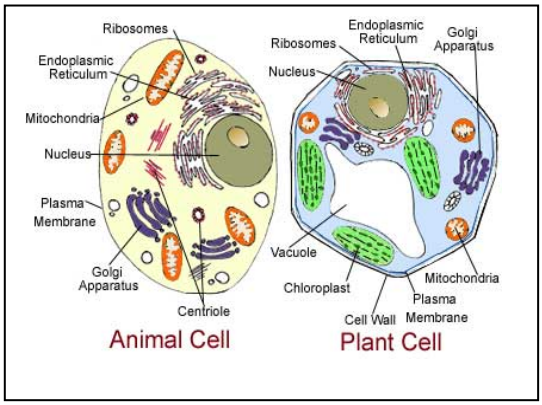
	Prokaryotic	Eukaryotic
Cell membrane	Yes	Yes
Cytoplasm	Yes	Yes
Genetic Material	Yes	Yes
Ribosomes	Yes	Yes
Nucleus	No	No
Organelles	No	No
Type of Cell	Simple	Complex



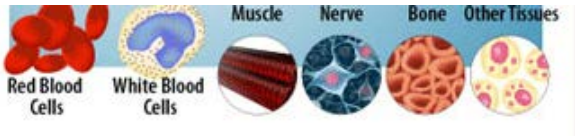
3. Animal Cells and Plant Cells are Eukaryotic Cells with cell organelles.

CELL ORGANELLES

ORGANELLE	LOCATION	DESCRIPTION	FUNCTION
CELL WALL	Plants cells only	OUTER LAYER , RIGID, STRONG, STIFF, NON-LIVING	*Protects and Support Cell * Allows oxygen and water to pass through
CELL MEMBRANE	Both plants and animal cells	Plant - inside cell wall Aniimal - outer layer	Controls what comes in and out of the cell
NUCLEUS	Plant and Animal Cells	Rounded shape surrounded by rest of organelles	Controls the cells activities
CYTOPLASM	Both plants and animal cells	Clear gel-like fluid	Home to the cell's organelles
MITOCHONDRIA	Both plants and animal cells	Bean shaped with inner membrane	Breaks down sugar molecules to create energy
ENDOPLASMIC RETICULUM	Both plants and animal cells	Network of folded tubes or membranes	Carries protein and other materials from one part of the cell to another
RIBOSOMES	Both plants and animal cells	Small bodies floating free or attached to the endoplasmic reticulum	Produces proteins
GOLGI BODIES	Both plants and animal cells	Flattened sacs or tubes	Receives proteins and other materials from the Endoplasmic Reticulum and packages them and then redistributes them
CHLOROPLASTS	Plants cells only	Green, oval structures usually containing chlorophyll	Captures energy from sunlight and uses it to produce food for cells
VACUOLES	Both plants and animal cells	Fluid-filled sacs	Storage area for cells
LYSOSMES	Plants cells -uncommom Animal cells - common	Small round structures	Use chemicals to break down large food particles into smaller ones, and breaks down old cells.



4. Specialized cells are cells that have developed special functions and features. Each cell starts to specialize into its special job—this is determined by the DNA, which holds the genetic code and controls what a cell turns into.



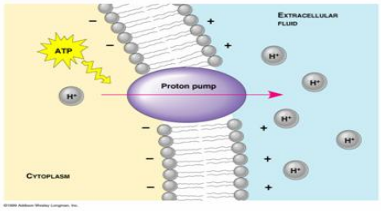
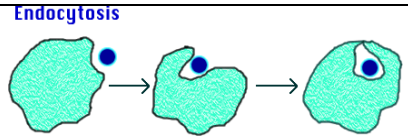
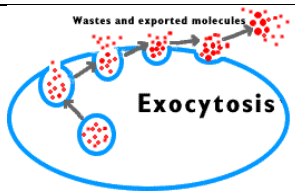
Cell Energy: Photosynthesis and Cellular Respiration

	Photosynthesis	Cellular Respiration
Occurs in:	Plant Cells, Some Prokaryotic and Protist Cells	Plant Cells and Animal Cells
Takes place in the:	Chloroplast	Mitochondria
Reactants (uses)	Water + Carbon Dioxide + Sunlight (energy)	Glucose + Oxygen
Produces (creates)	Glucose + Oxygen	Water + Carbon Dioxide + ATP (energy)
Full Equation	$6\,CO_2 + 6\,H_2O \xrightarrow{\text{Light energy from the sun}} C_6H_{12}O_6 + 6\,O_2$ carbon dioxide; water; glucose; oxygen	$C_6H_{12}O_6 + 6O_2 \rightarrow 6H_20 + 6CO_2 + \text{energy}$ (glucose + oxygen → water + carbon dioxide + energy)

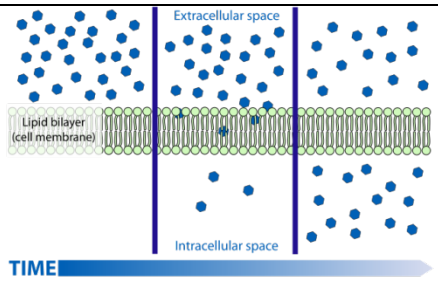
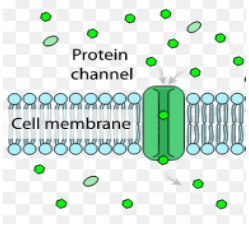
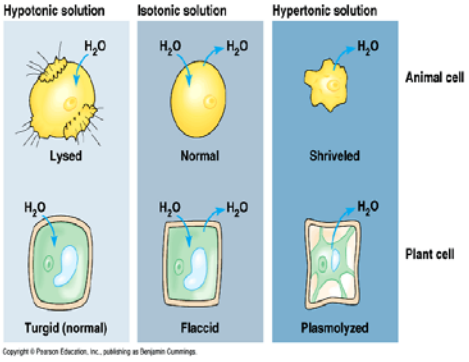
Cell Transport: Moving molecules across the cell membrane in order to maintain homeostasis.

1. Cells move things across the cell membrane in order to maintain homeostasis—a balance, equilibrium. There are two types of transport—Active Transport and Passive Transport.

2. Active Transport requires energy input in order to move things across the cell membrane.

Active Transport Moves molecules in and out of the cell using a protein pump in the cell membrane		Example: Sodium/Potassium Pump
Endocytosis Cell membrane eats/ingests food or liquids into the cell		Example: A White Blood Cell eating a foreign particle
Exocytosis A cell releases a substance like hormones or wastes through the cell membrane.		Example: A cell releasing hormones

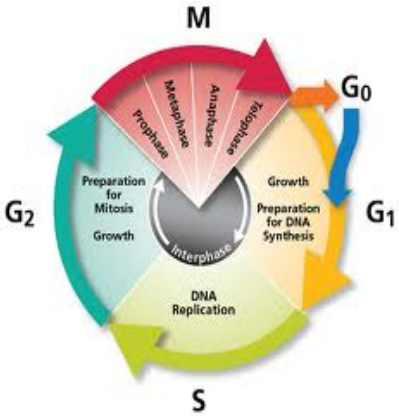
3. Passive Transport does not require energy.

Diffusion Movement of small molecules from areas of high concentration to areas of low concentration		Example: Diffusion of respiratory gases-- CO2 and O2 across the blood vessels and cells for cellular respiration
Facilitated Diffusion Uses protein channels to move larger molecules that cannot pass through the cell membrane. Does not require energy!!		Example: Glucose leaving the blood stream into cells for cellular respiration
Osmosis Movement of WATER ONLY across cell membranes of cells. Does not require energy!!		Example: Salt and Fresh Water Fish Hypertonic: Water enters cell, cells swell, and burst Hypotonic: Water leaves cell, cells shrinks and dies Isotonic: Equilibrium, cells are happy ☺

The Cell Cycle: Living organisms are made up of cells. Cells grow through the "cell cycle."

1. There are three phases of the Cell Cycle:
    a. Interphase: The majority of a cell's life
        i. G1—The cell goes through normal growth and function
        ii. S – DNA is replicated
        iii. G2 – The cell prepares for Mitosis
    b. Mitosis: The nucleus of a cell divides
        i. Prophase: DNA condenses into chromosomes
        ii. Metaphase: chromosomes line up in the center
        iii. Anaphase: chromosomes are separated to opposite poles of the cell
        iv. Telophase: nucleus finishes dividing
    c. Cytokinesis: The cell completely divides into two daughter cells

Note:
Interphase: cell goes through normal cell life function/job
Mitosis: when the nucleus divides
Cytokinesis: When the cell divides



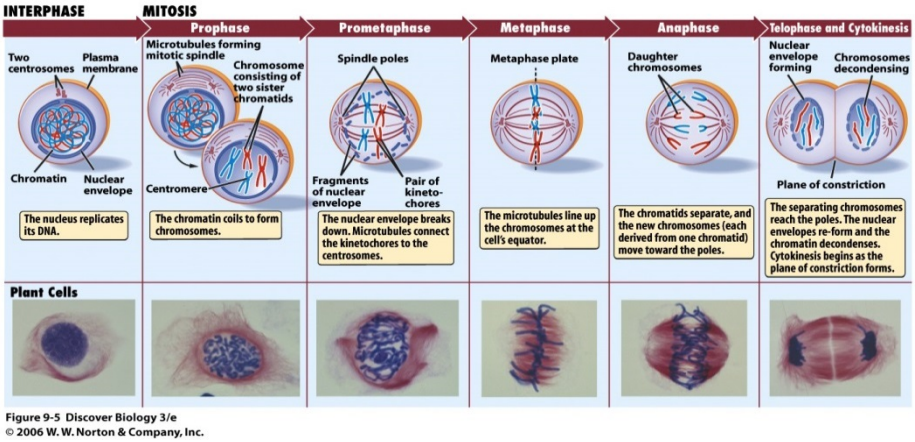


Figure 9-5 Discover Biology 3/e
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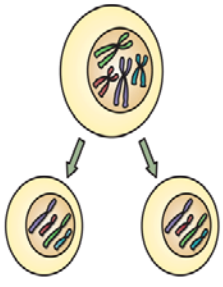
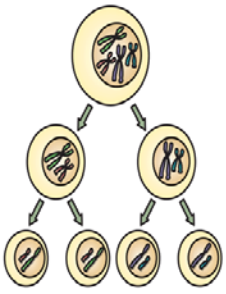
2. Disruptions in the cell cycle are when the cell loses control of cell division and cannot stop dividing-- Which results in abnormal cell growth called tumors = cancer.

Mitosis vs. Meiosis:

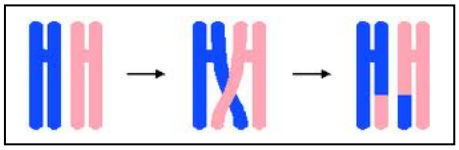
Mitosis creates body cells; Meiosis creates gametes sperm & egg

	Mitosis	Meiosis
# of divisions	1	2
# daughter cells	2 cells	4 cells
Genetic Make up	Identical	Unique
Type of cell created	Diploid (2n)	Haploid (n)
Type of reproduction	Asexual	Sexual
Examples	Skin, Hair	Sperm, Egg

MITOSIS	MEIOSIS
Produces genetically identical cells	Produces genetically unique cells
Results in diploid cells	Results in haploid cells
Takes place throughout an organism's lifetime	Takes place only at certain times in an organism's life cycle
Involved in asexual reproduction	Involved in sexual reproduction
	

1. Mitosis creates 2 identical daughter cells that are body cells, like skin cells.

2. Meiosis creates 4 genetically different daughter cells, like sperm or egg. Each cell has ½ the number of chromosomes because a sperm from dad and an egg from mom will combine to create a baby—which the full number of chromosomes.
    a. Things that occur to ensure genetic diversity (that's why you can have the same parents are your siblings, but still look different even though your DNA comes from the same place.
        i. Crossing Over of Chromosomes: see Diagram →
        ii. Segregation of Alleles: Alleles separate and move into different haploid gamete sex cell.
        iii. Independent Assortment: Traits don't follow each other, they move independently.

