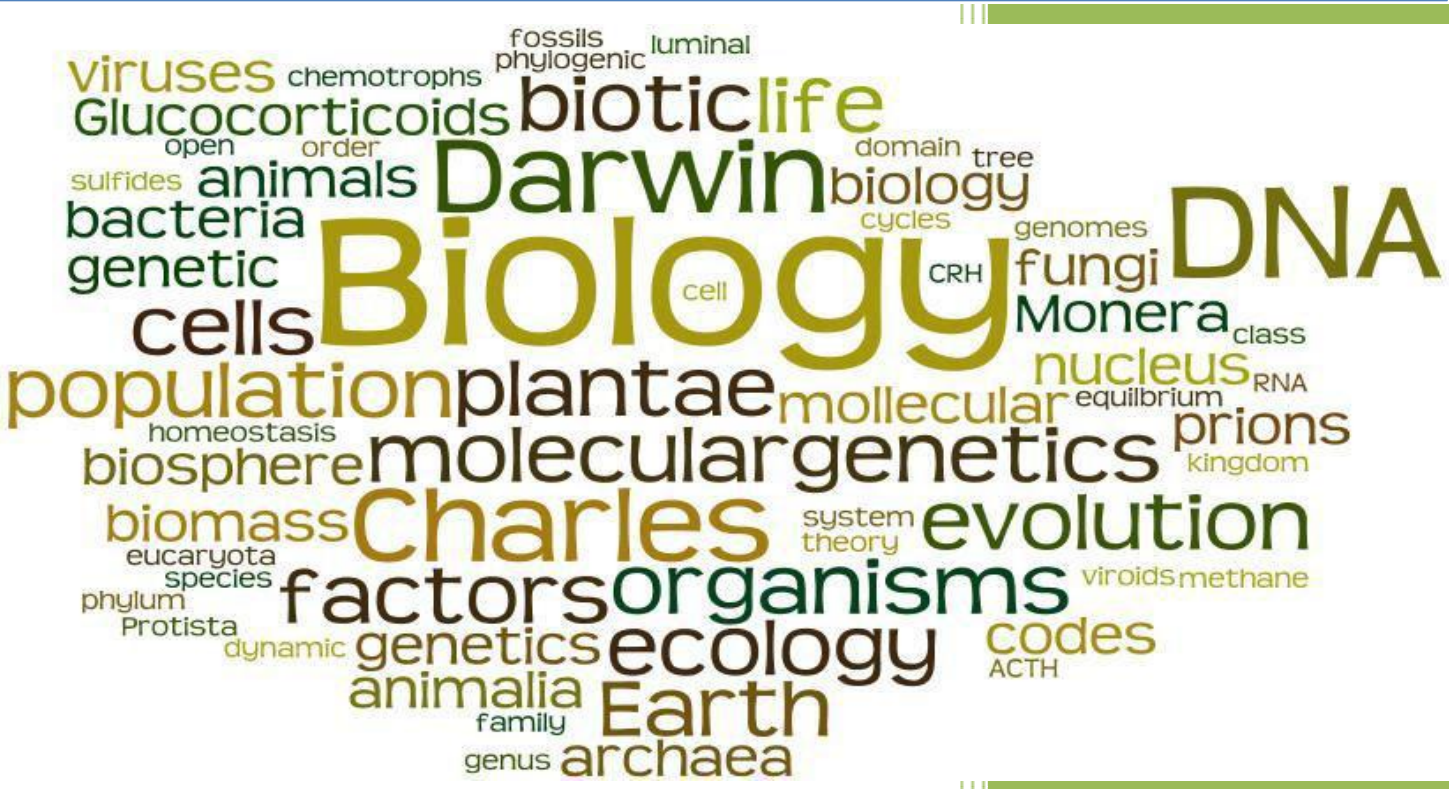
2015

BIOLOGY I EOC REVIEW BOOK



Gateway High School

School District of Osceola County

Unit Title: Biochemistry/SC.912.L.18.12 & SC.912.L.18.1

ORGANIC MOLECULES:
Organic compounds contain carbon and are found in all living things.

- Carbohydrates
- major source of energy(short term) and include sugars and starches
- made up of carbon, hydrogen, and oxygen with a 2:1 ratio of hydrogen to oxygen; monomer: monosaccharide
- plants and animals use carbohydrates for maintaining structure within the cells

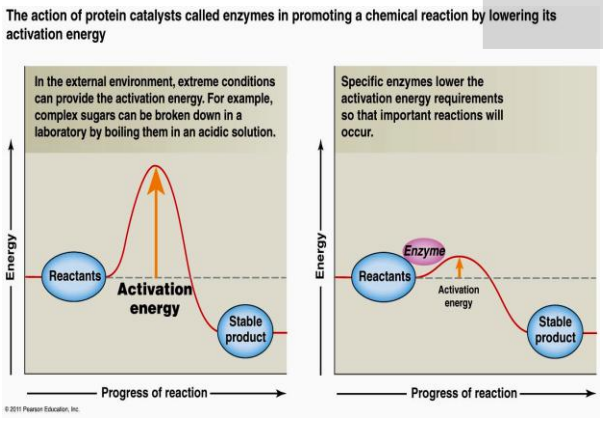
- Proteins
- Nitrogen-containing compounds made up of chains of amino acids
- 20 amino acids can combine to form a great variety of protein molecules
- can compose **enzymes**, hormones, antibodies, and structural components

- Lipids
- water-insoluble (fats and oils)
- made up of carbon, hydrogen and oxygen; composed of glycerol and fatty acid
- provide insulation, store energy(long term), and cushion internal organs, found in biological membranes
- saturated (with hydrogen, single bonds) and unsaturated (double bonds)

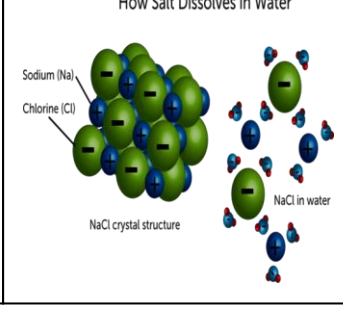
- Nucleic Acids
- direct the instruction of proteins
- genetic information an organism receives from its parents
- two types: DNA (deoxyribonucleic acid) and RNA (ribonucleic acid)
- composed of nucleotide (sugar, nitrogenous base and phosphate group)

ENZYMES:
Enzymes are special proteins that regulate nearly every biochemical reaction in the cell. Different reactions require different enzymes. Enzymes function to:
- Aid in digestion
- Break down complex molecules ("substrate" = reactant)
- Catalysts (speed up chemical reactions without being used up or altered)
- Factors that affect enzymes: pH, temperature, and quantity
- Lower activation energy for chemical reactions.

- Enzymes are affected by changes in pH. The most favorable pH value - the point where the enzyme is most active - is known as the optimum pH.
- Like most chemical reactions, the rate of an enzyme-catalyzed reaction increases as the temperature is raised. Most animal enzymes rapidly become denatured at temperatures above 40°C, most enzyme determinations are carried out somewhat below that temperature.

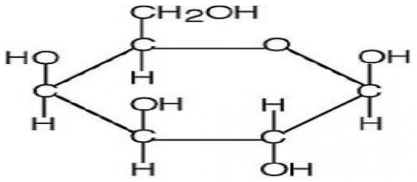


Water can **dissolve salt** because the positive part of **water** molecules attracts the negative chloride ions and the negative part of **water** molecules attracts the positive sodium ions.

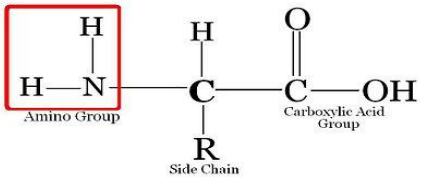


PROPERTIES OF WATER
- **Adhesion** -water is attracted to other molecules; **Cohesion**-water is attracted to itself; ex: capillary action-water defies gravity and moves up a tree
- **High heat capacity**-Holds heat to regulate temperature
- **High heat of vaporization** -sweating to cool down
- **Less dense as a solid** than a liquid (ice floats); ex: insulate lakes so that organisms can survive during the winter
- Water is a **great solvent** (good at dissolving things); ex: dissolve nutrients

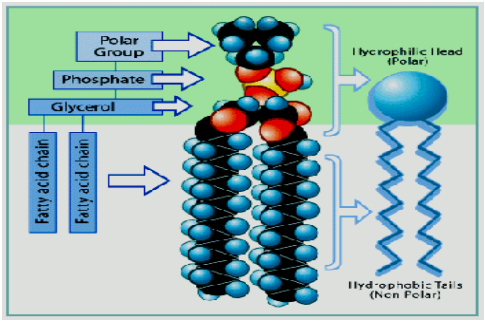
CARBOHYDRATE (monosaccharide – Glucose)



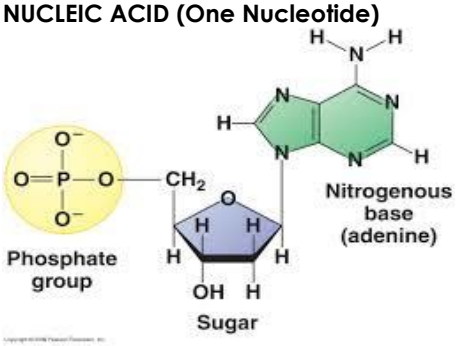
PROTEIN (One Amino Acid)



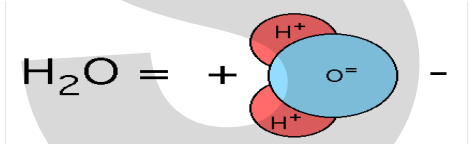
LIPID (ex: phospholipid/cell membrane)

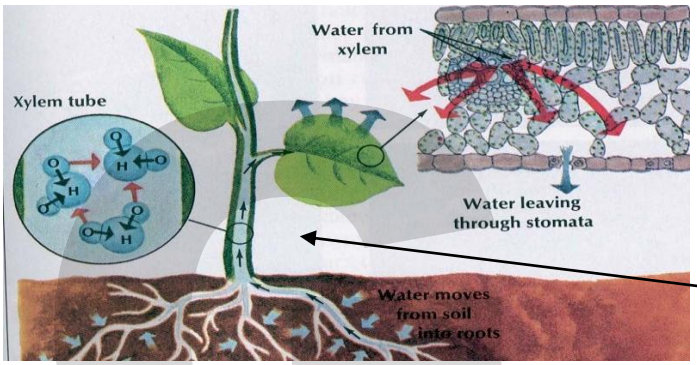


NUCLEIC ACID (One Nucleotide)



The uniqueness of water comes from its molecular structure.
Water is polar, it has a slight positive and slight negative charge on opposite ends.
Oxygen- slight negative charge
Hydrogen- slight positive charge
The polarity of water is responsible for effectively dissolving other polar molecules. This is important to remember because for most biological reactions to occur, the reactants must be dissolved in water.





Cohesive property of water in our body -It is the movement of water in and out of your cellular structures that deposits vitamin, nutrients and vital blood plasma.

Driving force of Transpiration
Water moves from roots to leaves in the xylem. The upward movement is explained by the transpiration-cohesion hypothesis. The cohesive (water is attracted to itself) and adhesive (water is attracted to other molecules) property of water allows it to move upward. Water moves upward in a continuous column, linked by hydrogen bonds and pulled by evaporation from the leaves.

Unit Title: Cellular Structure and Function/SC.912.L.14.1 & SC.912.L.14.3

LAW vs. THEORY
Law: Laws are simple and obvious statements about a phenomenon that never require a second guess, or an experiment to verify.
Theory: is a scientific explanation of an observed phenomenon. Unlike laws, theories actually explain why things are the way they are. Theories can never become laws or vice versa.

The Cell Theory was developed from three German scientist's discoveries. They are Matthias Schleiden, Theodor Schwann, and Rudolph Virchow.

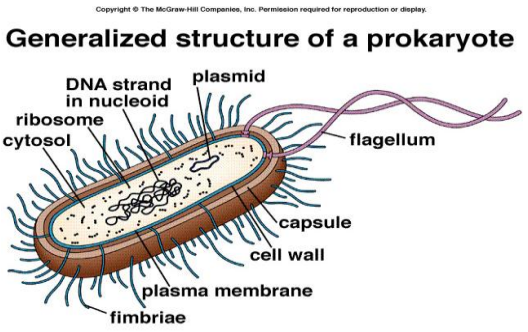
- In 1838 the German Botanist Matthias Schleiden discovered that all plants were composed of cells.
- Then only a year later a German zoologist, Theodor Schwann, discovered that all animals were composed of cells.
- Later in 1855 a German physician named Rudolph Virchow was doing experiments with diseases when he found that all cells come from other existing cells.

Cells of course were discovered much earlier. The first person to see a cell was Robert Hooke. He used a very primitive microscope, but when he was looking at cork cells under the microscope he saw cells for the first time.

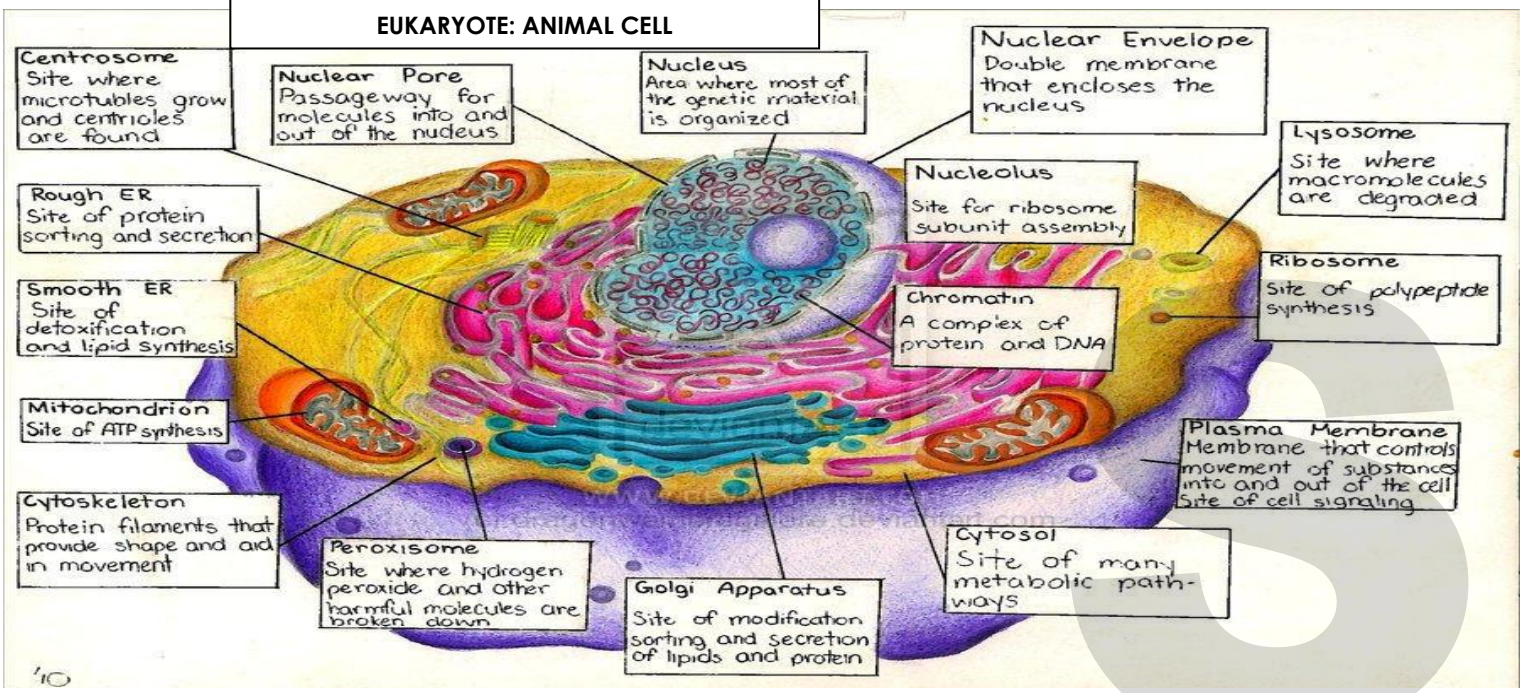
3 PARTS OF THE CELL THEORY:
- Cells are the basic units of structure and function in all living things.
- All organisms are composed of cells.
- All cells come from pre-existing cells.