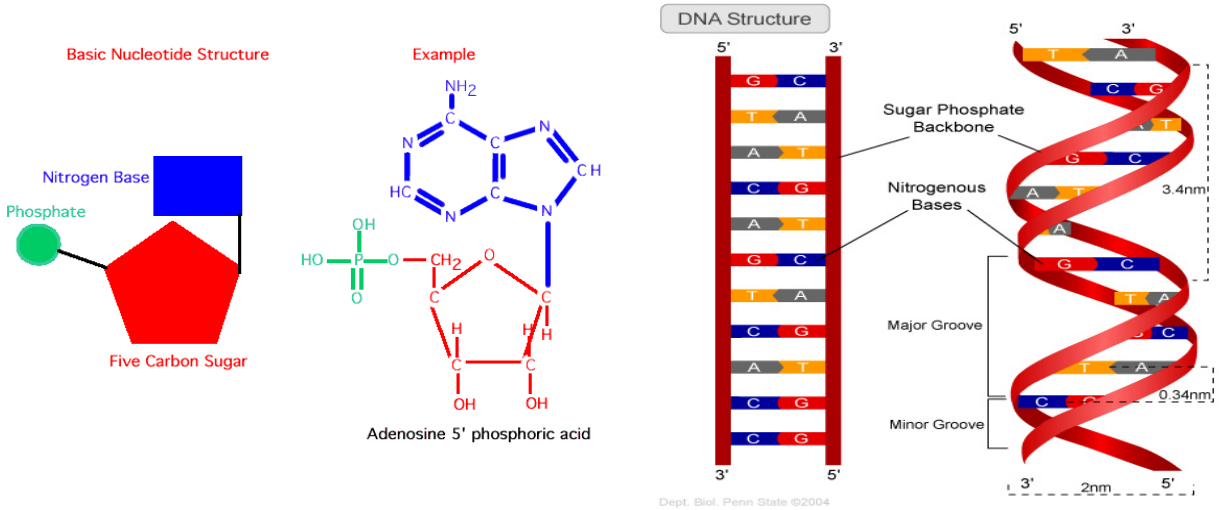


DNA Structure: DNA holds the genetic blueprint for all living organisms

5. DNA is found in the nucleus of all eukaryotic cells; it's just floating inside of prokaryotic cells.

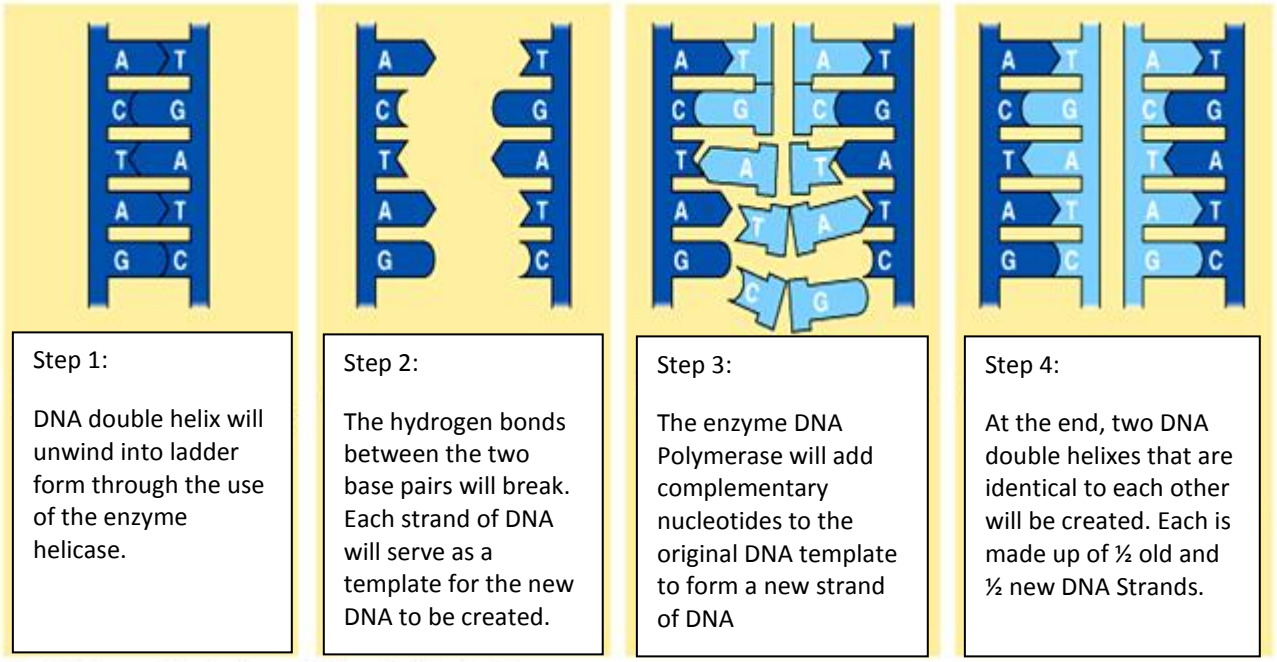
6. DNA is a form of Nucleic Acids (which is one of your 4 biomolecules- Lipids, Carbohydrate, Protein, Nucleic Acid).
   a. Monomers: Nucleotides
   b. Polymers: DNA and RNA

7. DNA is found in the form of a double helix. There are two strands that run anti-parallel.
   a. Backbone/Sides of DNA are made up of a sugar [Deoxyribose] and a phosphate
   b. The steps/rungs of DNA are made up of paired bases
      i. Adenine – Thymine
      ii. Cytosine – Guanine



8. DNA is inheritable. You get your DNA, your genes, from your parents.

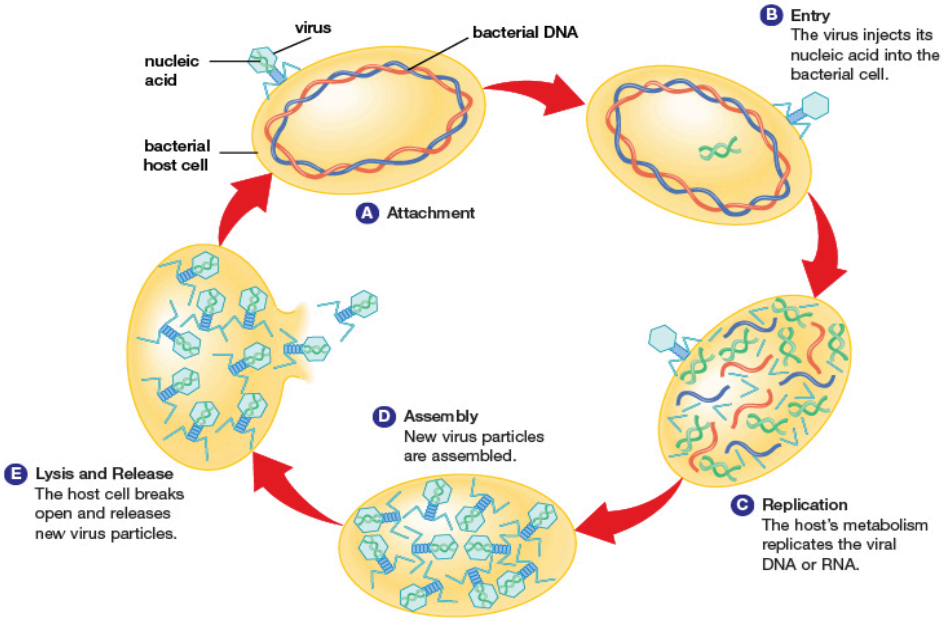
9. In the S Phase of the Cell Cycle, your DNA is replicated in preparation for mitosis, which is where one cell will grow and divide into two cells.



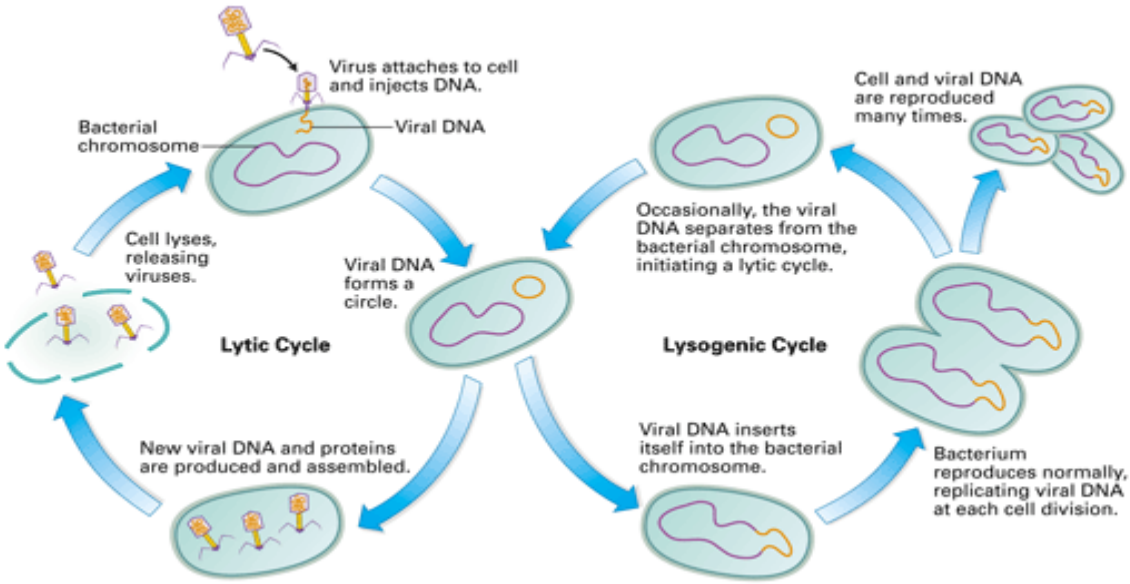
Step 1:	Step 2:	Step 3:	Step 4:
DNA double helix will unwind into ladder form through the use of the enzyme helicase.	The hydrogen bonds between the two base pairs will break. Each strand of DNA will serve as a template for the new DNA to be created.	The enzyme DNA Polymerase will add complementary nucleotides to the original DNA template to form a new strand of DNA	At the end, two DNA double helixes that are identical to each other will be created. Each is made up of ½ old and ½ new DNA Strands.

Viruses: Non-living organisms that invade living organisms

1. Viruses cannot be "cured" and are not affected by antibiotics. The medicine you take helps relieve the symptoms. Antibiotics are used to treat living pathogens like bacteria and viruses are not alive.
2. Viruses are not living organisms because they can not reproduce on their own. They must use another living cell (from a host) in order to make more virus parts.
3. The Human Immunodeficiency Virus (HIV) is a dangerous virus because it attacks the immune system T-cells, decreasing the body's ability to fight off infections.
4. Influenza (flu) attacks the respiratory system, leading to difficulty breathing and possibly pneumonia.
5. There are two reproductive cycles.
    a. Lytic: Attacks your cell right away and makes you sick immediately; you only get better when you immune system finishes fighting off the virus.
        i. Example: Flu, Common Cold



    b. Lysogenic: Virus injects its DNA into host cell and then lies dormant (asleep) for a period of time. Every time the host cell divides (mitosis), it will divide with the viral DNA. When it "wakes up," the virus enters the lytic cycle and attacks other living cells.
        i. Example: HIV →AIDS, Herpes



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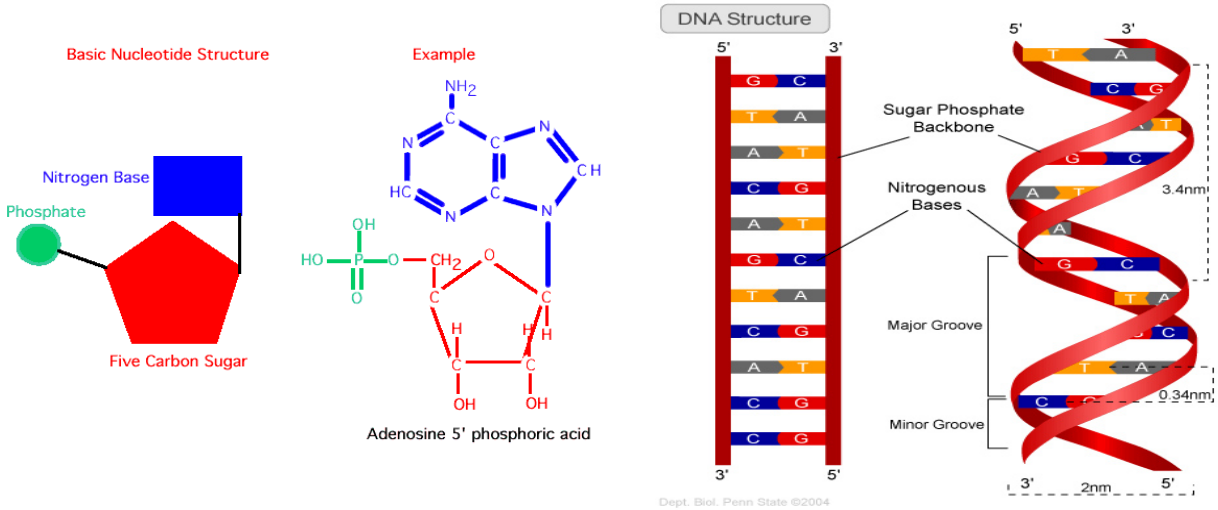

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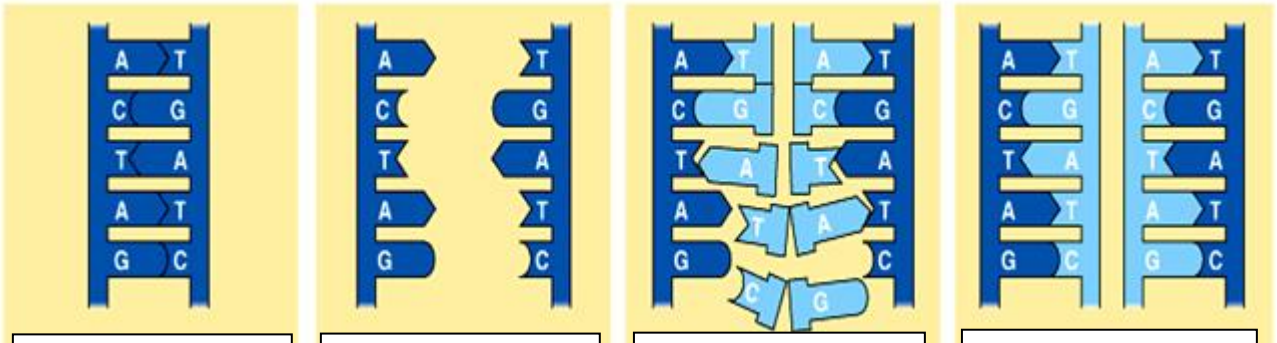

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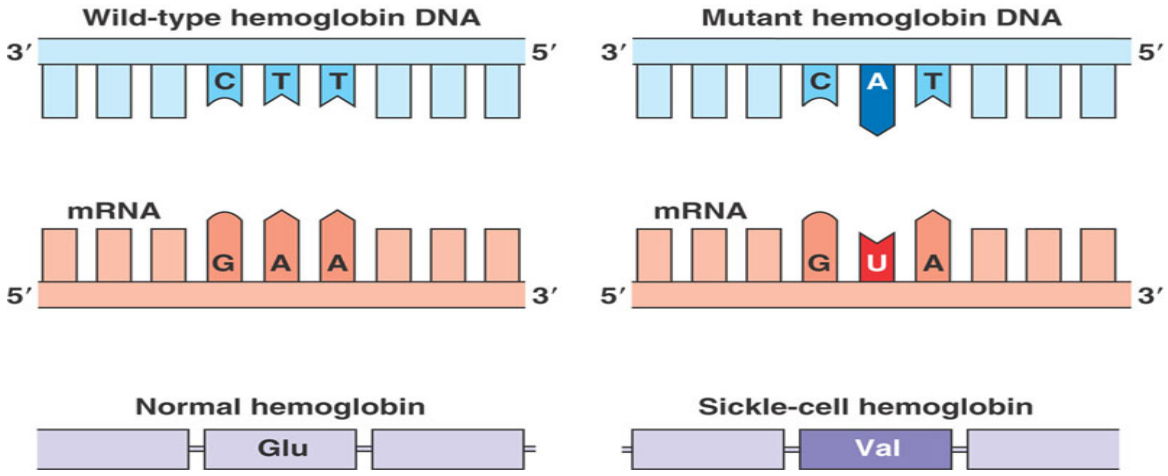
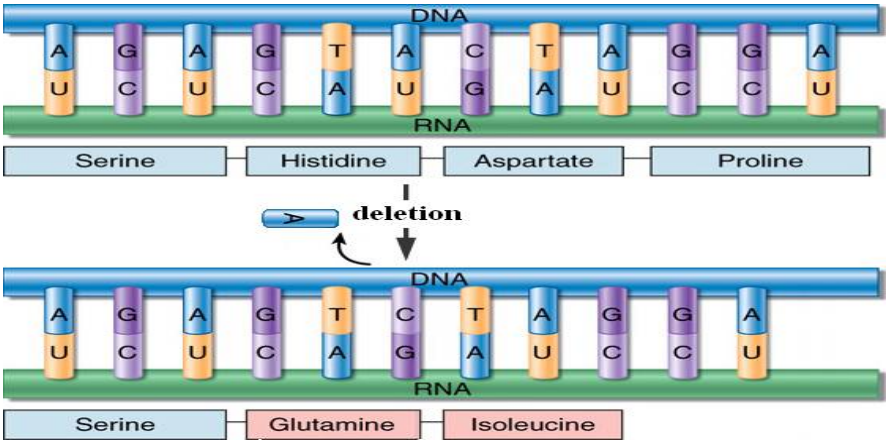
15. Sometimes, mutations in the DNA nucleotide bases can occur. This can be due to environmental factors like UV rays and radiation poisoning or it can be due to mistakes that occur when your cells go through DNA Replication during the S Phase of Interphase. There are two types of Gene Mutations (which is different from Chromosomal Mutations, which are mutations in the structure of the chromosomes on page 5 of this guide).

    a. Point Substitution Mutation: when one nucleotide base is replaced and substituted with a different base. It only affects one codon.

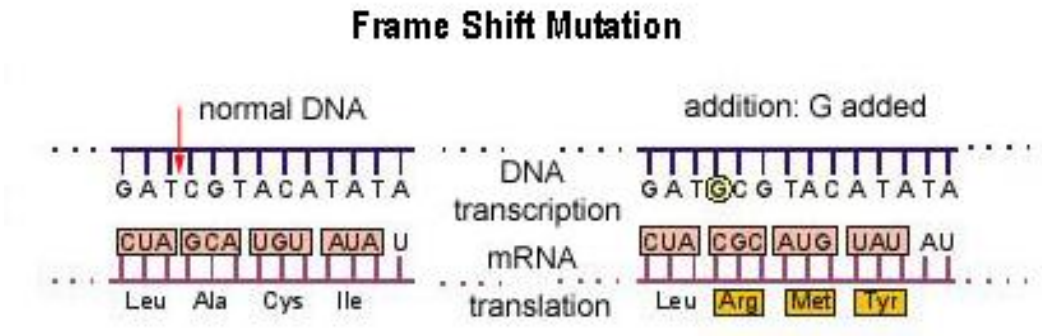


    b. Frameshift Mutation: when a nucleotide is deleted or added, causing the reading frame (which is in threes = codons) to shift

        i. Frameshift Deletion: when nucleotides are deleted and causes the reading frame to shift to the left



        ii. Frameshift Addition: when nucleotides are added and causes the reading frame to shift to the left



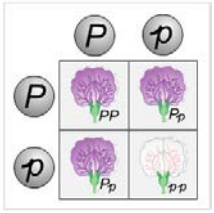
REPORTING CATEGORY 2: MECHANISMS OF GENETICS

Genetics- Punnett Squares: predicting the probability of a trait

Each organism gets its traits from mom (1/2) and dad (1/2). You can predict the probability of an organism receiving a trait by using punnett squares.

1. Phenotype: Physical traits (what you can see)
2. Genotype: Genes or alleles
    a. Homozygous: Purebred; same alleles
        i. Example: EE, ee, AA, aa, HH, hh
    b. Heterzygous: Hybrid; different alleles
        i. Example: Ee, Aa, Hh

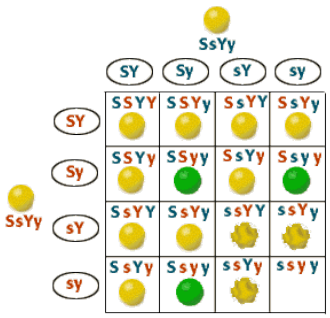
3. Mendelian Traits (discovered by Mendel and his pea plants)
    a. Simple Dominance and Recessive Traits: One trait is more dominant and masks than the other.
        i. Example: P = Purple; p = white



PP = Purple → 1 of 4 = 25%
Pp = Purple → 2 of 4 = 50%
pp = white → 1 of 4 = 25%

Purple = 3 of 4 = 75% White = 1 of 4 = 25%

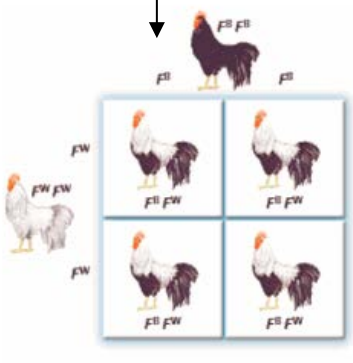
    b. Dihybrid: Looking at the probability of two traits; You must FOIL the parent genotypes before using a punnett square
        i. Example: S = Smooth, s = wrinkled; Y = yellow, y = green



SSYY = Smooth Yellow → 1 of 16
SSYy = Smooth Yellow → 1 of 16
SSyy = Smooth Green → 2 of 16
SsYY = Smooth Yellow → 2 of 16
SsYy = Smooth Yellow → 4 of 16
Ssyy = Smooth Green → 2 of 16
ssYY = Wrinkled Yellow → 1 of 16
ssYy = Wrinkled Yellow → 2 of 16
ssyy = Wrinkled Green → 1 of 16

Smooth Yellow = 9 of 16
Smooth Green = 3 of 16
Wrinkled Yellow = 3 of 16
Wrinkled Green = 1 of 16

4. Non-Mendelian Traits
    a. Co-dominance: Both traits are dominant and you will see both traits appear
        i. Example: A Blood + B Blood = AB Blood
        ii. Example: Black + White Cow = Spotted Black and White Cow