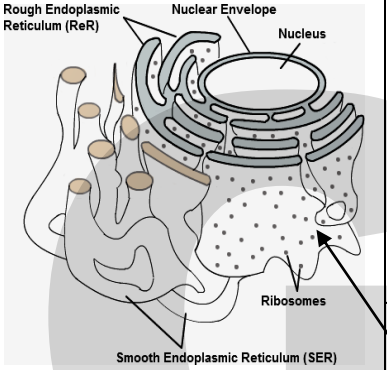
PROKARYOTIC CELLS vs. EUKARYOTIC CELLS

Features	Prokaryotic	Eukaryotic
Nucleus	NO	YES
Membrane-bound organelles	NO	YES
Size	small	large
Organisms	Bacteria, Archaea	Animals, Plants, Fungi, Protists
Ribosome and cell/plasma membrane	YES	YES
Cell wall	YES	Yes, except animals and some protists

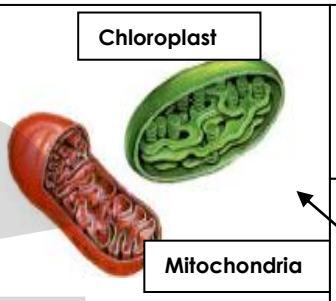


EUKARYOTE: ANIMAL CELL

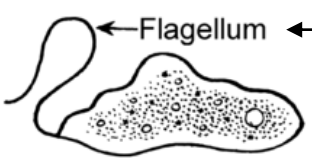




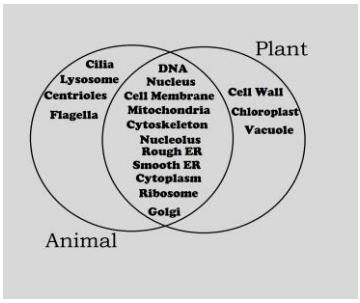
Rough ER- contains ribosomes; protein synthesis

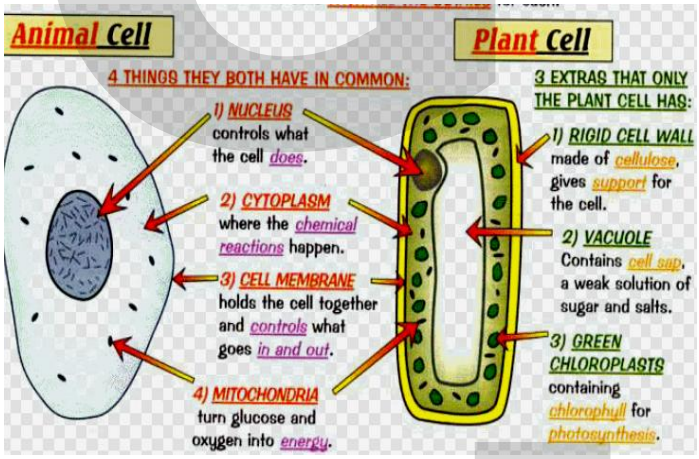


Cellular Energy
Mitochondria (plants/animals) are used to convert chemical energy into ATP for cellular activities. Chloroplast (plants) is used to capture light energy which is used for photosynthesis.



Movement; found in both prokaryotes and eukaryotes.





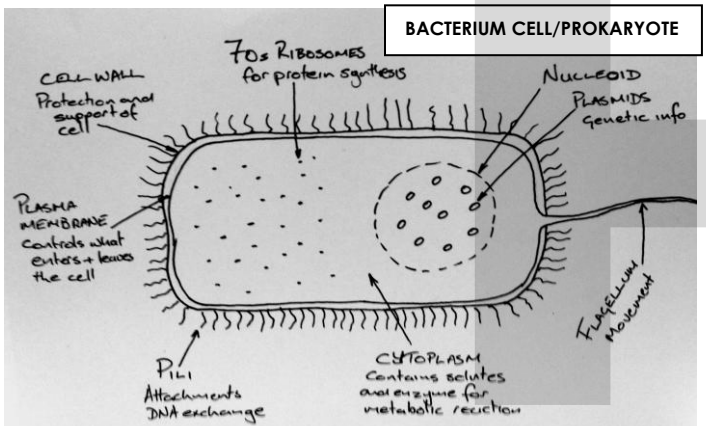
CELL TRANSPORT:

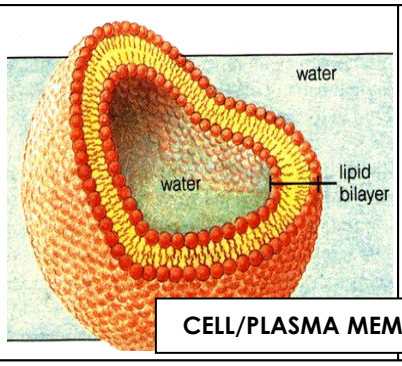
- Passive Transport – movement of substances across the plasma membrane without the use of the cell's energy (with the concentration gradient)

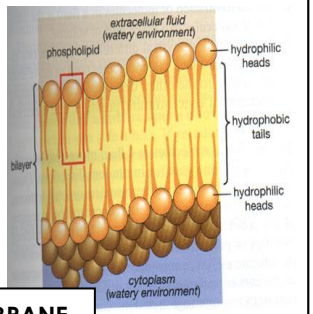
1. DIFFUSION – movement of substances across the plasma membrane from an area of high concentration to an area of low concentration
2. OSMOSIS – diffusion of water across the plasma membrane from areas of high concentration to areas of lower concentration
   - HYPOTONIC – water moves in; cell bursts
   - HYPERTONIC – water moves out; cell shrivels
   - ISOTONIC – no net movement; cell maintains equilibrium
3. FACILITATED TRANSPORT – a carrier molecule embedded in the plasma membrane transports a substance across the plasma membrane following the high-to-low concentration gradient

- Active Transport – movement of substances across the plasma membrane that requires the use of the cell's energy and carrier molecules; substances are moving from an area of low concentration to an area of higher concentration (against the concentration gradient)
   - ENDOCYTOSIS – large particles are brought into the cell
   - EXOCYTOSIS – large particles leave the cell

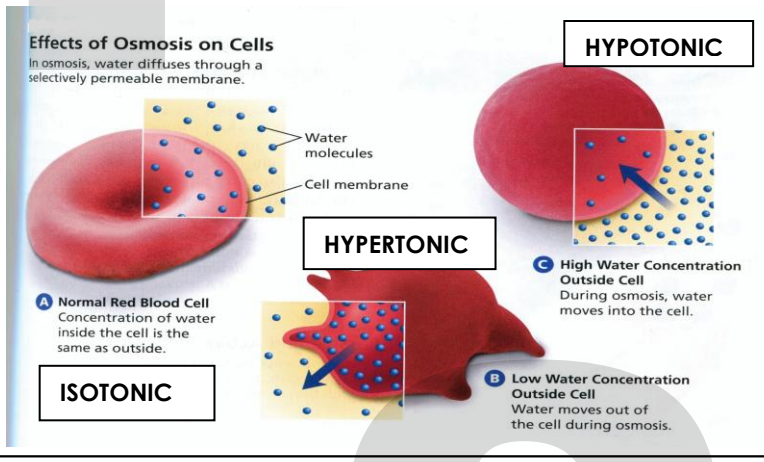
- HOMEOSTASIS – internal equilibrium; the plasma membrane regulates what enters and leaves the cell; a selectively permeable membrane only allows certain substances. to pass through







CELL/PLASMA MEMBRANE

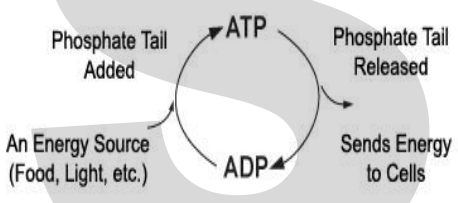


Unit Title: Cellular Energy/ SC.912.L.18.9

BIOCHEMICAL REACTIONS: chemical bonds are formed and broken within living things creating chemical reactions that impact the ability to maintain life and carry out life functions.

ATP – ATP is a molecule that stores and releases the energy in its bonds when the cell needs it; removing a phosphate group (P) releases energy for chemical reactions to occur in the cell and ATP becomes ADP; when the cell has energy, the energy is stored in the bond when the phosphate group is added to the ADP

ATP ⟷ ADP + P + ENERGY



- **Photosynthesis** – plant cells capture energy from the Sun and convert it into food (carbohydrates) and stored; plant cells then convert the carbohydrates into energy during cellular respiration; the ultimate source of energy for all living things is the Sun (in Chemosynthesis, organisms use sulfur or nitrogen as the main energy source)
$6CO_2 + 6H_2O$ + ENERGY (from light) → $C_6H_{12}O_6 + 6O_2$

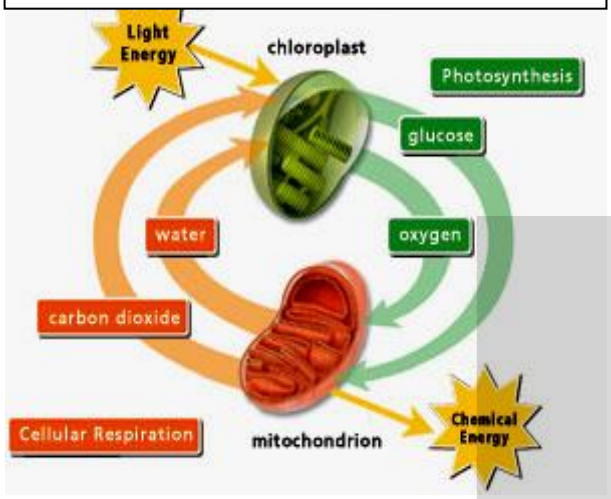
- Interrelated nature of photosynthesis and cellular respiration- the reactants of photosynthesis are the products of cellular respiration and vice versa.

- **Cellular Respiration (aerobic)** – food molecules are converted to energy and released; there are three stages to cellular respiration; the first stage is called glycolysis and is anaerobic (no oxygen is required); and are aerobic (oxygen is required)
$C_6H_{12}O_6 + 6O_2$ → $6CO_2 + 6H_2O$ + ENERGY (36 ATP)

- **Fermentation (anaerobic)** – when cells are not provided with oxygen in a timely manner, this process occurs to continue producing ATP until oxygen is available again; glucose is broken down; there are two types of fermentation:

Lactic Acid Fermentation (muscle cells) Glucose → Lactic Acid + 2ATP
Alcoholic Fermentation (plant cells) Glucose → CO_2 + Alcohol + 2ATP

Interrelationship between photosynthesis and cellular respiration

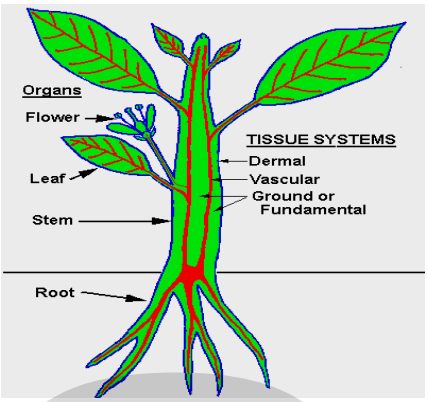


AEROBIC and ANAEROBIC RESPIRATION:
Aerobic Respiration/Cellular Respiration – 3 stages (glycolysis, Krebs cycle and Electron Transport chain)
- requires the presence of oxygen
- release of energy from the breakdown of glucose (or another organic compound) in the presence of oxygen to produce large amounts of energy.
- energy released is used to make ATP, which provides energy for bodily processes
- takes place in almost all living things

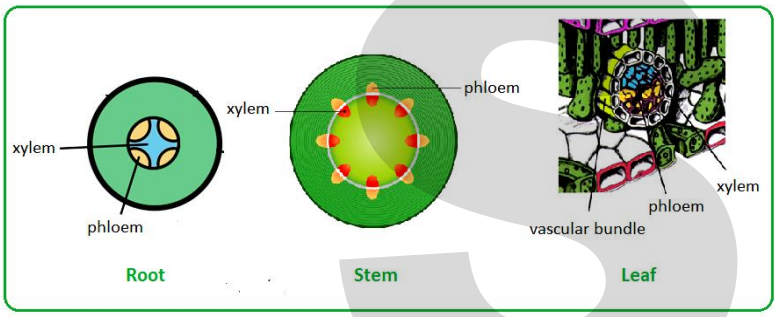
Anaerobic Respiration/Fermentation – 1 stage (glycolysis)
- occurs in the absence of oxygen
- breakdown of food substances in the absence of oxygen with the production of a small amount of energy
- produces less energy than aerobic respiration
- often called fermentation: lactic and alcoholic
- seen as an adaptation for organisms that live in environments that lack oxygen

Unit Title: Plant Organization/ SC.912.L.14.7

Plant Organs
Roots- Underground (usually), anchor the plant in the soil, absorb water and nutrients, conduct water and nutrients, and food storage.
Leaves-manufacture food material in the presence of sunlight and green pigment-chlorophyll present in the leaf (photosynthesis).
Stems-move water and minerals to the leaves; transport food (sap) downward from the leaves to the roots. The stem increases in thickness as it grows older. In the vascular bundle of a young stem the xylem and phloem are separated by cambium.
Flowers- enable angiosperm/flowering plants to reproduce, and their colors and shapes facilitate pollination, seed growth and seed dispersal. The sexual reproductive organs of the flower are the pistil, or female parts, and the stamen, or male parts.
Fruits- are ripened ovaries and protect seeds.
Cones-are the reproductive organs for gymnosperms (fruitless and flowerless)



Plant Tissues
Dermal- protection and prevention of water loss; epidermis
Meristematic-growth tissue and the location of most cell division. It is known as *undifferentiated tissue* because cells in the meristematic tissue will eventually become vascular, ground, or dermal tissue
Ground- photosynthesis, food storage, regeneration, support and protection; Parenchyma tissue, Collenchyma tissue, Sclerenchyma tissue
Vascular-transport of water/minerals **(xylem)** and transport of food **(phloem)**

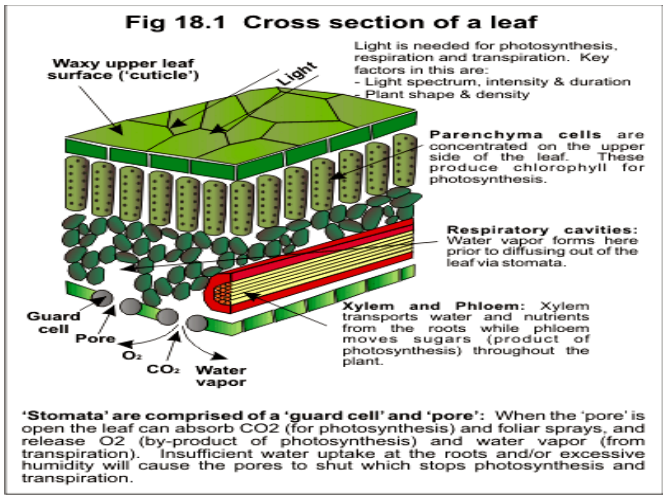


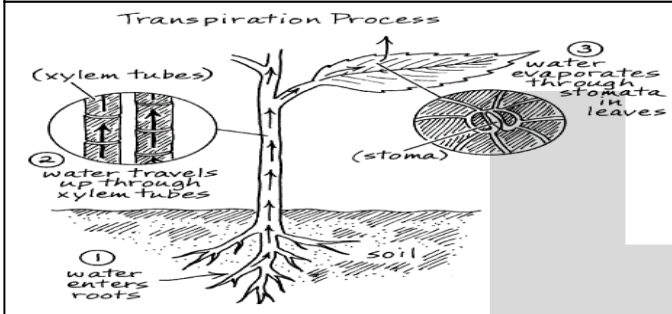
Photosynthesis-In plants and other photosynthetic organisms, photosynthesis takes place inside the chloroplasts. Plants change carbon dioxide and water into carbohydrates and give off oxygen (Photosynthesis uses the energy of sunlight to convert water and carbon dioxide into high-energy sugars and oxygen). Xylem: brings water to the leaf, Stomata: brings in carbon dioxide and remove oxygen, Chloroplast: pigment (chlorophyll) absorbs sunlight, Phloem: transportation of food and nutrients such as sugar and amino acids from leaves to storage organs and growing parts of plant.