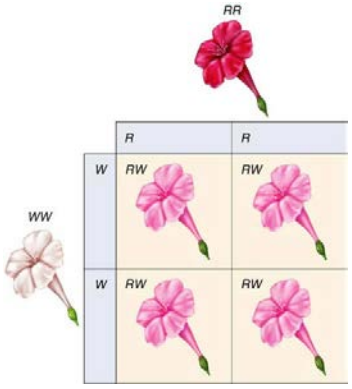


Co-dominance

BB = Black

WW= White

BW= Black and White



Incomplete Dominance

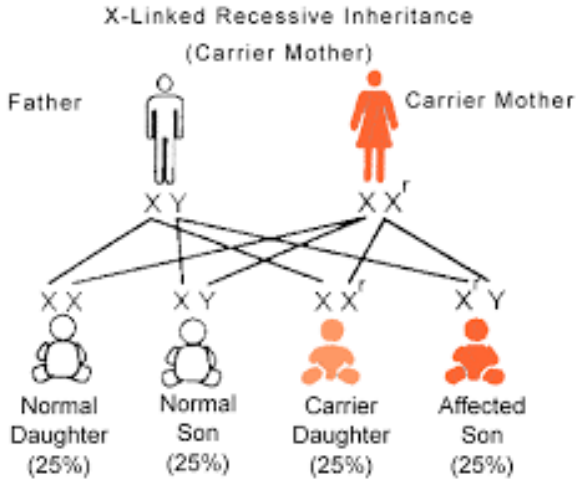
RR = Red

WW = White

RW = Pink

    b. Incomplete Dominance: One trait is not more dominant than the other- they blend to form a new trait.
        i. Example: Red + White Flower = Pink Flowers
        ii. Example: Black + White cats = Gray Cats
        iii. Example: Tall + Short = Medium

5. Sex-Linked Traits
   a. In this case, an inheritable trait is carried on one of the sex chromosomes (the X chromosome or the Y chromosome).
   b. Y-linked traits only show up in male offspring (because females don't have Y chromosomes).
   c. X-linked traits are twice as likely to show up in male offspring as in female offspring. This is because females have two X chromosomes, and X-linked recessive traits would be masked by the other dominant X chromosome. Look at the following hemophilia example.

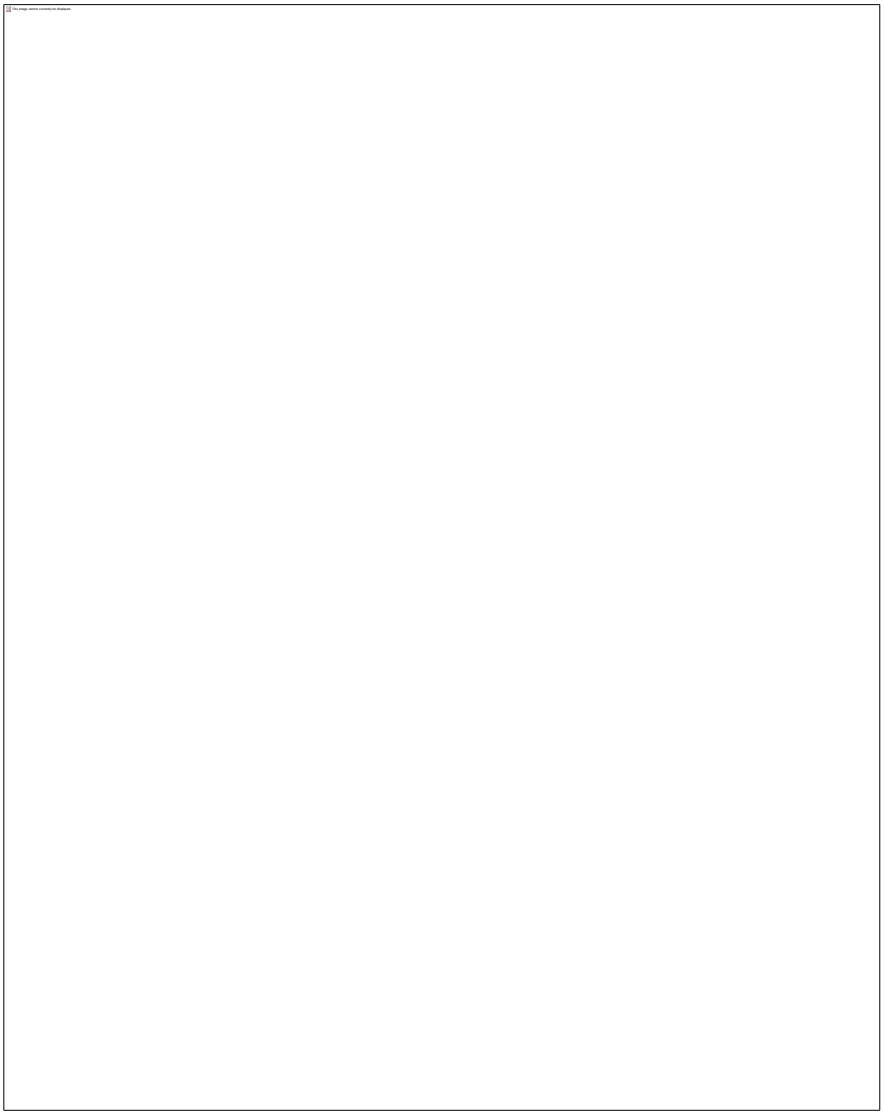


In this case, a father has a normal genome with a normal X and Y chromosome. A mother, however, is a carrier for a disease. This means she has one normal X chromosome and an X^r chromosome that carries a disease trait.

As you can see in the diagram to the right, the father passes his normal X chromosome to both of his daughters, but the mother passes one of her X chromosomes to a daughter who will not be a carrier and the other daughter who will be a carrier.

For the sons, one will be a normal son, receiving his Y chromosome from his father and a normal X chromosome from his mother. The other son, however, will have the disease because he will have gained the affected X^r chromosome from his mother.

Meiosis: the process of cell division which produces the gametes (sex cells, sperm and eggs)



1. Meiosis and Mitosis start out the same way. The chromosomes in the nucleus of the cell are duplicated in preparation for division.

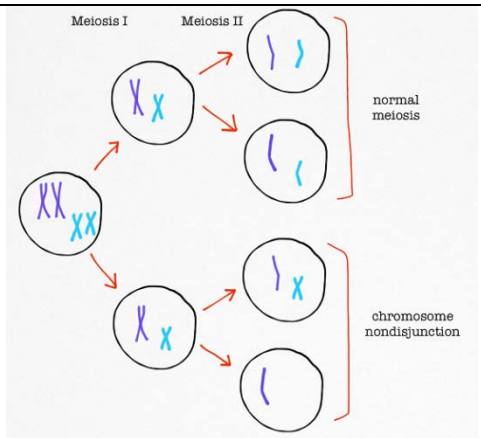
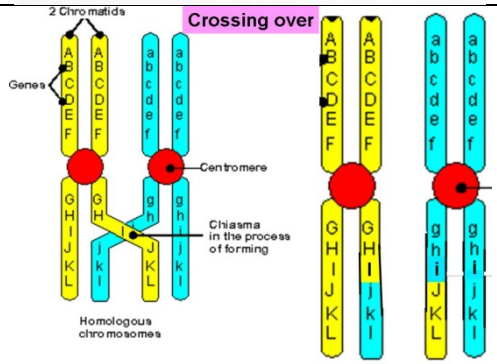
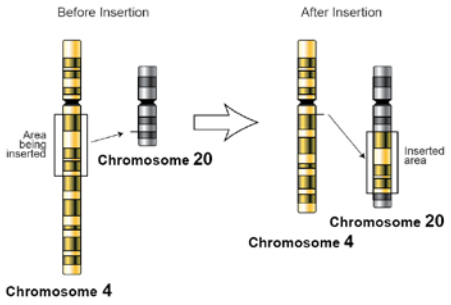
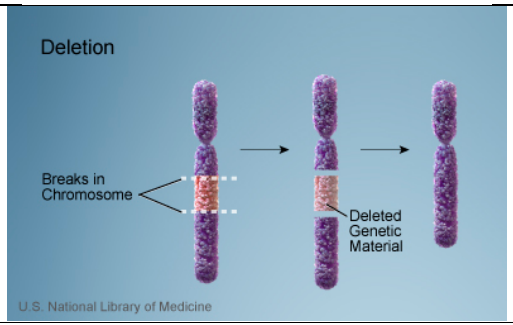
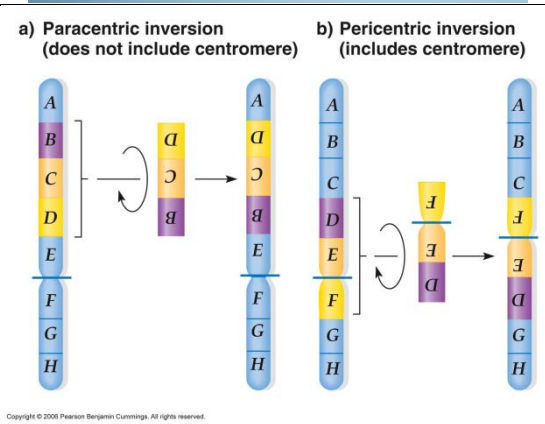
2. Both cells then undergo cell division, creating two copies of the original cell.

3. However, in meiosis, the cells divide for a second time. Since each human cell starts out with two copies of every chromosome (diploid), the gametes produced by meiosis now only have half as many (haploid).
   a. Humans have 23 pairs of chromosomes for 46 chromosomes total.
   b. The gametes that are produced only have one copy of each, and thus 23 chromosomes.

4. Before the second cell division, the chromosomes can get tangled up with each other. This can result in nondisjunction, insertion, deletion, or crossing over.

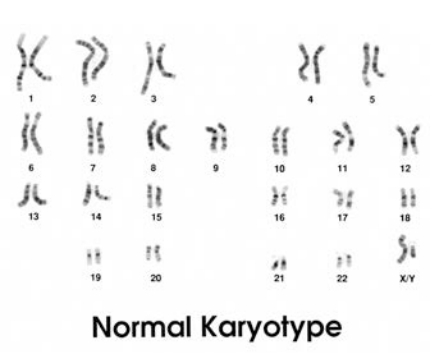
BIOLOGY EOC READING GUIDE

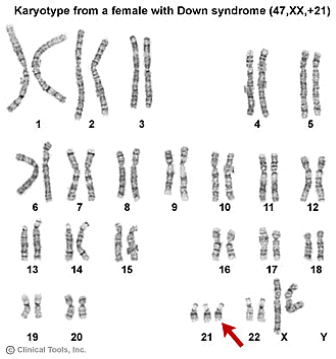
The following table describes what can happen to chromosomes during meiotic cell division. This is a normal and beneficial process because it helps contribute to the genetic diversity of organisms by mixing up the genes even more.

Nondisjunction – In this case, chromosomes fail to separate. This results in some gametes having an extra copy of a chromosome. This can lead to some genetic disorders, such as trisomy 21 (shown below in the karyotype).	
Crossing over – In this case, parts of different chromosomes get tangled up and trade parts with each other. This helps contribute to the genetic diversity of organisms by mixing up the genes a little.	
Insertion – Though it can happen through other means, such as infection with a virus or through gene technology, sometimes crossing over results in the transfer of whole sections of a chromosome to another one without exchange of material.	
Deletion – In this case, a whole section of a chromosome goes missing.	
Inversion – In this case, a portion of the DNA is cut, inverted, and then reinserted into the same spot. This can cause issues with the way genes are read and can render some genes unexpressable.	

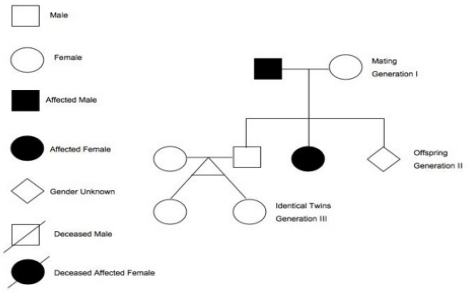
Gene Technology: using technology and looking at our genes

1. Karyotype: a picture of chromosomes used to identify chromosomal mutations; For every pair, there are two chromosomes (1 from Mom, 1 from Dad); Girls are XX and Boys are XY





2. Pedigree: family tree that traces genetic traits



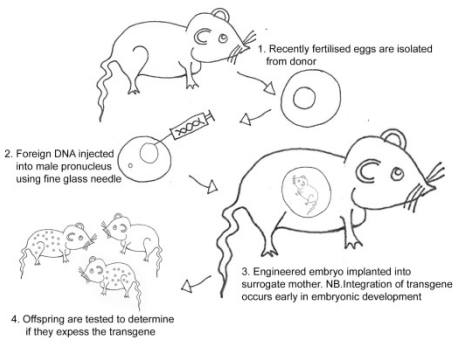
3. Genetically Modified Organisms: organism's genetic material has been altered using genetic engineering [ex: food]

4. Gene Therapy: using DNA as a pharmaceutical agent to treat disease

5. DNA Fingerprinting/Identification: sequencing DNA to identify and evaluate genetic information

6. Cloning: process of producing genetically identical individuals that occur in nature

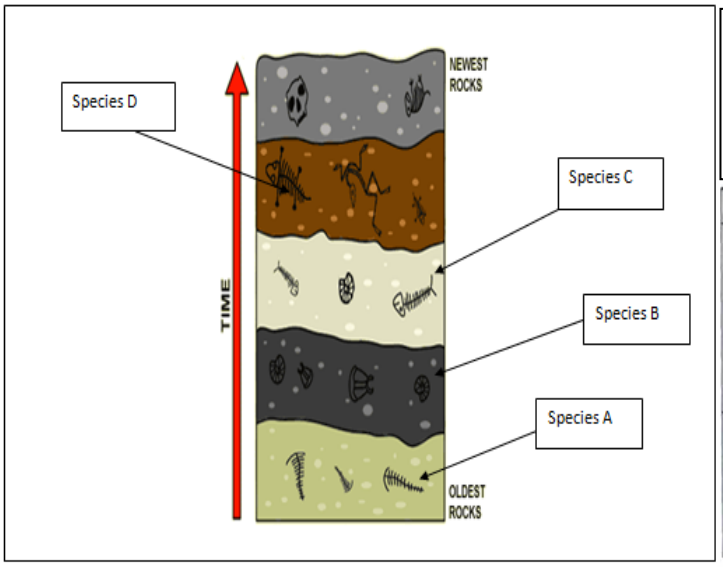
7. Transgenic Animals/Recombinant DNA: deliberately inserting a foreign gene into an organism



REPORTING CATEGORY 3: EVOLUTION AND CLASSIFICATION

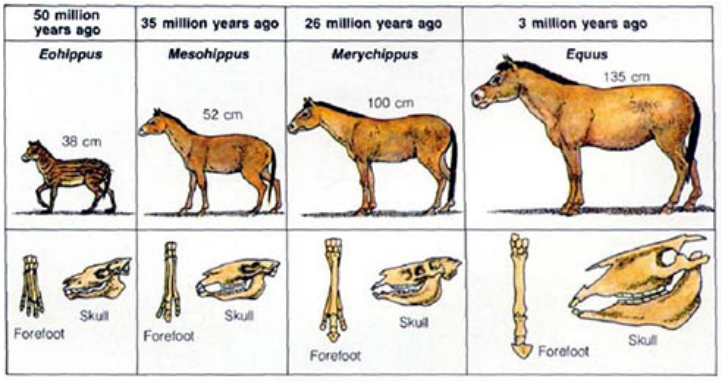
Evidence for Evolution: Evidence that supports the theory of evolution by looking at common ancestors

1. Fossil Records: records of lines of ancestry that are preserved through fossils locked in rock layers
    a. Gradualism – evidence of evolution would show gradual changes to the population as you examined the different layers of the fossil record.
    b. Puntuated equilibrium – Changes in the fossils of organisms would make a sudden appearance surrounded by periods of relative stability

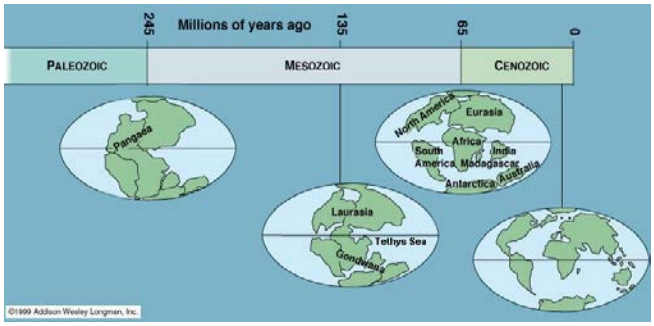


Newest rocks are closer to the surface. Older rocks are closer to the center of the earth.

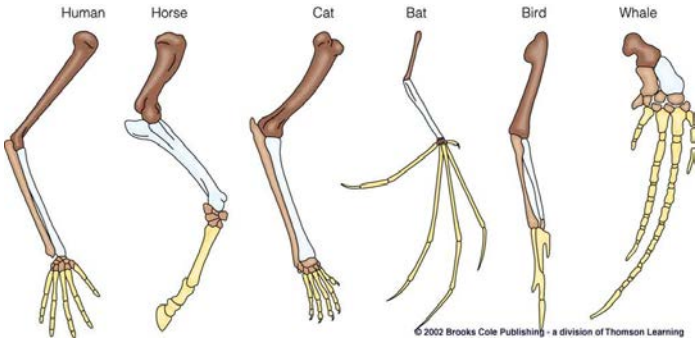
Fossil records can show how species evolved over time.



2. Biogeography: species that live in the same area are closely related, but some ancestors are found living far apart; Pangaea →continents
    a. This is why fossils found in western Africa (near the Atlantic coast) show similarities to fossils found in the jungles of South America in Brazil



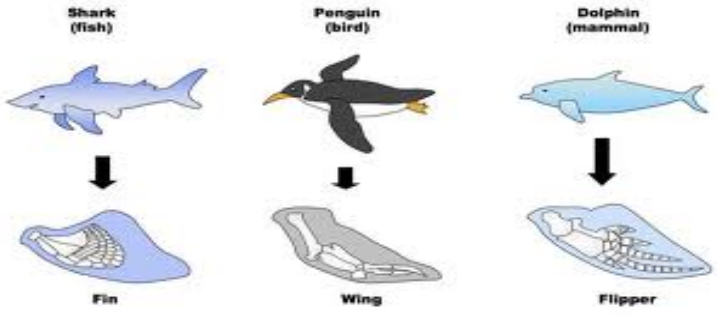
3. Anatomical Homologies: looking at structures vs. function
    a. Homologous Structures: structures that have evolved to have different functions = common ancestors
        i. Homologous structures often have similar characteristics in their bone structures



    b. Analogous Structures: structures have adapted to have similar functions, but they have different structures

Bird Wing

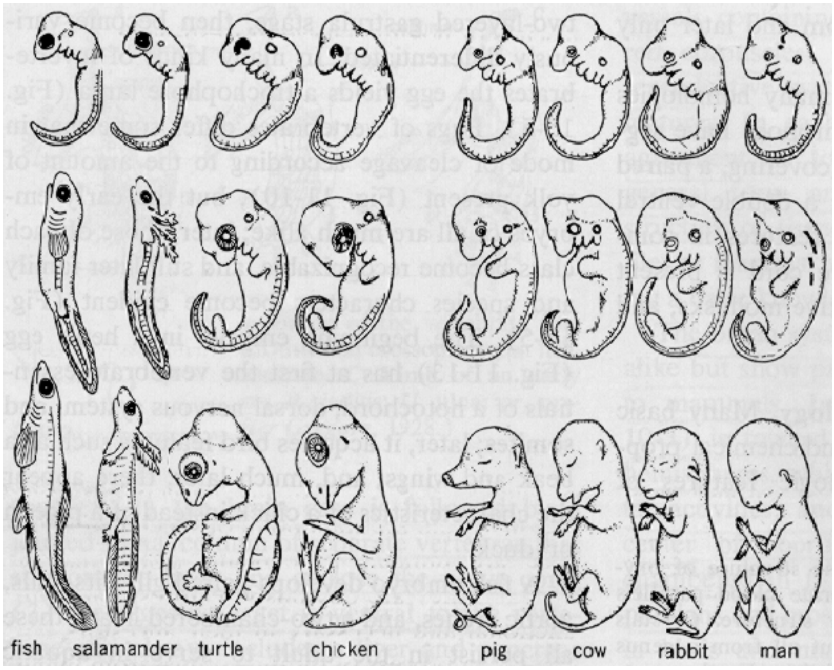
Insect Wing



4. Molecular/DNA Homologies: organisms that share common ancestors are related and can be proven by looking at DNA; similar DNA = common ancestor because you get your DNA from your parents

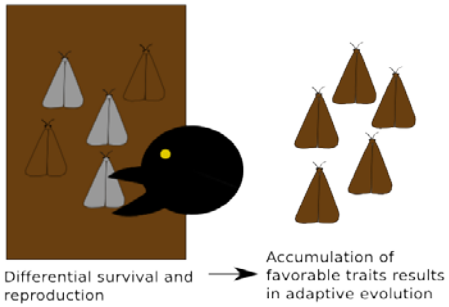
Species	Sequence of Amino Acids in the Same Part of the Hemoglobin Molecules
Human	Lys-Glu-His-Iso
Horse	Arg-Lys-His-Lys
Gorilla	Lys-Glu-His-Lys
Chimpanzee	Lys-Glu-His-Iso
Zebra	Arg-Lys-His-Arg

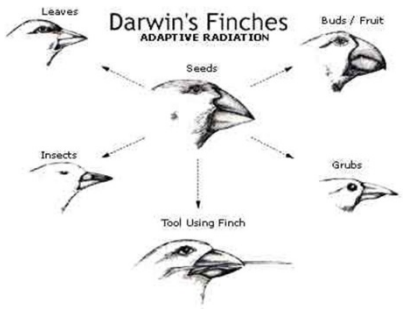
5. Embryology: some organisms start developing in ways that are common = similar DNA that dictates how organisms develop = common ancestors



Mechanisms for Evolution: Explanation for diversity of organisms and how organisms change over time

1. Natural Selection
    a. Charles Darwin
    b. Survival of the Fittest
        i. The organisms with the best adaptations live to reproduce and pass on their DNA/Traits
        ii. Organisms without the best adaptations die, do not reproduce, their DNA/trait are lost
    c. Occurs in populations, not individuals



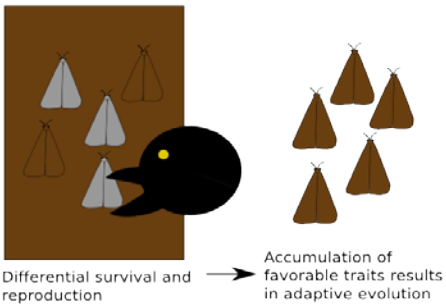


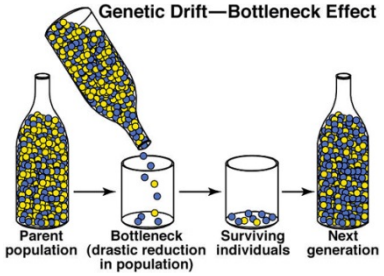
2. In order for Natural Selection to occur, the following must be true:
   a. Organisms must be able to inherit DNA/Traits from parents
   b. Finite Amount of Resource so organisms must compete in order to survive, otherwise, there'll be enough food and shelter for all organisms to survive.
   c. Reproductive Success – organisms that die are replaced by new organisms (that are born)

3. Other Situations that may result in evolution
   a. Genetic Drift: A change in the gene pool (organisms that can reproduce) that causes the species to evolve change

      i. Bottleneck Effect: a disaster happens and part of the population dies resulting in genetic drift

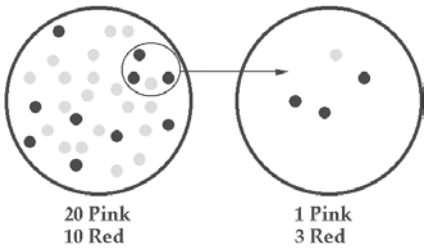
      For example, an environmental disaster changes the appearance of an environment. Moths living on a tree are no longer camouflaged, except for those that blend in with the new color. Only those moths that survive are "let out of a bottle," meaning that the new colors make up the new population.