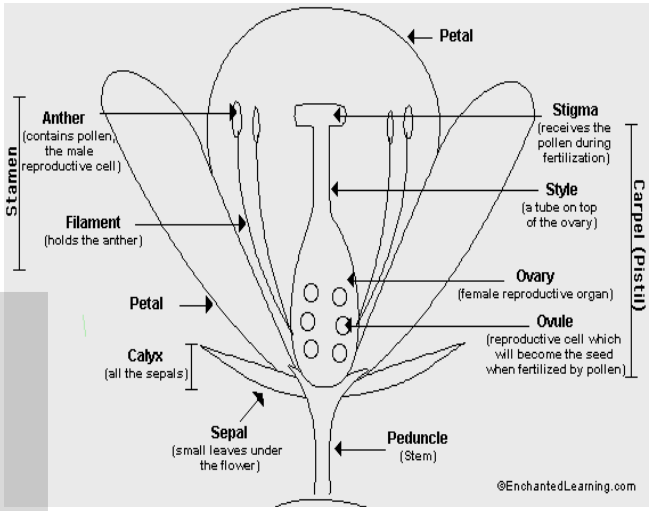
Cellular Respiration- Cells take the carbohydrates into their cytoplasm, and through a complex series of metabolic processes, they break down the carbohydrates and release the energy (ATP). This process takes place mainly in the mitochondria.

Transpiration-Transpiration is the evaporation of water into the atmosphere from the leaves and stems of plants. Plants pump the water up from the soil through the xylem to deliver nutrients to the leaves. This pumping is driven by the evaporation of water through small pores (stomata).

Reproduction- Flowers are the plant's reproductive structures. Angiosperms are types of plants that bear fruits and flowers. Flowers are usually both male and female, and are brightly colored to attract insects to help them carry pollen used for sexual reproduction. Gymnosperms are types of plants that use cones for reproduction. They do not bear fruits.







Unit Title: Cell Division/ SC.912.L.16.17

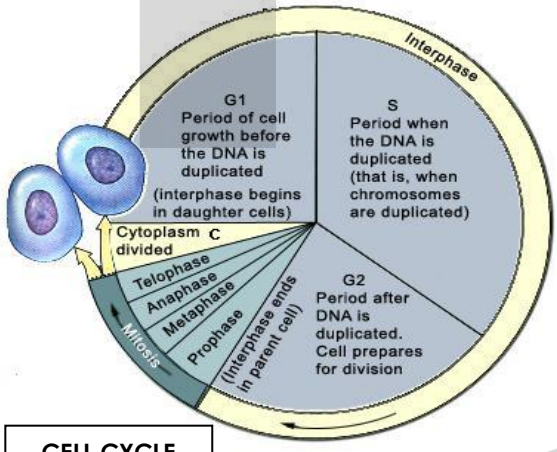
Asexual and Sexual Reproduction:

Asexual Reproduction – a single parent produces one or more identical offspring by dividing into two cells - **mitosis** (protists, arthropods, bacteria by binary fission, fungi, plants); produces large numbers of offspring

- **offspring are clones of parents (genetically identical)**
- common in unicellular organisms, good for stable environments
- budding, binary fission, conjugation
- quick process (low energy requirement) – produces high number of offspring

Sexual Reproduction – pattern of reproduction that involves the production and fusion of haploid sex cells; haploid sperm from father fertilizes haploid egg from mother to make a diploid zygote that develops into a multicellular organism through mitosis

- results in **genetic variation (diversity)**
- common in multicellular organisms (external or internal fertilization); good for changing environments
- slow process (high energy requirement) – produces low number of offspring
- meiosis = formation of sex cells (gametes)



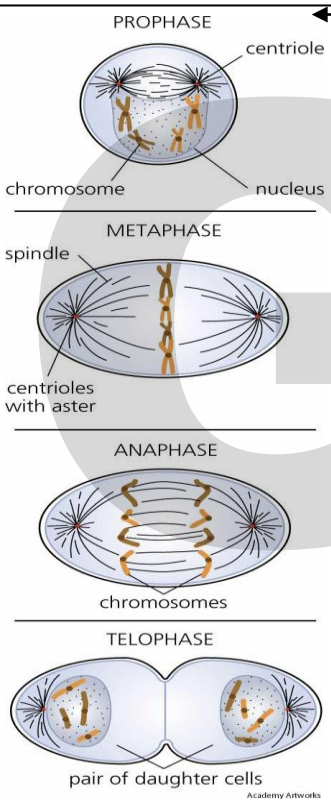
CELL CYCLE

Cell Cycle-
Interphase is technically not part of mitosis, but rather encompasses stages G1, S, and G2 of the cell cycle
Mitosis is when the cell divides (PMAT)
Cytokinesis- cytoplasm separates into two cells

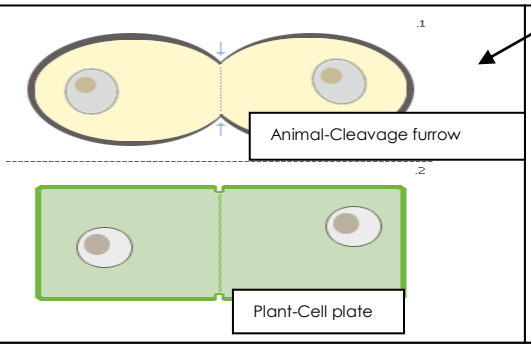
Cancers are diseases in which there is a defect in the regulation of the cell cycle; uncontrolled cell division.

CELL DIVISION:

- process of copying and dividing the entire cell
- the cell grows, prepares for division, and then divides to form new daughter cells
- allows unicellular organisms to duplicate in a process called asexual reproduction
- allows multicellular organisms to grow, develop from a single cell into a multicellular organism, make other cells to repair and replace worn out cells
- three types: binary fission (bacteria and fungi), mitosis, and meiosis

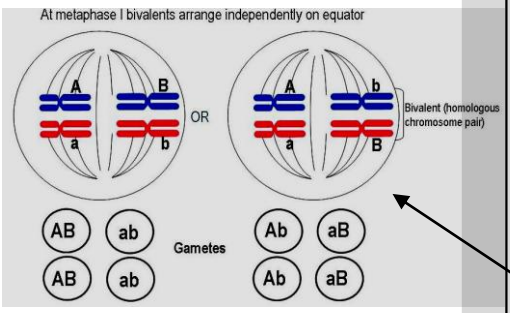


MITOSIS
Prophase- chromosome visible
Metaphase- chromosome line up in the middle
Anaphase- chromosome pulled apart
Telophase- two nuclei

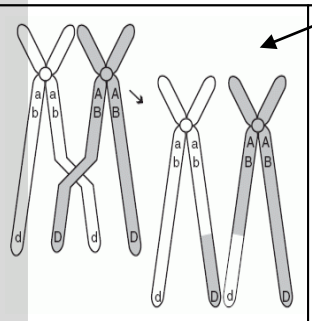


CYTOKINESIS- cytoplasm divides. Plant cells create cell plates to separate the two daughter cells. Animal cells pinch and create a cleavage furrow until the cell splits into two daughter cells.

Property	Mitosis	Meiosis
DNA Replication	During interphase before mitosis begins	During interphase before Meiosis I only
# of divisions	One	Two
Synapsis of homologous chromosomes	Do not pair.	Pair during Prophase I, with crossing over between non-sister chromatids
# of daughter cells and genetic composition	Two diploid (2n) daughter cells that are genetically identical to the parent cell	Four haploid (n) daughter cells, contain half the # of chromosomes as parents, daughter cells are genetically different from parent cells and each other
Role in animal body	Produces somatic cells for growth and repair	Produce gametes and assure genetic diversity in sexual reproduction



MEIOSIS: Metaphase I and II/INDEPENDENT ASSORTMENT
The random arrangement of pairs of chromosomes which leads to genetic diversity in gametes

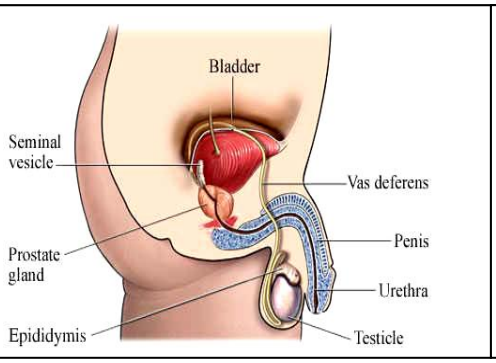


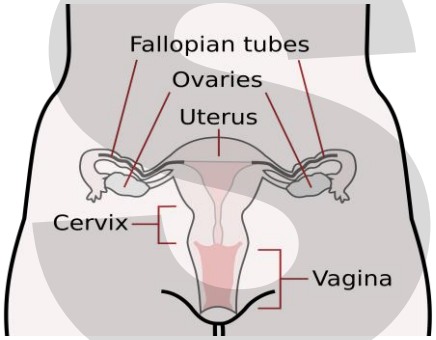
Crossing-over is the process that can give rise to genetic recombination. The duplicated homologous chromosomes pair, and crossing-over (the physical exchange of chromosome parts) occurs during **Prophase I/MEIOSIS**.

Unit Title: Human Reproduction/ SC.912.L.16.13

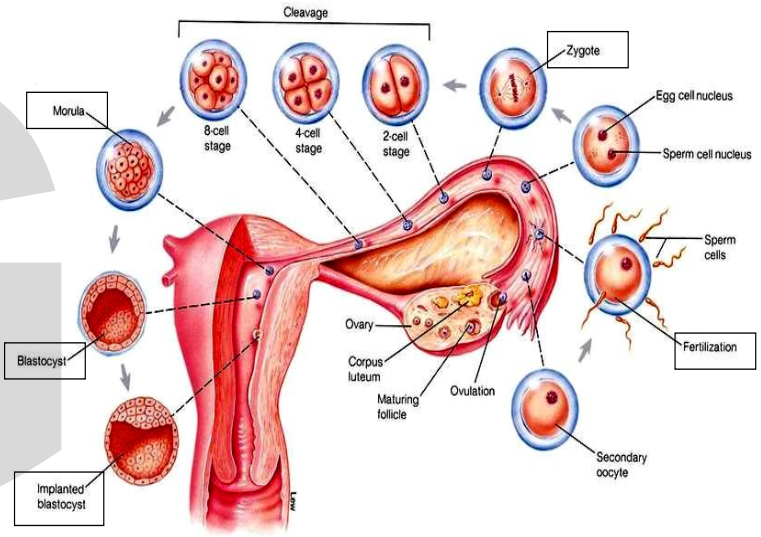
Male Structures
- **Vas deferens:** during sexual stimulation, the sperm travels through this long duct.
- **Testes:** sperm production
- **Penis:** male organ for sexual intercourse; contains a number of sensitive nerve endings.
- **Urethra:** carries urine from the bladder to outside the body; expels semen during orgasm
- **Scrotum:** pouch that encloses the testes
- **Epididymis:** immature sperm leaves the testes and mature in this duct; remain here until expelled or reabsorbed
- **Prostate gland:** walnut shape; controls urination and produce minerals and sugars that make up semen.
- **Seminal vesicle:** a pair of tube that produces fluid that becomes a large percentage of semen.

Female Structures
- **Ovaries:** oval-shaped, on both sides of the uterus, egg cells and hormones production
- **Oviduct/Fallopian tubes:** narrow tube, allows the egg to travel from ovary to lower part of the uterus; conception usually occurs there.
- **Vagina:** canal that joins the cervix to the outside of the body.
- **Uterus/womb:** hollow and pear-shaped organ that is the home to the developing fetus. 2 parts: cervix that leads to vagina and the upper part or corpus which expands to hold a developing baby.
- **Cervix:** lower part of the uterus; dilates during childbirth to allow the passage of the baby; sperm travel through the cervix; allows the passage of menstrual fluid.



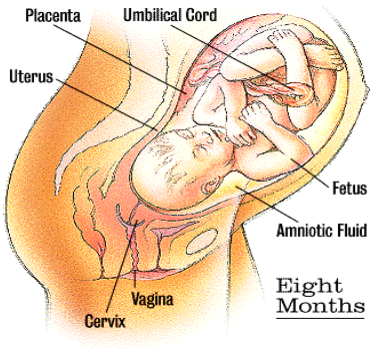


Fetus Life Support
- **Placenta:** organ attached to the lining of the uterus; keeps baby and mother's blood separate; provides a link between mother and baby.
- **Amniotic Sac:** membrane which contains the fetus and the amniotic fluid. This is the place where the fetus develops.
- **Amniotic Fluid:** liquid that cushions the baby and helps prevent injuries.
- **Umbilical cord:** connects the placenta to the developing baby. It removes waste products and carbon dioxide from the baby and brings oxygenated blood and nutrients from the mother through the placenta to the baby.



Blastocyst implants in the uterus where it grows into a fetus; uterus has the space to support the growth!

Embryogenesis: zygote to embryo to fetus
- Morula (zygote-16 cells)
- Blastula (zygote-100 cells)
- Gastrulation- development of 3 layers that are responsible for the development of tissues and organs.
- Neurulation- development of the nervous system.