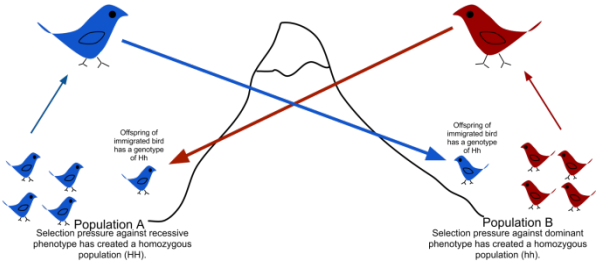


      ii. Founder's Effect:: a small portion of the population leave the area and form a new gene pool

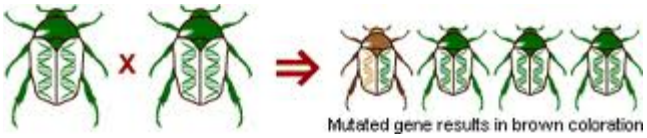
      For example, bacteria that are resistant to drugs are picked up after using the bathroom and placed on a countertop where they grow. Everyone gets sick because the new drug-resistant bacteria grow and flourish in the new environment.



   b. Gene Flow (Migration): a change in the gene pool due to movement of organisms (migration). Birds and even people who move around spread their genes to new places.



   c. Mutation: changes in DNA can cause a change in the population traits; increases genetic variation/diversity



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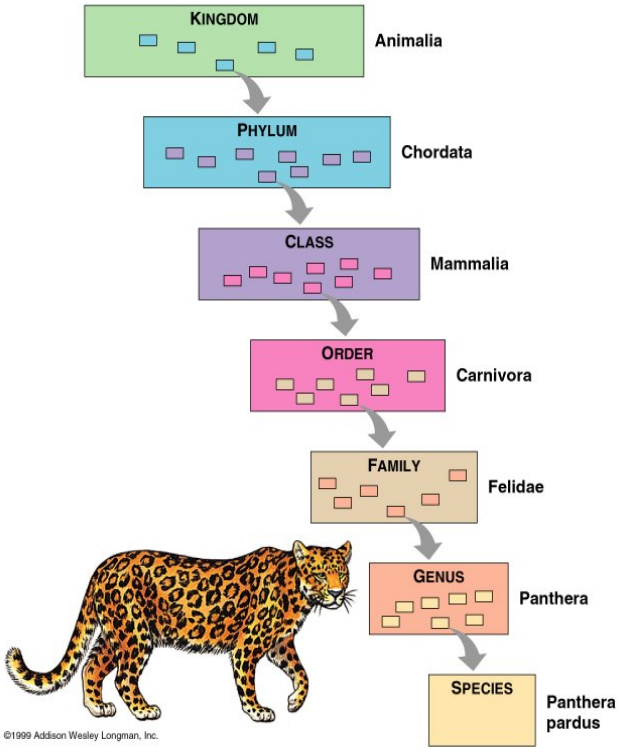
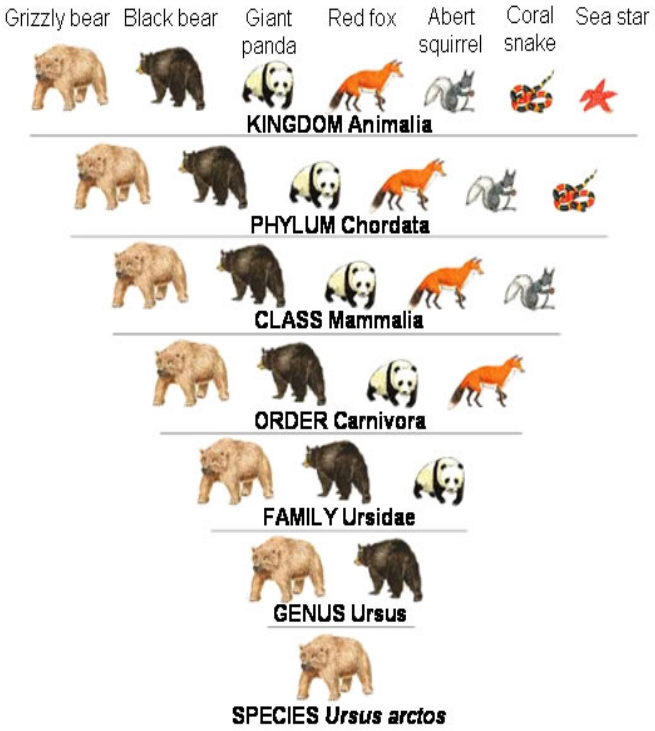
Taxonomy: Classifying organisms based on similarities

1. Organisms are classified into groups based on characteristics.

Classification of Living Things						
Domain	**Bacteria**	**Archaea**	**Eurkarya**			
Kingdom	**Eubacteria**	**Archaebacteria**	**Protista**	**Fungi**	**Plantae**	**Animalia**
Cell Type	Prokaryote	Prokaryote	Eukaryote	Eukaryote	Eukaryote	Eukaryote
Cell Structures	Cell walls with peptidoglycan	Cell walls without peptidoglycan	Cell walls of cellulose in some; some have chloroplasts	Cell walls of chitin	Cell walls of cellulose; chloroplasts	No cell walls or chloroplasts
Number Of Cells	Unicellular	Unicellular	Most unicellular; some colonial; some multicellular	Most multicellular; some unicellular	Multicellular	Multicellular
Mode Of Nutrition	Autotroph or heterotroph	Autotroph or heterotroph	Autotroph or heterotroph	Heterotroph	Autotroph	Heterotroph
Examples	Streptococcus, Escherichia coli	Methanogens, halophiles (Lives in extreme areas)	Amoeba, Paramecium, slime molds, giant kelp	Mushrooms, yeasts	Mosses, ferns, flowering plants	Sponges, worms, insects, fishes, mammals

2. Each organism has a scientific name made up of the "genus species" classification group names.

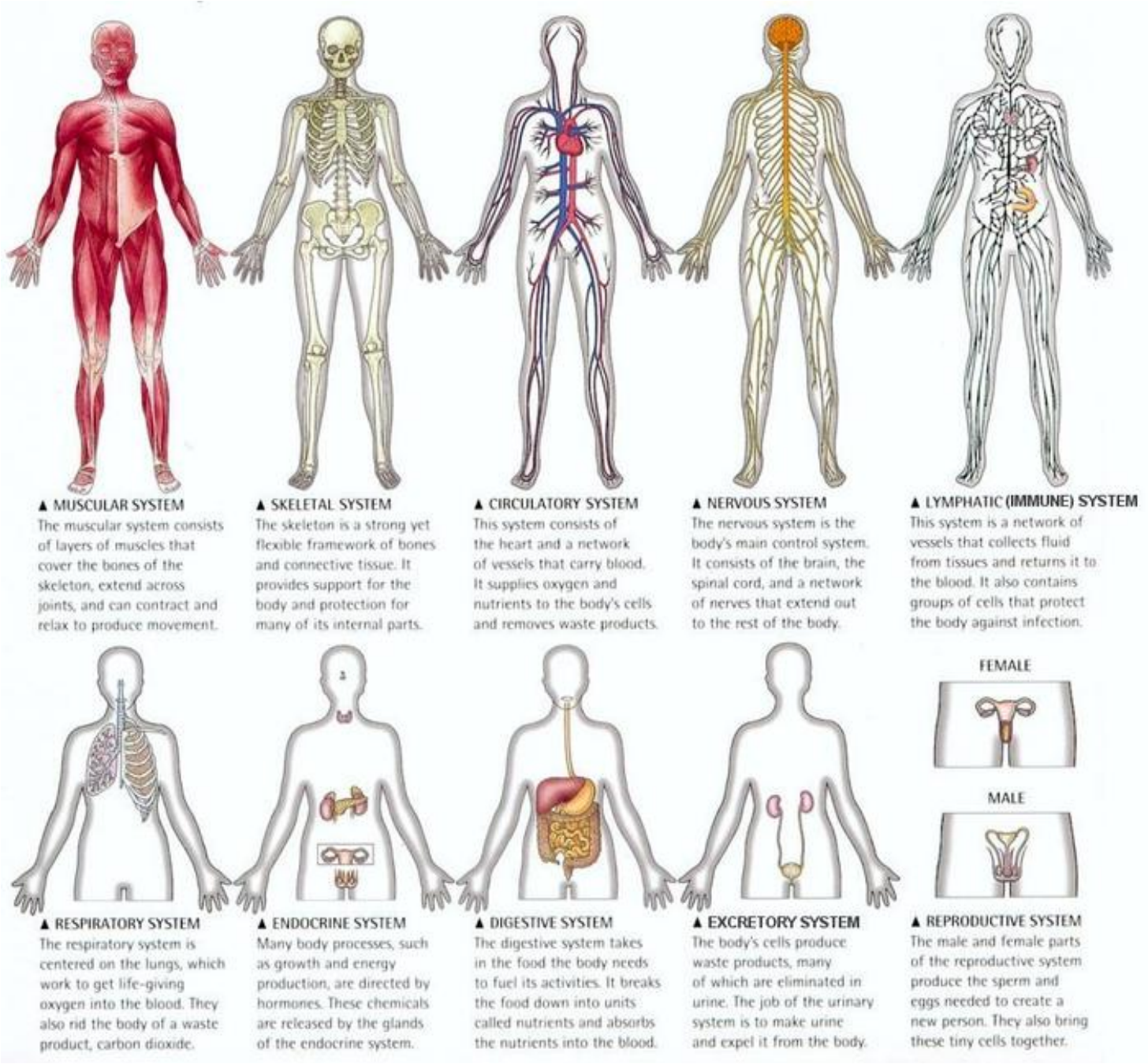




REPORTING CATEGORY 4: BIOLOGICAL SYSTEMS AND PROCESSES

Animal Body Systems:

Body systems must work together to keep an organism alive. No one individual body system can keep someone alive on its own.



▲ MUSCULAR SYSTEM
The muscular system consists of layers of muscles that cover the bones of the skeleton, extend across joints, and can contract and relax to produce movement.

▲ SKELETAL SYSTEM
The skeleton is a strong yet flexible framework of bones and connective tissue. It provides support for the body and protection for many of its internal parts.

▲ CIRCULATORY SYSTEM
This system consists of the heart and a network of vessels that carry blood. It supplies oxygen and nutrients to the body's cells and removes waste products.

▲ NERVOUS SYSTEM
The nervous system is the body's main control system. It consists of the brain, the spinal cord, and a network of nerves that extend out to the rest of the body.

▲ LYMPHATIC (IMMUNE) SYSTEM
This system is a network of vessels that collects fluid from tissues and returns it to the blood. It also contains groups of cells that protect the body against infection.

▲ RESPIRATORY SYSTEM
The respiratory system is centered on the lungs, which work to get life-giving oxygen into the blood. They also rid the body of a waste product, carbon dioxide.

▲ ENDOCRINE SYSTEM
Many body processes, such as growth and energy production, are directed by hormones. These chemicals are released by the glands of the endocrine system.

▲ DIGESTIVE SYSTEM
The digestive system takes in the food the body needs to fuel its activities. It breaks the food down into units called nutrients and absorbs the nutrients into the blood.

▲ EXCRETORY SYSTEM
The body's cells produce waste products, many of which are eliminated in urine. The job of the urinary system is to make urine and expel it from the body.

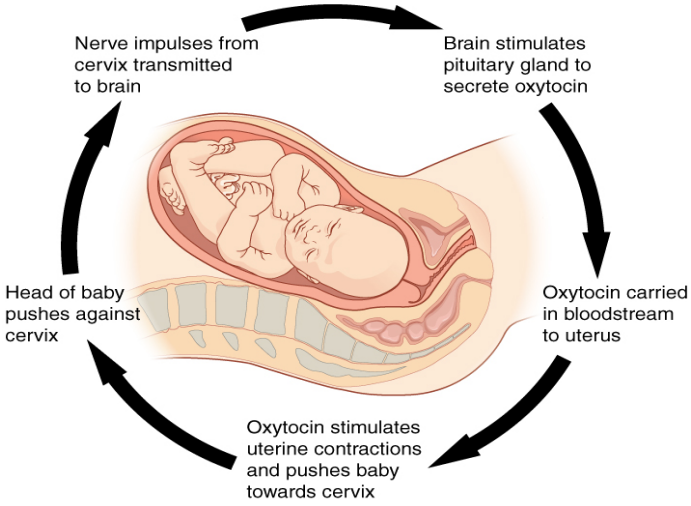
FEMALE

MALE

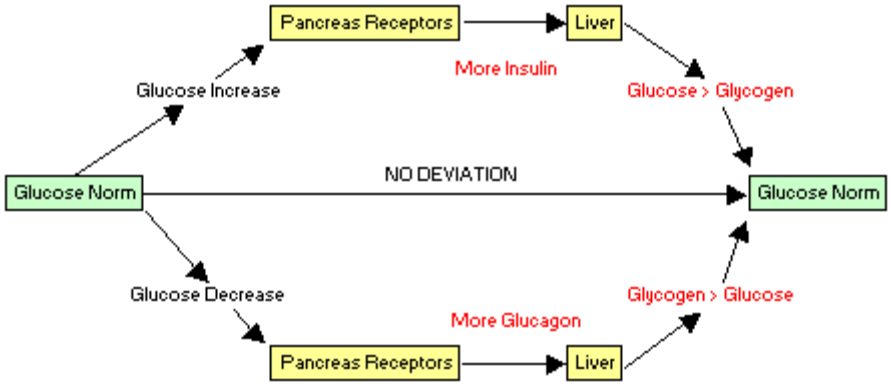
▲ REPRODUCTIVE SYSTEM
The male and female parts of the reproductive system produce the sperm and eggs needed to create a new person. They also bring these tiny cells together.

BIOLOGY EOC READING GUIDE

1. Feedback Mechanisms: Your body is able to regulate itself and maintain homeostasis through Feedback mechanisms.
    a. Positive Feedback: Keep increasing a response until the disturbance is over
        i. Fever: Increasing body temperature until the virus/pathogen is "dead"
        ii. Child Labor: Increasing muscle contractions until the baby is born



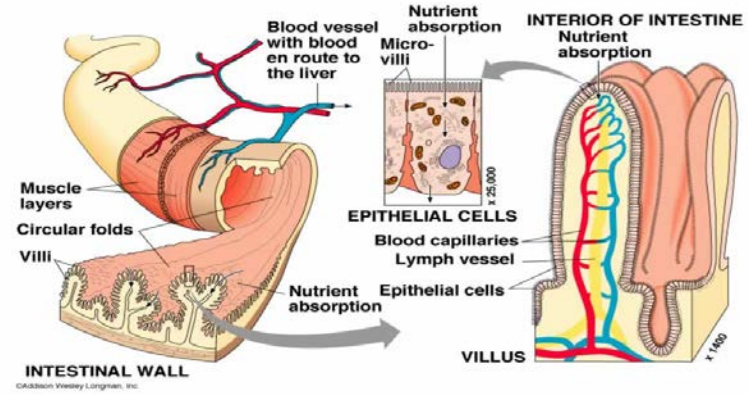
    b. Negative Feedback: A check and balance system that will reverse the disruption or disturbance.
        i. Temperature
            1. Too Hot: the body releases sweat to cool down body temperature
            2. Too Cold: the body will begin to shiver, which means the muscles move creating heat, to warm the body up
        ii. Blood Glucose Levels
            1. The pancreas secretes insulin and glucagon in order to regulate blood glucose levels. Too high or too low glucose levels can cause the body to go into shock



        iii. Heart Rate/Pulse: The heart pumps blood carrying oxygen to the rest of the body.
            1. Exercise can cause the heart to pump quicker in order to deliver enough oxygen to the muscles to maintain the level of activity

2. Body systems work together to maintain homeostasis (which is a balance). The following below are ways systems work together in order to regulate, absorb nutrients, reproduce, and protect for injury or illness.
    a. Regulation: the following are examples of how the body regulates --
        i. Temperature: see above
        ii. Heart Rate/Pulse: see above
        iii. Breathing Rate: You can breathe faster or slower depending on the amount of oxygen you need and the amount of carbon dioxide you make as a waste and breathe out.
        iv. Blood Glucose Sugar Levels: see above

b. Nutrient Absorption: the body breaking down and absorbing nutrients from food
    i. Digestive System and Circulatory System works together
        1. The Digestive system physically (chewing food, churning food in stomach) and chemically (saliva, enzymes, stomach acid) breaks down food polymers into monomers
        2. Once food has been broken down and reaches the small intestines, all the broken food (glucose) is absorbed into the blood stream.
            a. The small intestines have microvilli which are finger-like projections that increase surface area in order to efficiently absorb digested food into the circulatory system.



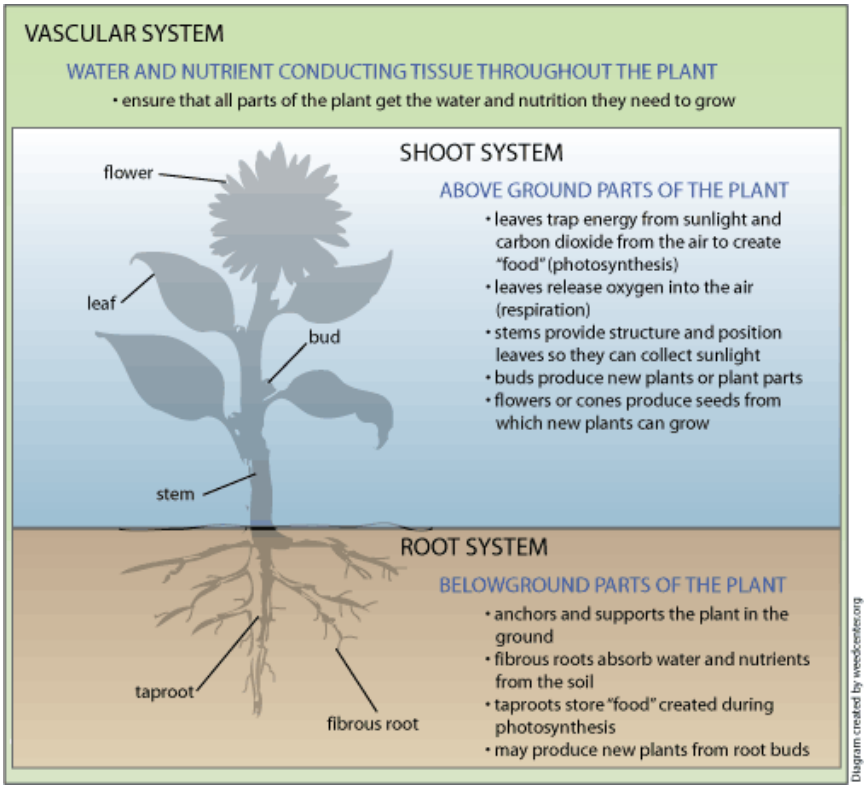
        3. Once the digested food gets absorbed into the circulatory system, the food travels in the blood streams to the muscles where the glucose (broken down food) gets converted into energy through Cellular Respiration in the muscle cell's mitochondria.
            a. Cellular Respiration: Glucose + Oxygen→ Water + Carbon Dioxide + ATP (energy)

c. Reproduction
    i. Endocrine System and Reproductive System works together
        1. Endocrine System creates hormones, like Estrogen and Testosterone.
        2. Female Reproductive System creates egg game and the Male Reproductive System creates sperm gamete cells needed in order to create new life.

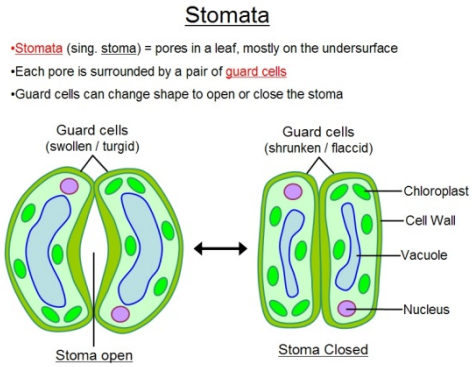
d. Defense from injury or illness
    i. Many organ systems work to help protect the body
        1. Integumentary System: Skin is the main barrier between the body and outside environment
        2. Immune System: White blood cells seek out and destroy foreign pathogens
        3. Respiratory System: hairs in the nose and mucus helps to trap and stop particles, like pollen and dust from entering the body.

Plant Systems:

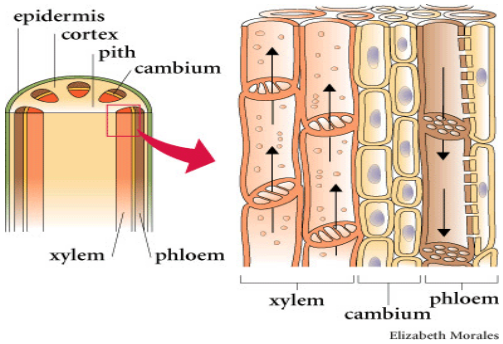
Just like animal systems, plants have systems that work together to keep the plants alive.