1st Trimester	2nd Trimester	3rd Trimester
• Implantation of blastocyst • Neural tube closes • Rapid growth • Brain, spinal cord, heart and other organs begin to form • Basic facial features begin to appear • Eye lenses begin to form	• Urine forms • Sex becomes apparent • Bones develop • Fat accumulates • Begins to hear • Hair grows • Movement • Fingerprints and footprints form	• Eyes open and close; respond to light • Bones are fully developed • Rapid weight gain • Lots of movements • Organs are ready to function on their own

Unit Title: Genetics/ SC.912.L.16.1

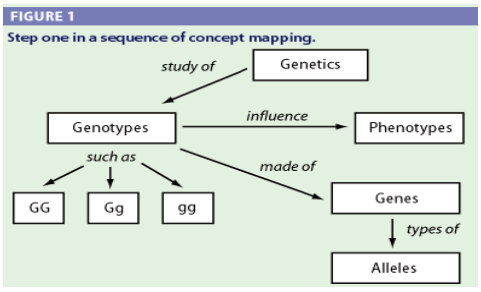
MENDELS LAWS OF HEREDITY:

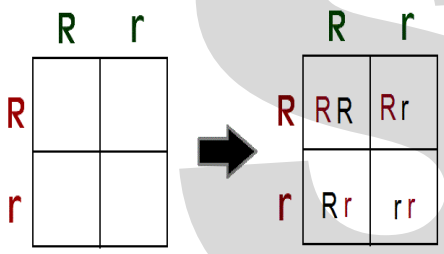
1. **Law of Dominance**
- The dominant allele will prevent the recessive allele from being expressed
- Recessive allele will appear when it is paired with another recessive allele in the offspring

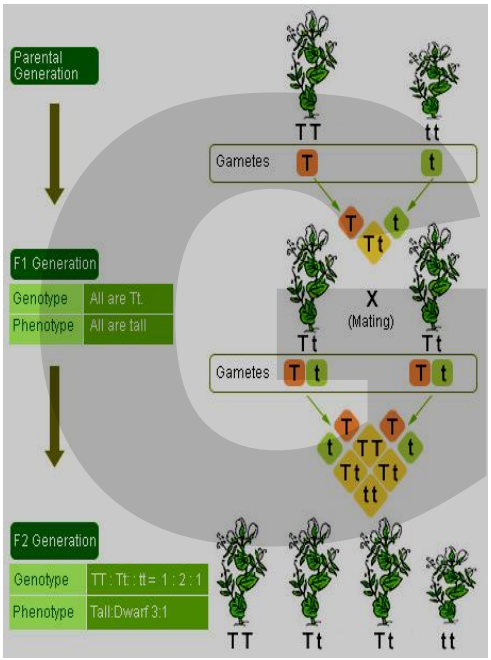
2. **Law of Segregation**
- Gene pairs separate when gametes (sex cells) are formed
- Each gamete has only one allele of each gene pair

3. **Law of Independent Assortment**
- Different pairs of genes separate independently of each other (metaphase I) when gametes are formed (Anaphase II in Meiosis)

GENETICS:
– Gregor Mendel experimented with sweet pea plants in 1800s
– **Trait** – characteristic an individual receives from its parents
– **Gene** – carries instructions responsible for expression of traits; a pair of inherited genes controls a trait; one member of the pair comes from each parent; often called **alleles**
– **Homozygous** – two alleles of a pair are identical (BB or bb)
– **Heterozygous** – two alleles of a pair are different (Bb); often called "hybrid"
– **Dominant** – controlling allele; designated with a capital letter (RR, Rr)
– **Recessive** – hidden allele; designated with lower-case letters (rr)
– **Genotype** – genetic makeup of an organism (represented by the letters)
– **Phenotype** – physical appearance of an organism (description of the letters)
– **Monohybrid** – cross involving one trait
– **Dihybrid** – cross involving two traits
– **Punnett Square** – graphic organizer used to show the probable results of a genetic cross
– **Pedigree** – graphic organizer to map genetic traits between generations
– **Test Cross** – mating of an individual of unknown genotype with an individual of known genotype; can help to determine the unknown genotype of the parent







Mendel's experiment
Crossing true-breeding tall plants (homozygous TT) with true-breeding dwarf plants (homozygous tt) produced all tall plants (heterozygous Tt).
Crossing hybrid/heterozygous tall plants (Tt) produced 75% tall plants (1homozygous tall plant and 2 heterozygous tall plants) and 25% dwarf plants.

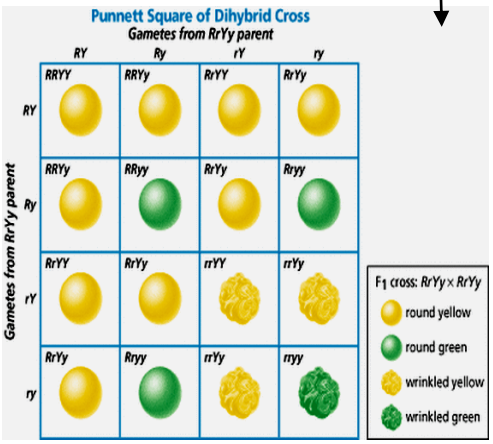
A **monohybrid** cross contains four boxes; a cross between two heterozygous individuals would reveal a 1:2:1 genotype ration and a 3:1 phenotype ratio in the offspring; the probability that the offspring will show a dominant phenotype is ¾, or 75%

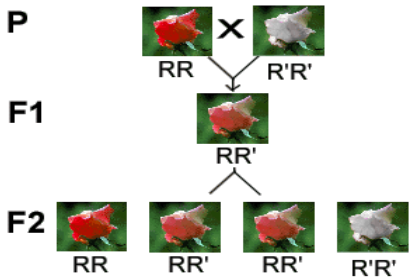
A **dihybrid** cross contains sixteen boxes; a dihybrid cross reveals two traits for both parents; a cross between two heterozygous individuals would reveal a 9:3:3:1 phenotype ratio in the offspring.
-Independent Assortment

Dominant and Recessive
(T = Tall & t = short
Cross: Tt x Tt

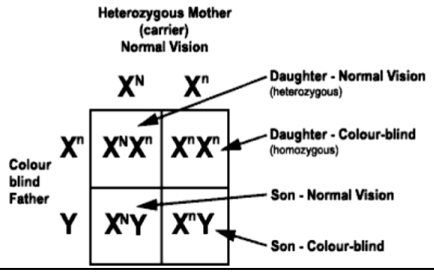
	T	t
T	TT	Tt
t	Tt	tt

Genotypic ratio: 1 : 2 : 1 (TT=25% Tt=50% tt=25%)
Phenotypic ratio: 3 : 1 (Tall=75% Short=25%)





Incomplete Dominance
RR- Red R'R'-White RR'- Pink



Sex-linked
X^NX^n – normal vision/carrier female
X^nX^n – color blind female
X^nY- color blind male X^NY- normal vision

PATTERNS OF INHERITANCE:
Sex-Linked Traits
- Traits associated with particular sexes
- 23rd pair of chromosomes; Males = XY; Females = XX
- X-Linked Traits inherited on X chromosome (ex: colorblindness, baldness, hemophilia)

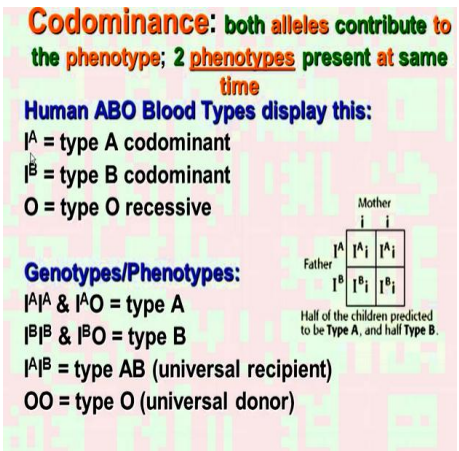
Multiple Alleles
- Presence of more than two alleles for a trait (ex: eye color)

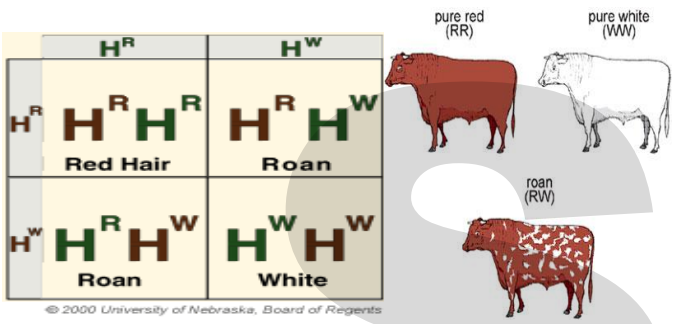
Polygenic Inheritance
- One trait controlled by many genes (ex: hair color, skin color); genes may be on the same or different chromosomes

Codominance
- Phenotypes of both homozygous parents are produced in heterozygous offspring so that **both alleles are equally expressed/dominant** (ex: black chicken + white chicken = checkered chickens), (ex: sickle cell anemia)

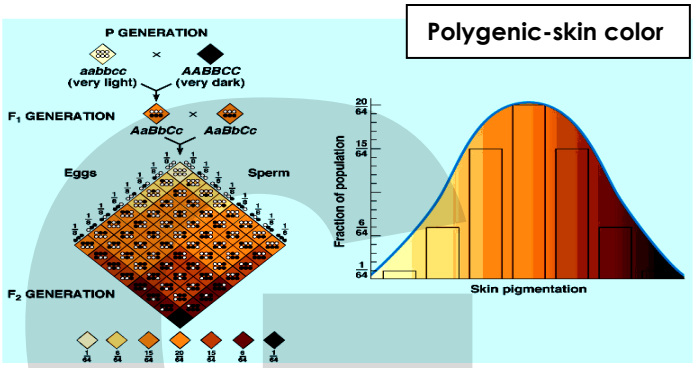
Incomplete Dominance
- Phenotype of a heterozygote is intermediate between the two homozygous parents; **neither allele is dominant**, but combine to display a new trait (ex: red flower + white flower = pink flower)

Blood type- Multiple Alleles and Codominant
A number of human traits are the result of more than 2 types of alleles (multiple alleles). There are 3 different alleles for blood type (A, B, & O).
Blood type A is dominant to O. B is also dominant to O. A and B are both codominant.

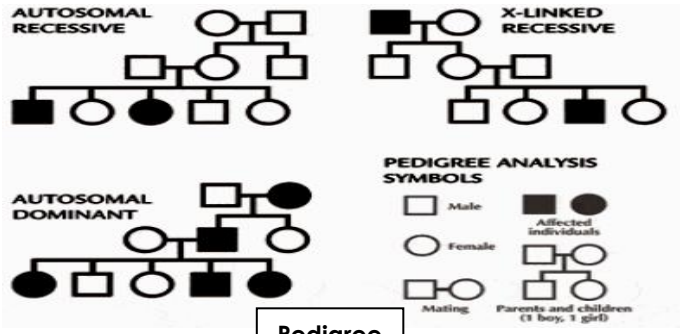




Codominance- red hair and white hair cows will produce roan cows (red and white).



Polygenic-skin color



Pedigree

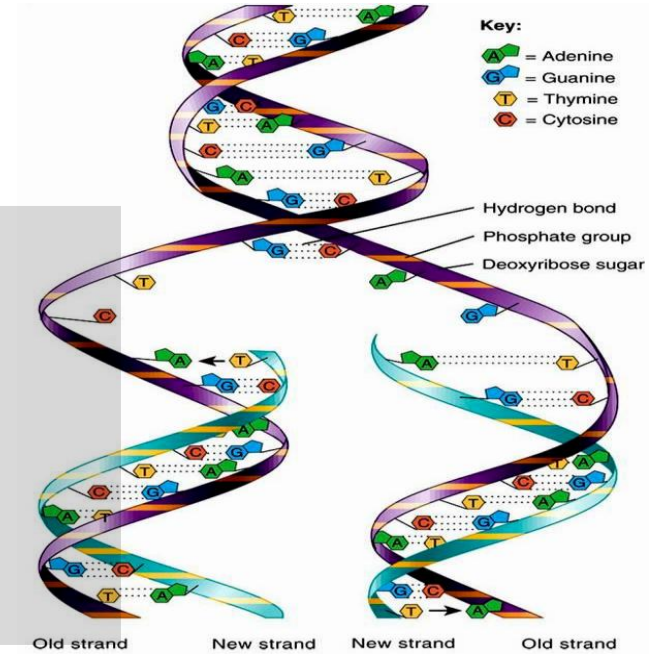
Unit Title: Protein Synthesis/ SC.912.L.16.3

DNA & RNA:
- Nucleic acids composed of nucleotides
- Nucleotides composed of: Phosphate group, Sugar Nitrogenous base

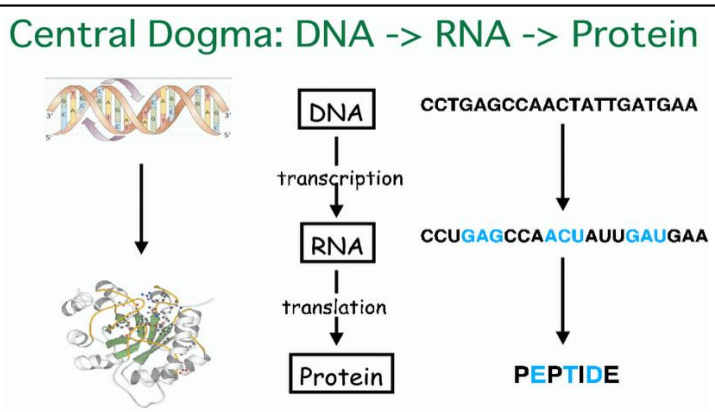
DNA Replication:
Helicase unravels the DNA molecule and each strand serves as a template to make new exact copies (so that when mitosis takes place, each cell has the exact copy of DNA). DNA polymerase is used to add the nitrogenous bases to create the new strands. **Semiconservative model**- the two new copies consist of an old strand and a new strand.

Deoxyribonucleic acid
- Double-stranded, twisted helix
- Never leaves the nucleus
- Nitrogenous bases: adenine, thymine, guanine, cytosine(Guanine w/Cytosine, Adenine w/Thymine)- held together by weak hydrogen bonds (A-T, T-A or C-G, G-C)
- Sugar: deoxyribose
- Controls production of all proteins
- DNA coiled into chromosomes in nucleus
- Tiny sections of DNA are called genes
- Sequence of bases determines sequence of amino acids in proteins

Ribonucleic acid
- Single-stranded
- Leaves the nucleus
- Nitrogenous bases: adenine, uracil, guanine, cytosine (A-U, T-A or C-G, G-C)
- Sugar: ribose
- Three major types of RNA (Ribosomal – rRNA; Messenger – mRNA; Transfer – tRNA)
- Leaves the nucleus to carry out functions in cytoplasm



Protein Synthesis- Central Dogma
Transcription: takes place in the nucleus; DNA to mRNA (mRNA is made from one strand of DNA, carries message to ribosomes)
Translation: takes place in the cytoplasm; mRNA to protein (mRNA translated into a protein at the ribosomes; tRNA transfers amino acids from cytoplasm to ribosomes)

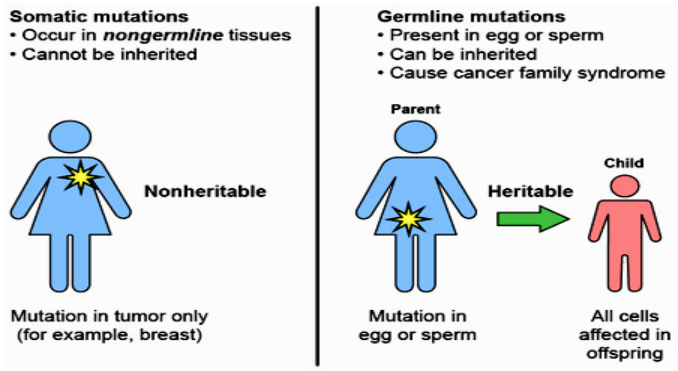


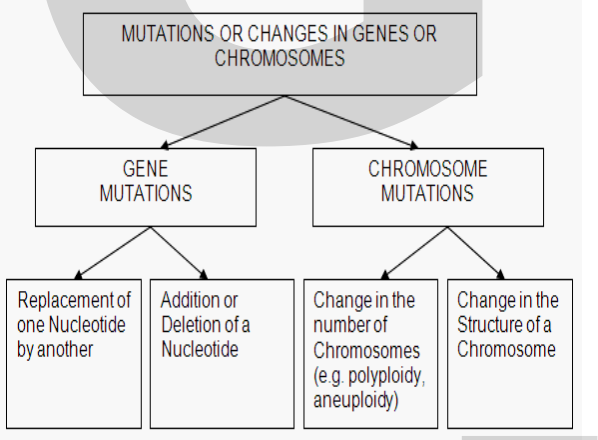
The **genetic code is universal** to ALL life and tells us that everything is related. All life regenerates itself by producing offspring and passing on the genetic code. The genetic code is used to produce amino acids, which are the building blocks for proteins (build and construct practically everything in your body). Variations in the genetic code caused by mutations may alter the protein sequence, which can lead to variation in species.

Universal Genetic Code Chart
Messenger RNA Codons and Amino Acids for Which They Code

First base	Second base U	Second base C	Second base A	Second base G	Third base
U	UUU PHE, UUC PHE, UUA LEU, UUG LEU	UCU SER, UCC SER, UCA SER, UCG SER	UAU TYR, UAC TYR, UAA STOP, UAG STOP	UGU CYS, UGC CYS, UGA STOP, UGG TRP	U C A G
C	CUU LEU, CUC LEU, CUA LEU, CUG LEU	CCU PRO, CCC PRO, CCA PRO, CCG PRO	CAU HIS, CAC HIS, CAA GLN, CAG GLN	CGU ARG, CGC ARG, CGA ARG, CGG ARG	U C A G
A	AUU ILE, AUC ILE, AUA ILE, AUG MET or START	ACU THR, ACC THR, ACA THR, ACG THR	AAU ASN, AAC ASN, AAA LYS, AAG LYS	AGU SER, AGC SER, AGA ARG, AGG ARG	U C A G
G	GUU VAL, GUC VAL, GUA VAL, GUG VAL	GCU ALA, GCC ALA, GCA ALA, GCG ALA	GAU ASP, GAC ASP, GAA GLU, GAG GLU	GGU GLY, GGC GLY, GGA GLY, GGG GLY	U C A G

MUTATIONS:
- change in genetic code
- passed from one cell to new cells
- transmitted to offspring if occurs in sex cells
- most have no effect
- **Gene Mutation** – changes in a single gene; point/substitution or insertion and deletion; occurs during DNA replication.
- **Chromosome Mutation** – changes in many genes; occurs during cell division.
- Can be spontaneous or caused by environmental **mutagens** (radiation, chemicals, etc.)



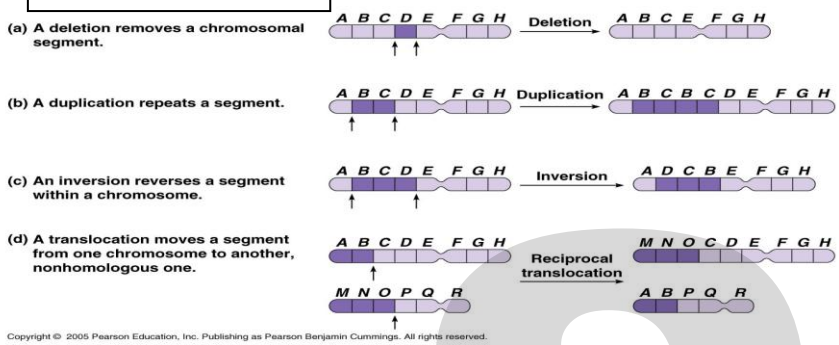


The actual effect of a single gene mutation depends on many factors:
- A substitution on the third base of a codon may have no effect because the third base is less important.
- If a single amino acid is changed to a similar one, then the protein structure and function may be unchanged, but if an amino acid is changed to a very different one, then the structure and function of the protein will be very different.
- Additions and Deletions are Frameshift mutations and are far more serious than substitutions because more of the protein is altered.
- Some proteins are simply more important than others. For instance non-functioning receptor proteins in the tongue may lead to a lack of taste but is not life threatening, whereas non-functioning hemoglobin is fatal.
- Some cells are more important than others. Mutations in somatic cells (i.e. non-reproductive body cells) will only affect cells that derive from that cell, so will probably have a small local effect like a birthmark (although they can cause widespread effects like diabetes or cancer). Mutations in germ cells (i.e. reproductive cells) will affect every single cell of the resulting organism as well as its offspring. These mutations are one source of genetic variation.

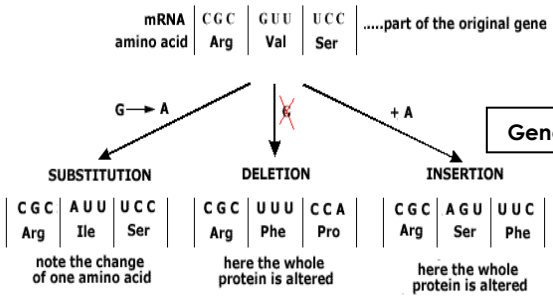
As a result of a gene mutation there are three possible phenotypic effects:
- Most mutations have no phenotypic effect. These are called silent mutations, and we all have a few of these.
- Of the mutations that have a phenotypic effect, most will have a negative effect. Most of the proteins in cells are enzymes, and most changes in enzymes will stop them working. When an enzyme stops working, a metabolic block can occur, when a reaction in cell doesn't happen, so the cell's function is changed. An example of this is the genetic disease phenylketonuria (PKU)
- Very rarely a mutation can have a beneficial phenotypic effect, such as making an enzyme work faster, or a structural protein stronger, or a receptor protein more sensitive. Although rare beneficial mutations are important as they drive evolution.

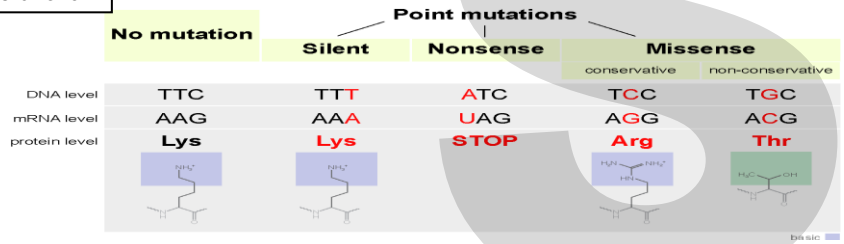
Mutations in chromosomes are different from gene mutations, modification results in more marked phenotypic effects. Mutations in chromosomes occur during the formation of zygote where there are changes in the number of chromosomes; this may result in fission or fusion of chromosomes. Changes in the structure of chromosome can occur in many ways including inversion, duplication, deletion or translocation.

Chromosomal Mutations



Gene Mutations

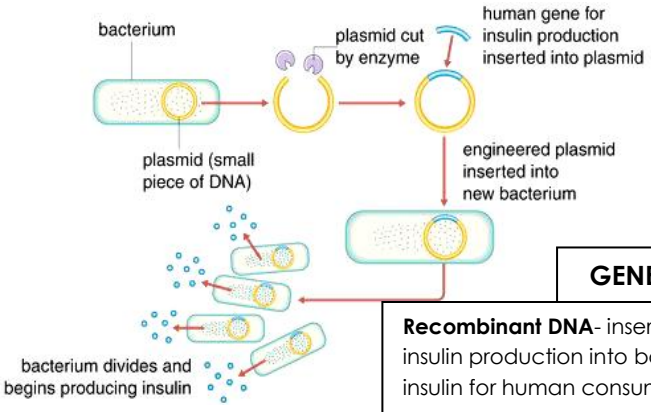




Unit Title: Biotechnology/ SC.912.L.16.10

Biotechnology is the manipulation of organisms or their parts to produce useful products to improve human health and food production.

Genetic Engineering is the process of manually adding new DNA to an organism. Examples of genetically engineered (transgenic) organisms currently on the market include plants with resistance to some insects, plants that can tolerate herbicides, and crops with modified oil content.



GENETIC ENGINEERING

Recombinant DNA- insert human gene for insulin production into bacteria to produce insulin for human consumption.

IMPACT OF BIOTECHNOLOGY ON-

Environment:

- For the most part, crops developed with biotechnology will have many positive impacts on the environment.
- Benefits include reduced pesticide use, improved water and soil conservation and greater safety for workers and the ecosystem.
- Biotechnology has aided in the removal of pollution from our soils, water, and air.
- Also, it has helped us find ways to use our garbage to create new needed products.
- Concerns have been raised that a herbicide tolerant plant could pass that gene responsible for the tolerance on to a weed species, thus conferring herbicide tolerance.

Society:

- For developing countries, biotechnology can increase crop yields, thereby helping to address food shortages and hunger.
- In time, biotechnology may produce biodegradable packaging, alternatives to chemical pharmaceuticals, and more healthful food products (e.g. vegetables with increased quantities of antioxidants to reduce the risk of cancer.); as well as foods, when consumed, will deliver vaccines that can currently only be given by injection.
- Also, it is used to solve crimes with DNA and forensic testing.
- Concerns: Accidental immunity of pests, weeds, viruses, and bacteria; biological warfare.

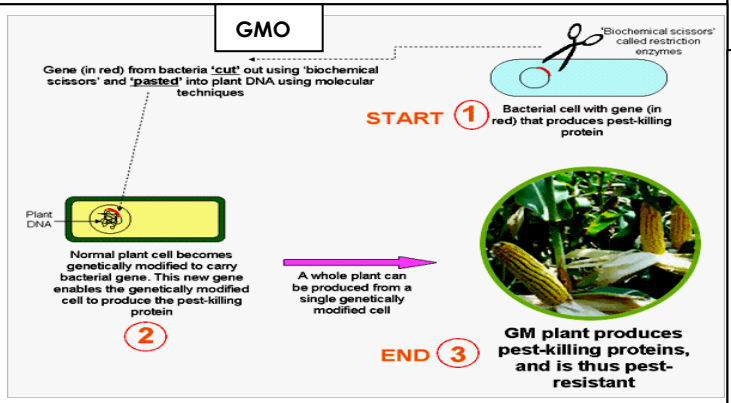
Individual:

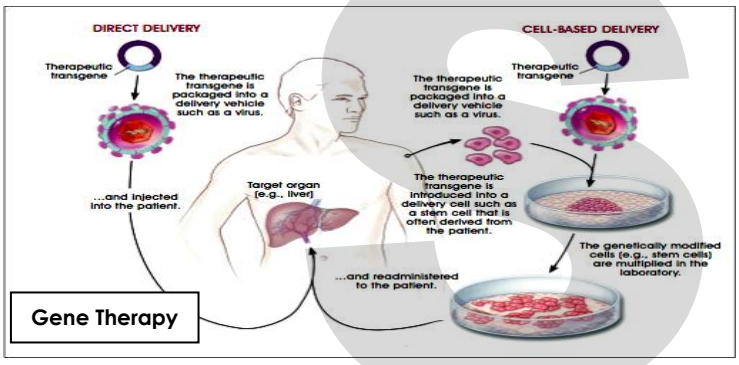
- It provides medicine, and can detect and treat diseases: Diabetes, sickle-cell anemia, antibiotics, etc.

Usage	Concerns
• GMOs- genetically modified plants to be pest/disease resistance; to use less water and fertilizers. • Genetically modified bacteria to clean up toxic waste/oil spill. • Biofertilizers- increase fertility of soil. • Gene cloning- specific DNA sequence is isolated and reproduced for medical research, production of insulin and vaccines. • Gene therapy-a nonfunctioning gene in human cells are replaced with a functioning one. • DNA fingerprinting- fragments of DNA are used to identify criminals or to reveal paternity.	• Reduce genetic diversity • Safety of genetic modified foods • Discrimination by DNA • Interference with nature

DNA Fingerprinting

GMO





Gene Therapy

Unit Title: Immune System/ SC.912.L.14.52

Immune System
The body's defense against disease causing organisms, malfunctioning cells, and foreign particles.

- **Antibody**: a protein produced by the human immune system to tag and destroy invasive microbes.
- **Antigen**: any protein that our immune system uses to recognize "self" vs. "not self."

Nonspecific External Barriers
skin, mucous membranes

If these barriers are penetrated, the body responds with

Innate Immune Response
phagocytic and natural killer cells, inflammation, fever

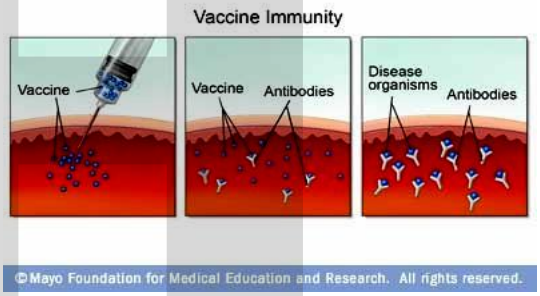
If the innate immune response is insufficient, the body responds with

Adaptive Immune Response
cell-mediated immunity, humoral immunity

Nonspecific Immune Response is our first line of defense (skin, mucous) against invading organisms. It is not tailored to any specific pathogen and treats all equally.
Specific Immune Response is effective against specific pathogens and is based on memory (memory cells- Tcells/Bcells). Antigen based…identifies a specific pathogen and creates antibodies for it. This involves various white blood cells called lymphocytes or leukocytes.

Nonspecific defense mechanisms		Specific defense mechanisms (immune system)
First line of defense	Second line of defense	Third line of defense
• Skin • Mucous membranes • Secretions of skin and mucous membranes	• Phagocytic white blood cells • Antimicrobial proteins • The inflammatory response	• Lymphocytes • Antibodies

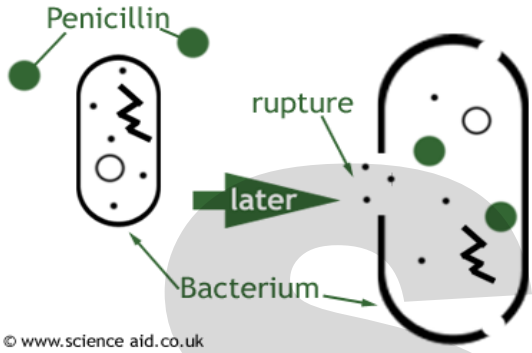
Vaccines vs. Antibiotics
- Vaccine kills virus while antibiotics kill bacteria.
- Vaccine is taken once and has permanent effect whereas antibiotics work during the time of disease.
- Antibiotics are available in different forms like tablets, capsules, drops or ointments. Vaccines can be given orally or through injection.
- Vaccines are preventive method that is taken before getting infected. Antibiotics are taken after getting infected.



How vaccines work? The proteins are recognized as antigens by our immune systems. This causes a mild immune response. Memory T-cells and B-cells remain ready to fight off the illness if it is encountered again.

Genetic factors, pathogenic agents and environmental factors can negatively affect individual health by causing illnesses or diseases…
- Genetic mutations occur when DNA changes, altering the genetic instructions. This may result in a genetic disorder or a change in characteristics.
  Mutations can be caused by exposure to specific chemicals or radiation. For example, cigarette smoke is full of chemicals that attack and damage DNA. This causes mutations in lung cell genes, including the ones that control growth.
  Other genetic illnesses caused by genetic factors: heart disease, diabetes, asthma
- Environmental factors relate to pollution of air, water, and air caused by emissions, chemical fertilizers, pesticides, and other chemicals that are released from factories can cause severe health problems.
- Pathogenic agents are the bacteria, viruses, fungi, and protozoan that cause diseases.

Antibiotics help destroy bacteria (but not viruses). Antibiotics work in one of several ways:
- Slowing bacteria reproduction.
- Interfering with bacterial cell wall formation.