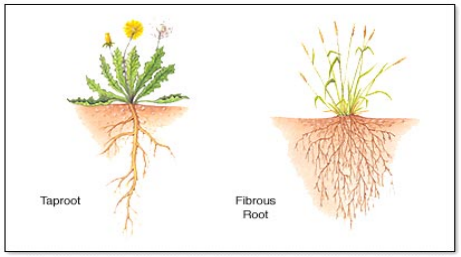
1. Plant Structures:
    a. Leaf: Capture sunlight for photosynthesis
        i. Stomata: Small openings/pores in the leaf where water (transpiration) and respiratory gases (carbon dioxide and oxygen) can move in/out of the leaf
        ii. Guard Cells: Controls and regulates when stomata opens and closes

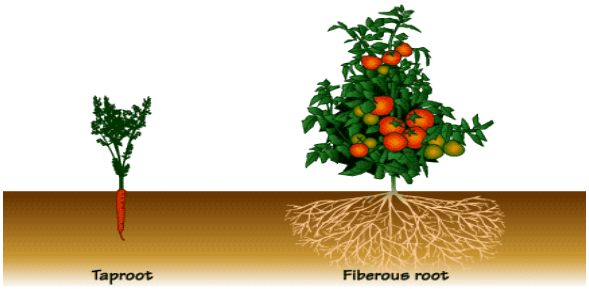


    b. Stem/Trunk: Helps support leaves; has tubes that carry water, nutrients, and food throughout the plant
        i. Xylem: tube that carries water throughout the plant, from root to leaves
        ii. Phloem: tube that carries nutrients and food-> glucose throughout the plant



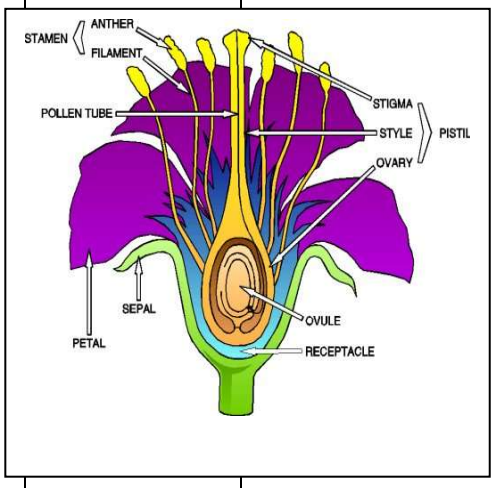
c. Root : Helps to anchor the plant to the ground and absorb water for the plant to use in photosynthesis
   i. Fibrous Roots: small think roots that are able to spread horizontally in search for water
      1. Grass
   ii. Tap Roots: a single thick root that is good at anchoring plants to the ground
      1. Ex: Carrots





2. Each plant organ helps support the plant in the following systems:

Plant Systems	Organs/Structures	Description
Transport	**Stem and Trunk** -Phloem -Xylem **Roots** -Taproot -Fibrous Roots **Leaves** -Stomata -Guard Cells	Responsible for the movement of water, minerals, and food to travel to all parts of the plant
Reproduction	**Flower** -Male Portion -Stamen -Female Portion -Pistal	Responsible for the continuation of plant species by sexual or asexual means **Asexual Reproduction in Plants** – Plants can reproduce by asexual (vegetative) means. Asexual plants are able to reproduce through structures such as rhizomes, plantlets, or runners. The new plants are genetically identical to the parent plant unlike sexual reproduction. **Sexual Reproduction in Plants** – Plants can reproduce sexually using structures found in the **plant flower**. The male reproductive structure produces **sperm cells** (**pollen**). The female reproductive structures include the ovule that produces the **egg cells** (**ova**). **Pollination** - The transfer of pollen from the anthers of a flower to the stigma of the same flower or of another flower. Flowers are bright and colorful to attract pollinators like bee. Pollination is a prerequisite for **fertilization**: the fusion of nuclei from the pollen grain with nuclei in the ovule. Fertilization allows the flower to develop seeds which then goes through **germination** - the process in which a plant emerges from a seed and begins growth.
Response		Allows plant to receive information from their surrounds and translate it into some type of action **Hormones**: can control when a plant's reproduction process (flower) **Tropisms**: process where plants receive information from the environment and translate it into a response: -Thigmotropism: responds to touch (vines) -Phototropism: responds to light -Hydrotropism: responds to water -Gravitotropism: responds to gravity



REPORTING CATEGORY 5: INTERDEPENDENCE WITHIN ENVIRONMENTAL SYSTEMS

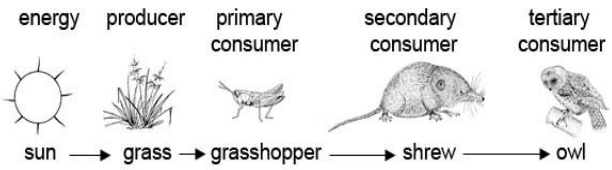
Food Chains and Webs: Showing how energy flows through the ecosystem

1. Arrows in a food chain and web show where the energy is going. Energy starts with the sun.

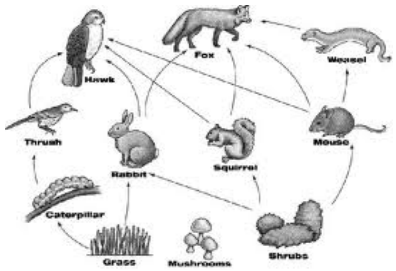
2. Trophic levels: organisms are classified by their feeding relationships.
   a. Producer, Primary consumer, Secondary consumer, Tertiary Consumer, Quaternary Consumer
   b. In a food web, one organisms might be in multiple trophic levels.

3. Food Chain: shows one line of energy flow
4. Food Web: shows all the relationships and energy in an ecosystem
   a. Don't forget about decomposers, like bacteria and mushrooms.

Food Chain

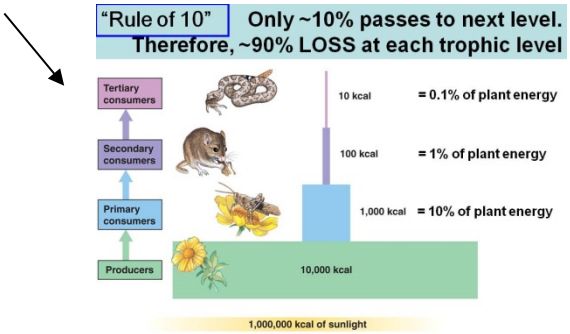


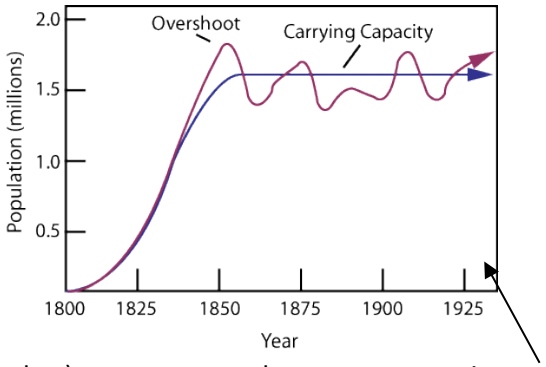
Food Web



5. Relationships Among Organisms
   a. Predation: one predator captures and eats the prey
      i. Bear eats Salmon
   b. Competition: two organisms compete and fight for the same resource (mates, food, shelter, water)
      i. Two foxes fight over a rabbit; Two stags fight for a doe
   c. Parasitism: one organism--parasite, benefits by living and harm another--host
      i. Flea and Dog
   d. Commensalism: one organism benefits by living with another, but the other is not harmed or benefits
      i. Vine living with a tree for support
      ii. birds live around cattle to eat the bugs that get stirred up when the cattle walks
   e. Mutualism: both organisms benefit by living together
      i. Bird eats all the ticks on a rhino

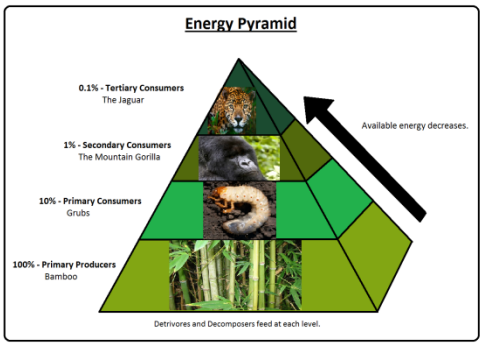
6. Only 10% of energy is passed on when organisms are eaten. 90% is lost in creating heat and survival life processes [like breathing, moving, heart beating…]



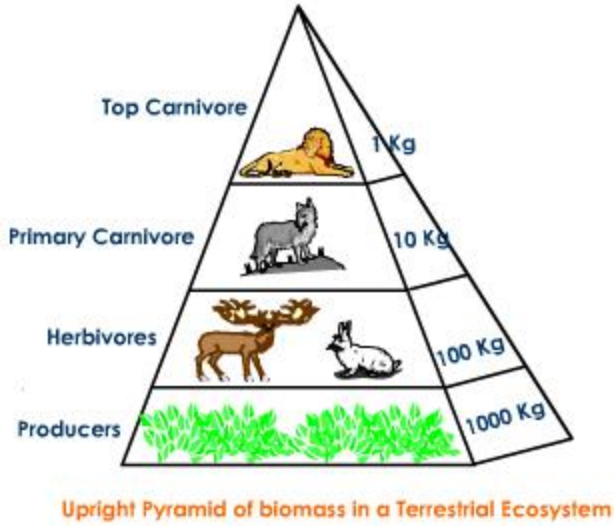


7. Carrying Capacity: because of finite resources (food, water, shelter), an area can only support a certain number of organisms. This is called the carrying capacity.

8. Types of Ecological Pyramids
   a. Energy Pyramid: shows amount of energy available at each trophic level

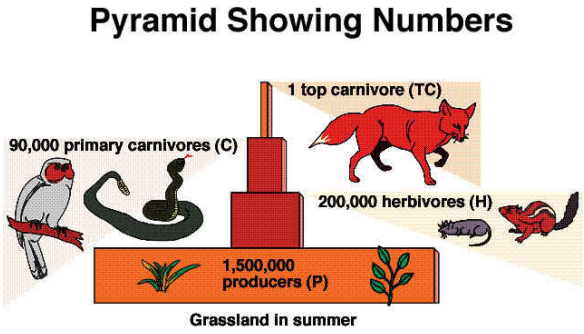


   b. Biomass Pyramid: shows amount of biotic (living) tissue available at each tropic level



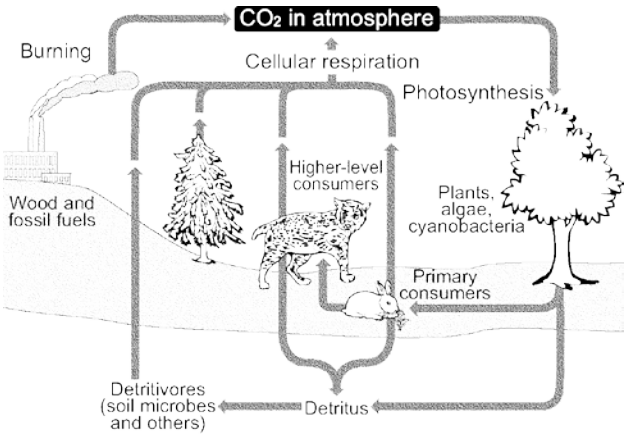
Upright Pyramid of biomass in a Terrestrial Ecosystem

   c. Numbers Pyramid: shows the number of individual organisms found at each tropic level



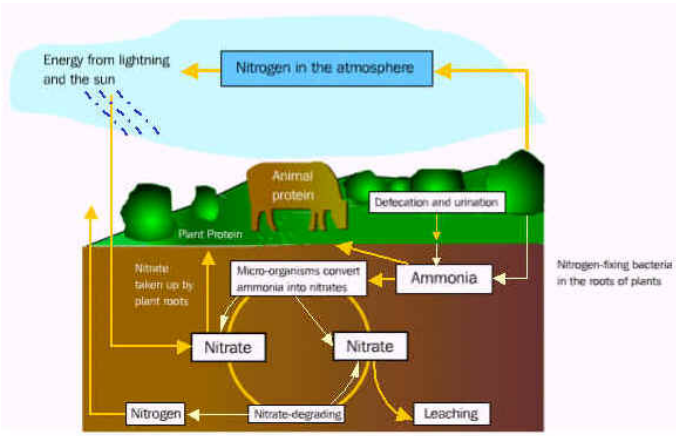
Cycles: Showing how nutrients flow through the ecosystem

Carbon Cycle: Carbon is needed by living organisms



Nitrogen Cycle: Nitrogen is needed by living things; can be found in all DNA

1. Bacteria and lightening changes nitrogen in the air into a usable form
2. Plants uptake the nitrogen from the soil; plants are then eaten by animals
3. Animals die and get decomposed, returning the nitrogen back into the soil
4. Some bacteria can change nitrogen in the soil into nitrogen gas to be released back into the air



Ecological Succession:

1. Primary: land starts out w/no soil; must start with pioneer species like lichen in order to create soil, takes longer
2. Secondary Succession: land already has soil, occurs after a disturbance like forest fire, occurs faster