Unit Title: Evolution and History of life/ SC.912.L.15.1, SC.912.L.15.13, SC.912.L.15.8

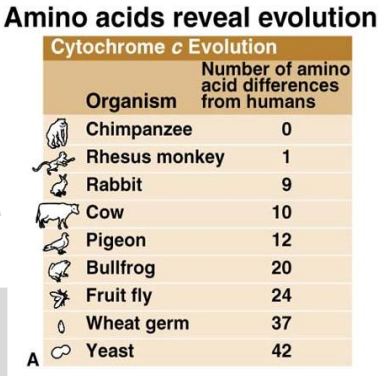
THEORY OF EVOLUTION:
- proposed by Charles Darwin
- process by which organisms that are best suited to environment survive and pass genetic traits on to offspring
- **Adaptation** – organisms with the most suited traits will survive
- **Evolution** – change in a species over time (not a single individual, but the group)

EVIDENCE OF EVOLUTION:

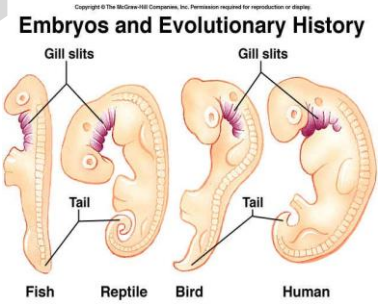
- **Fossils-** may appear in rocks, ice, and amber; when fossils are arranged in order of their age, the fossil record provides a series of changes that occurred over time; comparison of anatomical characteristics reveals shared ancestry/common ancestry
- **Molecular Biology-** comparing DNA/gene or protein sequences from organisms (closely-related organisms will have similar DNA, RNA, and protein (amino acid) sequences). This also gives evidence of a common ancestor
- **Embryology-** embryos of different vertebrates look alike in their early stages, giving the superficial appearance of a relationship
- **Comparative anatomy-**

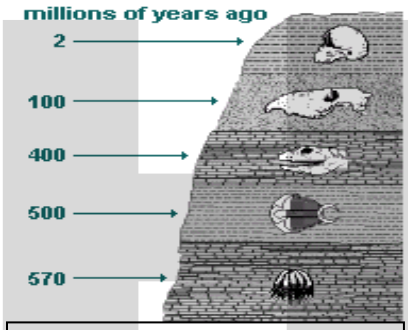
Homologous structures - structures (body parts/anatomy) which are similar in different species because the species have common descent. They may or may not perform the same function. An example is the forelimb structure shared by cats and whales. Vestigial structures are anatomical features that are still present in an organism (although often reduced in size) even though they no longer serve a function. Whales, which evolved from land mammals, have vestigial hind leg bones in their bodies.

-**Biogeography-** patterns of past evolution are found in the natural geographic distribution of related species, similarity of endemic island species to nearby mainland species.

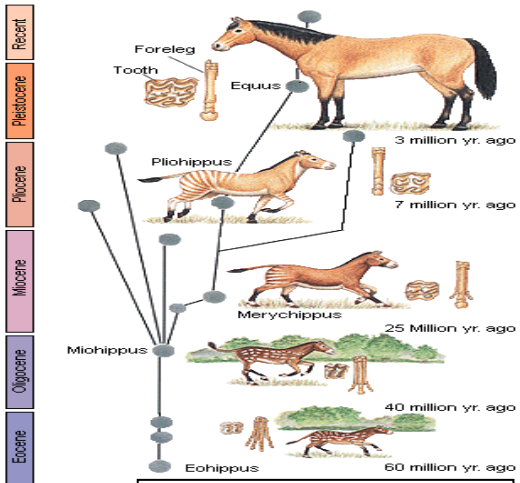


Molecular Evidence



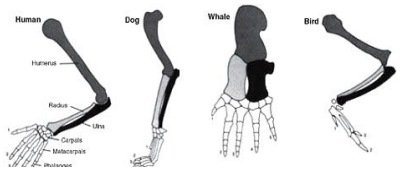


Fossil Evidence-younger/newer specimen at the top

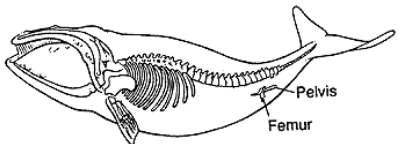


Fossil Evidence - Horse Evolution

Homologous structure- Forelimbs in humans, dogs, whales and birds



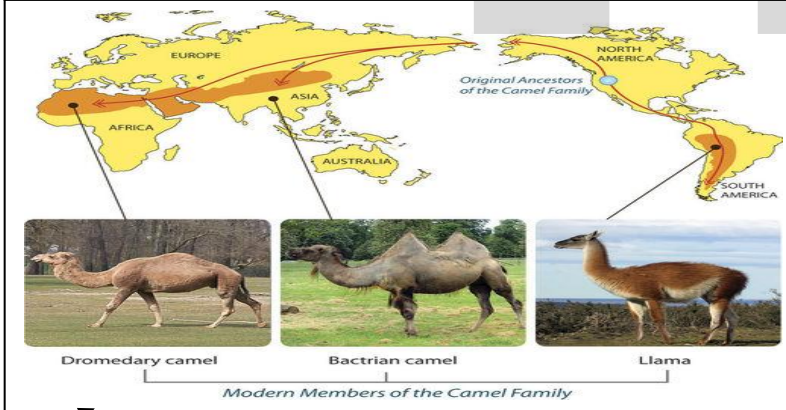
Vestigial Structures- pelvis and femur bones in whales



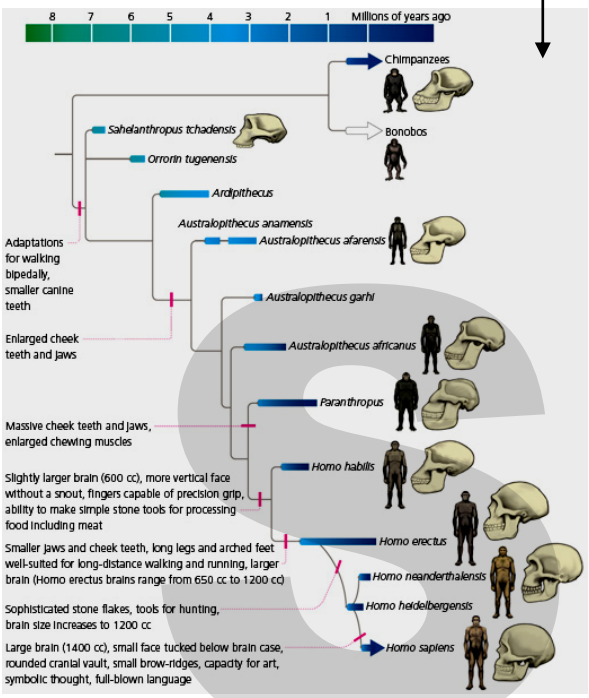
Hominids are the family of organisms that includes humans.

Trends in Hominid Evolution:

- Bipedalism (walk on two legs)
- Increase in brain size
- Smaller teeth and jaw
- Tool usage
- Language development



Biogeography is the study of how species are distributed spatially across the landscape (geographically).



Mechanisms for Evolutionary Change-

- Mutations
- Genetic Drift
- Natural Selection
- Migration/Gene Flow

Natural Selection-is the gradual process by which heritable biological traits become either more or less common in a population. Organisms that are best adapted to an environment *survive* and *reproduce* more than others.

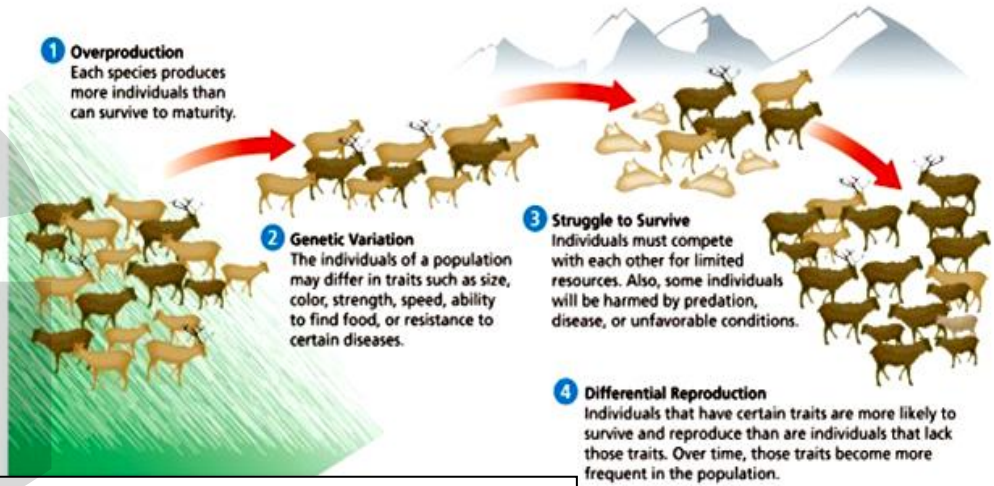
Conditions required for natural selection:

There is variation in traits.
For example, some beetles are green and some are brown.

There is differential reproduction.
Since the environment can't support unlimited population growth, not all individuals get to reproduce to their full potential. In this example, green beetles tend to get eaten by birds and survive to reproduce less often than brown (camouflage with the bark of trees) beetles do.

There is heredity.
The surviving brown beetles have brown baby beetles because this trait has a genetic basis.

End result
The advantageous trait, brown coloration, which allows the beetle to have more offspring, becomes more common in the population. Eventually, all individuals in the population will be brown.



Conditions required for Natural Selection

Evolutionary Change

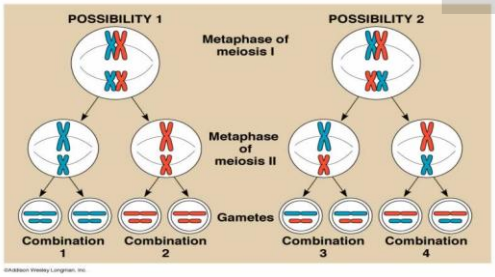
Mutation is the change in DNA. Since all cells in our body contain DNA, there are lots of places for mutations to occur; however, not all mutations matter for evolution. Somatic mutations occur in non-reproductive cells and won't be passed onto offspring only those in germ cells/gametes. Evolutionary change is based on the accumulation of many mutations.

Gene Flow/Migration is any movement of genes from one population to another. Gene flow includes lots of different kinds of events, such as pollen being blown to a new destination or people moving to new cities or countries. If genes are carried to a population where those genes previously did not exist, gene flow can be a very important source of genetic variation which could potentially lead to the evolution of the species in that population.

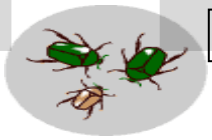
Genetic drift along with natural selection, mutation, and migration - is one of the basic mechanisms of evolution. In each generation, some individuals may, just **by chance**, leave behind a few more descendents (and genes, of course!) than other individuals. The genes of the next generation will be the genes of the "lucky" individuals, not necessarily the healthier or "better" individuals.

Nonrandom Mating- mating that has not occurred due to chance (arranged marriages).

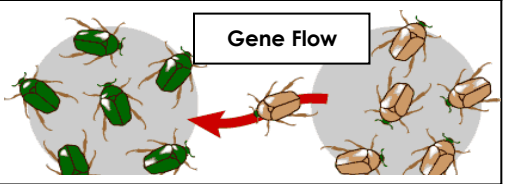
Genetic Recombination increase Genetic Diversity-



Meiosis- Independent Assortment of chromosomes during **Metaphase I and II increases genetic variations**

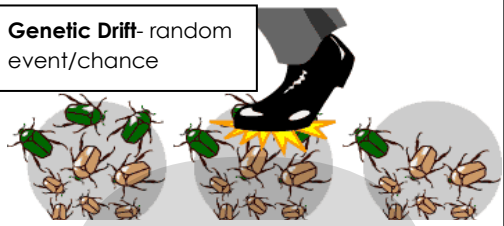


Mutation



Gene Flow

Natural Selection



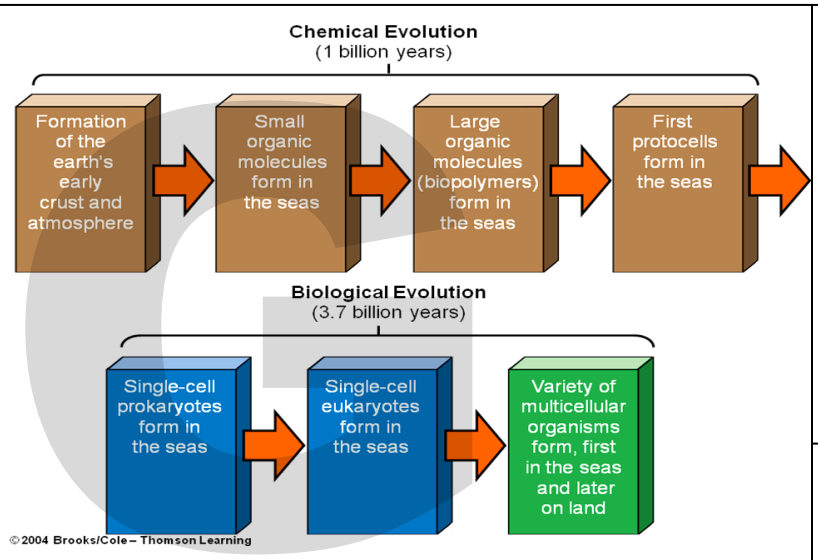
Genetic Drift- random event/chance

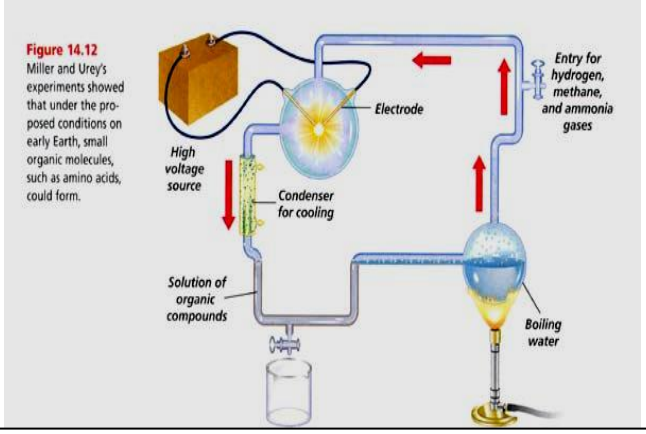
Scientific Explanation of the Origin of Life

1. Simple organic molecules were formed (primordial soup)
2. Replicating molecules evolved and began to undergo natural selection.
3. Replicating molecules became enclosed within a cell membrane
4. Formation of prokaryotes. Some cells began to evolve modern metabolic processes and out-competed those with older forms of metabolism(Endosymbiotic theory)
5. Multicellularity evolved.

Conditions contributing to the origin of life on Earth:

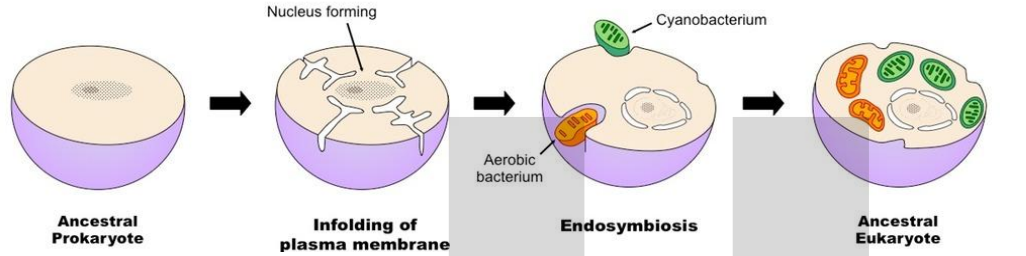
- Presence of liquid water
- Moderate temperature
- Free oxygen
- Sunlight
- Formation of the ozone layer using oxygen
- Absence of toxin from the atmosphere
- Absence of radiation





Miller/Urey Experiment showed that amino acids (organic molecules) could be formed from matter present on early Earth (inorganic molecules: ammonia, hydrogen)

Origin of Life on Earth
Chemical Evolution- inorganic molecules formed complex organic molecules (building blocks of life)
Biological Evolution- prokaryotes engulfed each other to form eukaryotes (Endosymbiotic theory)



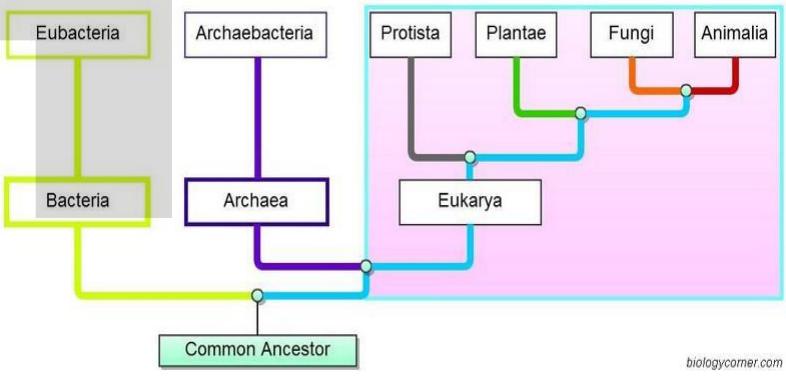
Endosymbiotic Theory states that several key organelles of eukaryotes originated as symbiosis between separate single-celled prokaryotic organisms.

Unit Title: Classification/SC.912.L.15.6

CLASSIFICATION:
- process in understanding how organisms are related and how they are different
- It also follows the evolutionary trends
- **taxonomy** – branch of biology that studies grouping and naming of organisms

History of classification systems-
- early 1700s, Carolus Linnaeus developed a system based on physical characteristics; two kingdoms (plants and animals)
- developed "genus" and "species"
- designed system of naming called **binomial nomenclature** ("two names") which gave each organism two names, a genus and a species, Genus always capitalized, both should be underlined or italicized

One of the new reasons why species are being re-evaluated is because of DNA analysis. Basic genetic analysis information can change our ideas of how closely two species are related and so their classification can change.



Organisms are classified into three Domains and into one of six Kingdoms of life. Organisms are placed into these categories based on similarities or common characteristics. Some of the characteristics that are used to determine placement are cell type, metabolism, and reproduction.
Domain: Archaea, Bacteria and Eukarya
Six kingdoms: Archaea/Archaeabacteria, Bacteria/Eubacteria, Protista, Fungi, Plantae, and Animalia

LEVELS OF CLASSIFICATION:
- Kingdom
- Phylum
- Class
- Order
- Family
- Genus
- Species

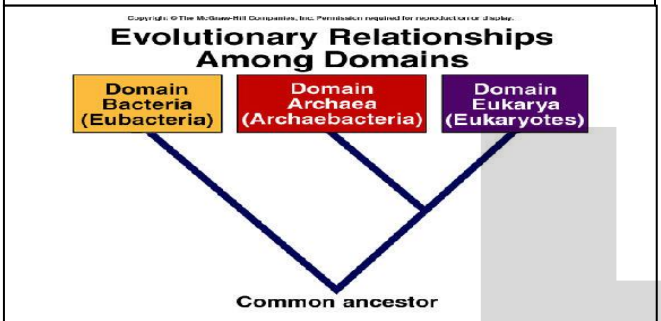
CLASSIFICATION OF HUMANS:
Kingdom: *Animalia* (multicellular organisms that eat food)
Phylum: *Chordata* (dorsal hollow nerve cord, notochord, pharyngeal slits)
Class: *Mammalia* (hair, mammary glands, endothermic, and four-chambered heart)
Order: *Primates* (nails, clavicle, orbits encircled with bone, enlarged cerebrum, and opposable digits)
Family: *Homidae* (bipedal – walk erect on two feet, advanced tool use)
Genus: *Homo* ("human" like)

Classification of Living Things

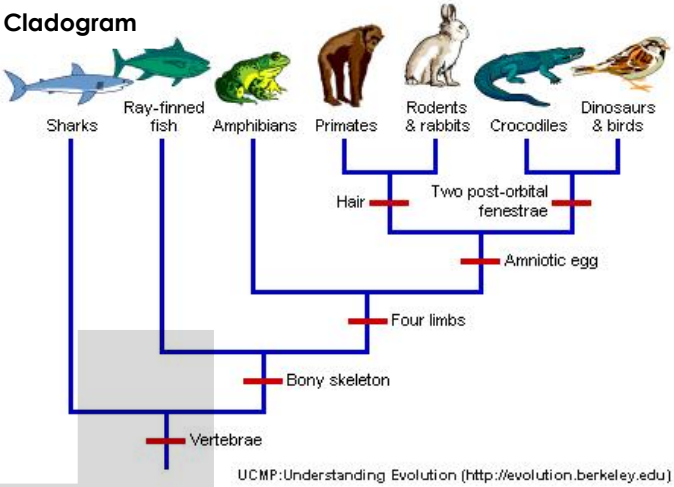
DOMAIN	Bacteria	Archaea	Eukarya			
KINGDOM	Eubacteria	Archaebacteria	Protista	Fungi	Plantae	Animalia
CELL TYPE	Prokaryote	Prokaryote	Eukaryote	Eukaryote	Eukaryote	Eukaryote
CELL STRUCTURES	Cell walls with peptidoglycan	Cell walls without peptidoglycan	Cell walls of cellulose in some; some have chloroplasts	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	*Amoeba, Paramecium*, slime molds, giant kelp	Mushrooms, yeasts	Mosses, ferns, flowering plants	Sponges, worms, insects, fishes, mammals

Autotrophs- are organisms that can produce their own food from the substances available in their surroundings using light (photosynthesis) or chemical energy (chemosynthesis); producers.
Heterotrophs- are organisms that cannot produce their own food and rely on other organisms for energy/food; consumers.

A **phylogenetic tree** is another way of representing evolutionary relationships.
Branches represent real lineages that occurred in the evolutionary past.
It includes information about ancestors, duration of evolutionary lineages, amounts of evolutionary change that has occurred.



Cladogram



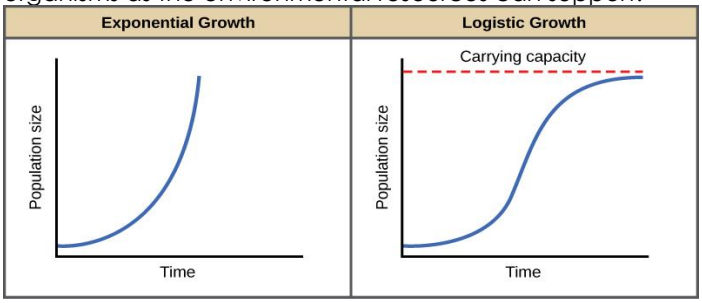
Unit Title: Populations and Ecosystems/SC.912.L.17.5

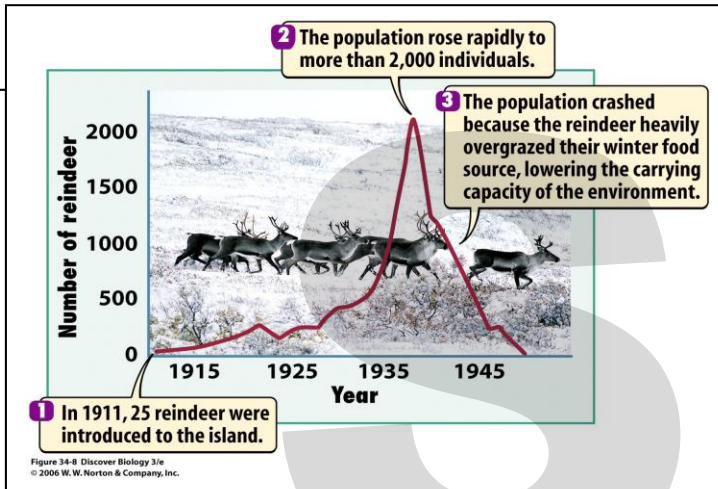
Population: all the individuals of a species that live together in an area.
Limiting factor- are biotic or abiotic factors that influence population density and growth, and cause them to fluctuate. These factors include the availability of food, predation, or availability of water and space, temperature.

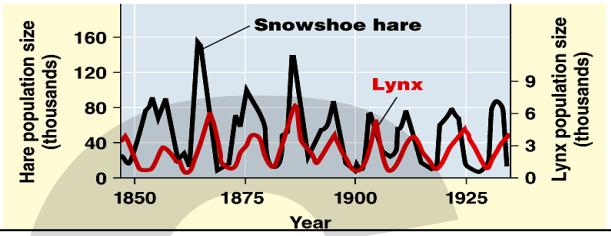
Factors that change population size/density-

- **Density-dependent factors- Biotic factors** in the environment that have an increasing effect as population size increases. Ex. Disease, competition, parasites
- **Density-independent factors- Abiotic factors** in the environment that affect populations regardless of their density. Ex. Temperature, storms, habitat destruction, drought
- Immigration- movement of individuals into a population
- Emigration- movement of individuals out of a population
- Death/mortality
- Birth/natality

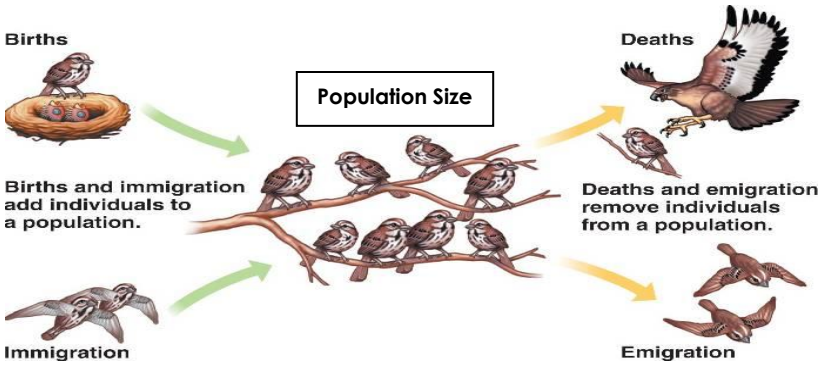
Carrying Capacity- the maximum population size that can be supported by the available resources, there can only is as many organisms as the environmental resources can support.







Population change-
Snowshoe hare is the primary food of the lynx/ predator-prey relationship.
Population cycles of these two species are closely linked.

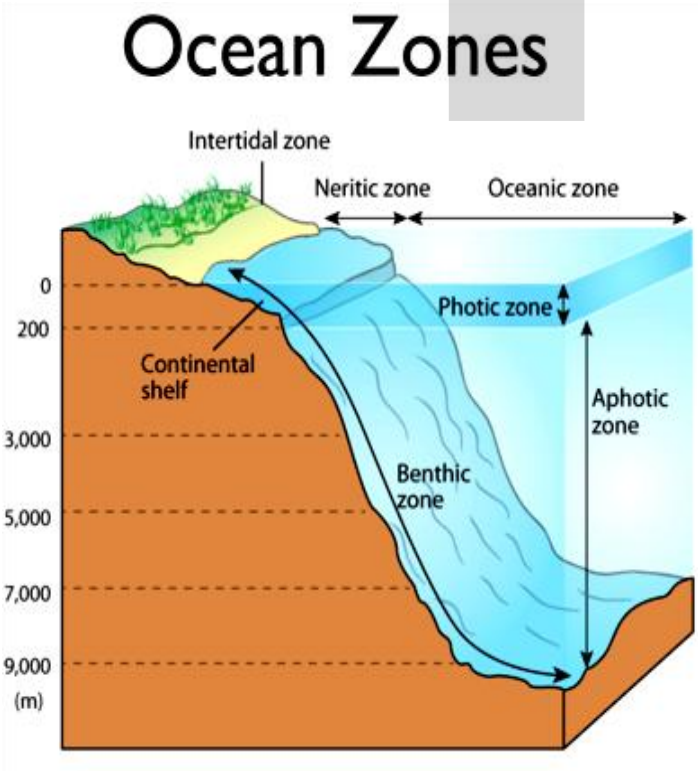


Aquatic Biomes

Factors affecting aquatic biomes: salinity, temperature, light and depth.

All aquatic ecosystems are affected by the same abiotic factors: sunlight, temperature, oxygen, and salt content.

- ✓ Sunlight is an especially important factor in aquatic ecosystems. Sunlight is necessary for photosynthesis in the water just as it is on land. However, because water absorbs sunlight, there is only enough light for photosynthesis near the surface or in shallow water. Most marine food chains begin with photosynthetic single-celled organisms which are affected by daily and seasonal changes in light intensity and duration. The most common producers in aquatic ecosystems are algae rather than plants.
- ✓ Most of the life forms are found in places where higher density of light is present.
- ✓ The metabolic rate of almost all the organisms thriving in this ecosystem is influenced by the water temperature. Some organisms such as the trout grow at relatively cool stream temperatures.
- ✓ Dissolved gases--gases dissolve more in cold water than in warm water. The two most important gases to marine organisms are: oxygen and carbon dioxide. Oxygen is essential for cellular respiration and carbon dioxide for photosynthesis.
  a. Oxygen, a product of photosynthesis, is greatest at the surface where the sea water is in contact with the atmosphere. The colder the water, the more oxygen it can contain.
  b. Carbon dioxide is absorbed from the atmosphere, a process which may slow global warming. Its levels, however, may be lower in the euphotic zone due its use by algae and bacteria during photosynthesis.
  c. Nitrogen must be fixed into nitrates before used by most marine algae. This accomplished by other microorganisms, such as cyanobacteria. Nitrogen is a major limiting factor in the sea.
- ✓ Salinity is a measure of the total dissolved solids in water (mostly salt); with an ocean global average of 35 parts salt per thousand parts water. Salts come from land via rivers, where it concentrates as ocean water evaporates. Ocean salinity confers an average pH of 8.1 which favors precipitation of calcium carbonate (used to make shells). It decreases the freezing point of water, so that in natural environments on Earth, it doesn't exactly freeze, it becomes more like slush. Salinity also affects water density; saltier water is denser.



The intertidal zone
is closest to shore. At high tide it is covered with water. At low tide, it is exposed to air. Living things must adapt to changing conditions and moving water in this zone.

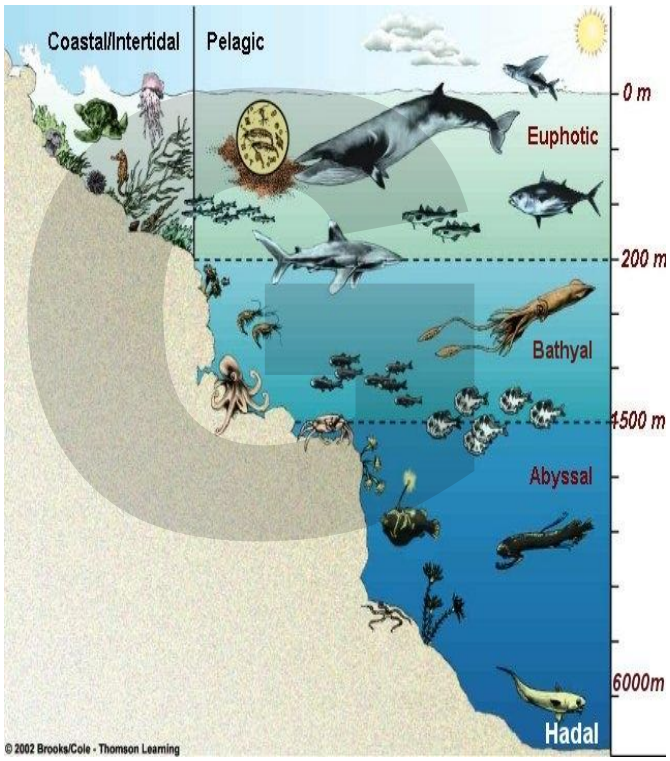
The neritic zone
lies over the continental shelf. The water is not very deep. There are plenty of nutrients and sunlight. Many organisms live in this zone.

The oceanic zone
is the open ocean out past the continental shelf. The water may be very deep. Nutrients may be scarce. Fewer organisms live in this zone.

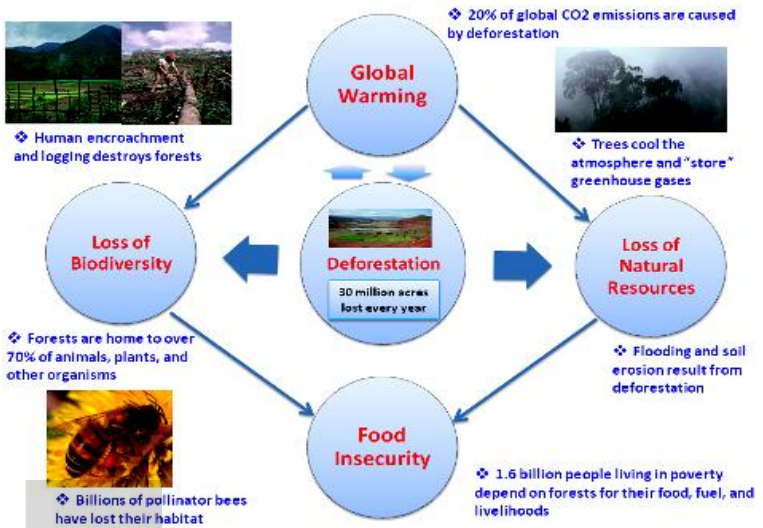
The photic zone
is the top 200 meters of water. This zone has enough sunlight for photosynthesis. That's why there are more living things here than in the aphotic zone.

The aphotic zone
is water below 200 meters. There isn't enough sunlight here for photosynthesis. Living things must eat whatever drifts down from above or each other. That's why there are fewer living things here than near the surface.

The bentic zone
is on the ocean floor. The ocean floor drops as you move away from the continents. There are fewer living things on the ocean floor where the water is very deep.



Consequences of Biodiversity Reduction-
Habitat loss and degradation, introduction of a non-native species, climate change, and pollution are some factors that can lead to the extinction of a species, which can then affect an entire ecosystem.
The loss of biological diversity destabilizes ecosystems and makes them more vulnerable to shocks and disturbances such as hurricanes and floods, which may further reduce the ability of environments to provide for human well-being.

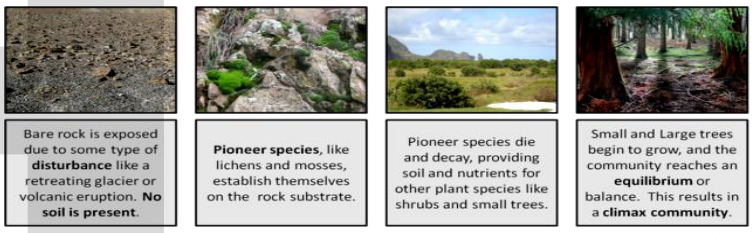


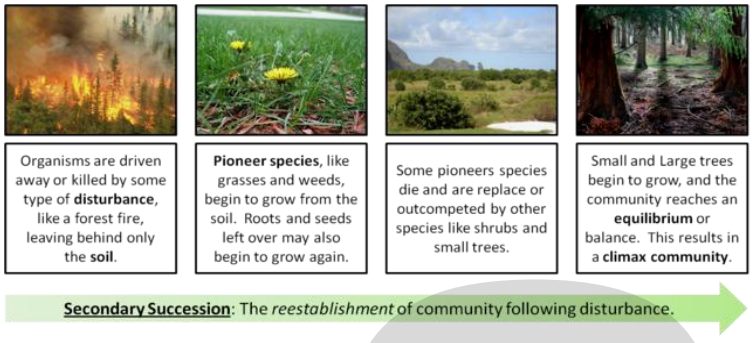
Potential Changes to an ecosystem
Seasonal changes/Climate changes

- ✓ For many species, the climate where they live or spend part of the year influences key stages of their annual life cycle, such as migration, blooming, and mating
- ✓ Climate is an important environmental influence on ecosystems. Climate changes and the impacts of climate change affect ecosystems in a variety of ways. For instance, warming could force species to migrate to higher latitudes or higher elevations where temperatures are more conducive to their survival. Similarly, as sea level rises, saltwater intrusion into a freshwater system may force some key species to relocate or die, thus removing predators or prey that were critical in the existing food chain.

Succession is the gradual process by which ecosystems change and develop over time. Nothing remains the same and habitats are constantly changing

- ✓ Primary succession is the series of community changes which occur on an entirely new habitat which has never been colonized before. Pioneer species (first species to inhabit a barren area) include: mosses
- ✓ Secondary succession is the series of community changes which take place on a previously colonized, but disturbed or damaged habitat. For example, land clearance or a fire.





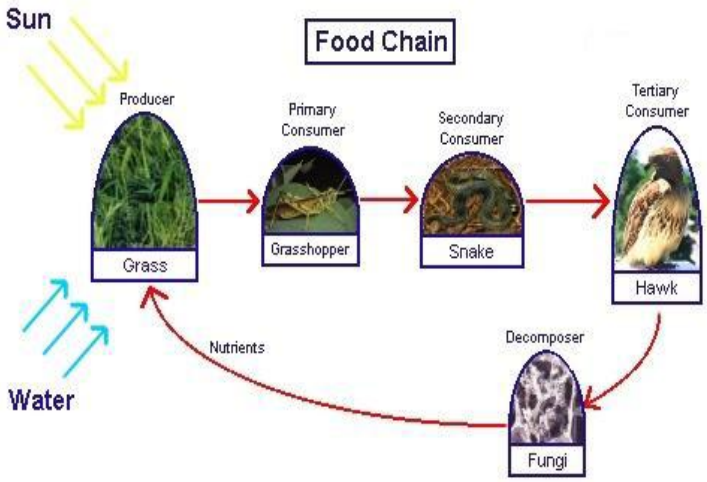
Unit Title: Energy Flow/ SC.912.L.17.9

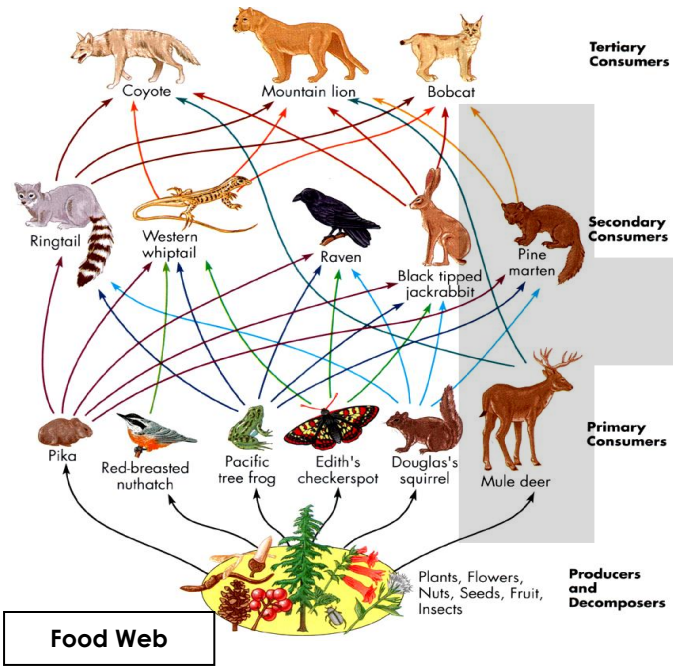
ENERGY FLOW IN AN ECOSYSTEM
SUN >>>>> GRASS >>>>> MICE >>>>> HAWK
Sunlight is the main energy source for living things. Energy flows through an ecosystem from the sun to organisms within the ecosystem in one direction. Two main groups of organisms in the ecosystem are the producers and consumers.
Producers – autotrophs, use sun's energy to make their own food, plants (grass)
Consumers – heterotrophs, cannot make their own food, eat other living things to get their energy (mice- primary consumers; and hawk- secondary consumer)

FOOD CHAIN:
All living things need food to give them the energy to grow and move. A food chain shows how each living thing gets its food. It shows who is eating who. The arrow means "is eaten by"
- Path of energy from producer to consumer
- Each level is called a trophic level (trophic = energy)
- Approximately 10% energy is transferred to next level
- 90% used for personal metabolism and development

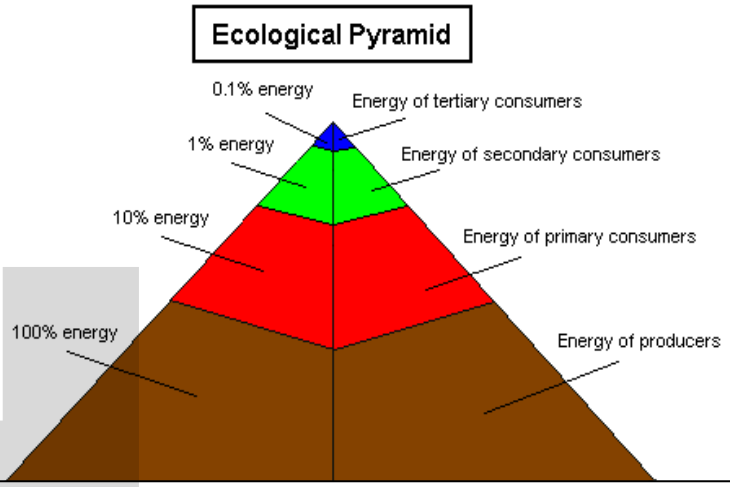
FOOD WEB:
- Interconnected food chains; consists of many food chains and feeding relationships.
- Shows all possible feeding relationships at each trophic level in a community

ECOLOGICAL PYRAMID:
- Representation of energy transfer
- Pyramid of Energy – each level represents energy available at that level, 90% decline
- Pyramid of Biomass – each level represents amount level above needs to consume
- Pyramid of Numbers – each level represents number of organisms consumed by level above it





Food Web



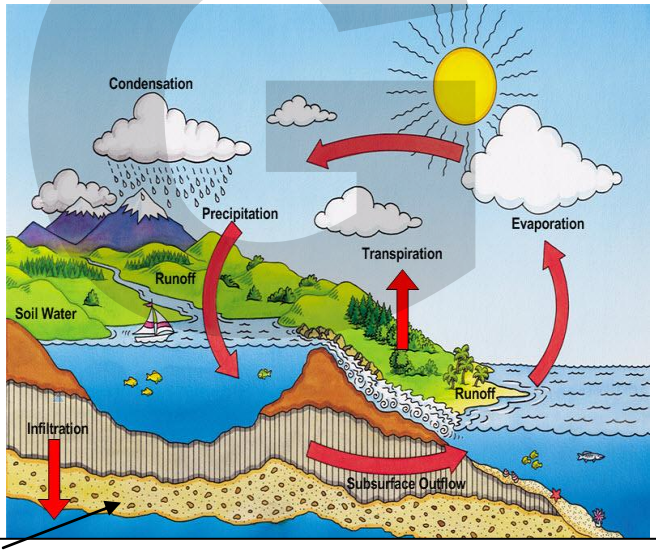
Only 10% of the energy is passed on to the next trophic level; most is used up by the organism and some released as heat.

STRUCTURE OF AN ECOSYSTEM
Organism >>>>> Species >>>>> Population >>>>> Community >>>>> Ecosystem >>>>> Environment
Species – group of organisms that can interbreed
Population – units of single species
Community – groups of interacting populations
Ecosystem – groups of interacting communities
Habitat – place where an organism lives
Niche – organism's role within its habitat

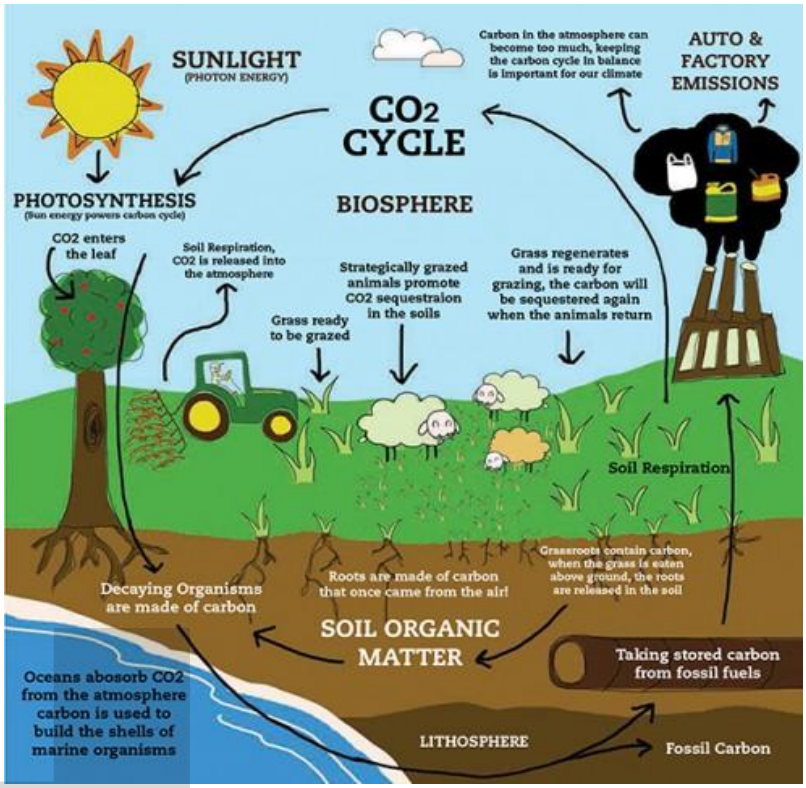
- Plants are called producers because they are able to use light energy from the sun to produce food (sugar) from carbon dioxide and water.
- Animals cannot make their own food so they must eat plants and/or other animals. They are called consumers. There are three groups of consumers.
  - ✓ Animals that eat only plants are called herbivores (or primary consumers).
  - ✓ Animals that eat other animals are called carnivores. Carnivores that eat herbivores are called secondary consumers, and carnivores that eat other carnivores are called tertiary consumers. Animals and people who eat both animals and plants are called omnivores.
- Then there are decomposers (bacteria, fungi, and even some worms), which feed on decaying matter. These decomposers speed up the decaying process that releases mineral salts back into the food chain for absorption by plants as nutrients.

Impact of changing one organism in a food web can alter the balance in an ecosystem-
If for example, the producer is removed, the consequences could be dire. Producers capture sunlight directly and make chemical energy for consumers. If this is the only producer that a particular consumer eats, it may die as well. Pandas eat only bamboo. As bamboo is removed from the habitat, pandas will eventually diminish and possibly die off. If a secondary consumer or tertiary consumer were removed, for example, wolves, the primary consumers overpopulate. This is seen in places where wolves once roamed and no longer do. Deer are overpopulating out of control and they are exceeding the carrying capacity for their range. The deer population can experience an explosion and subsequent die off due to starvation. As you can see, no matter where the food web loses a member, the effects are great.

BIOGEOCHEMICAL CYCLES:
(Matter cannot be created nor destroyed, but can be converted/recycled to other forms)
Water Cycle – water is recycled through evaporation, condensation, precipitation, runoff, groundwater, aquifers, respiration, transpiration, excretion, decomposition
Carbon Cycle – carbon is recycled through respiration, photosynthesis, fuel combustion, decomposition; carbon can be atmospheric or dissolved, or can be found in organic compounds within the body



The Sun's heat provides energy to evaporate water from the Earth's surface (oceans, lakes, etc.). Plants also lose water to the air (this is called transpiration). The water vapor eventually condenses, forming tiny droplets in clouds. When the clouds meet cool air over land, precipitation (rain, sleet, or snow) is triggered, and water returns to the land (or sea). Some of the precipitation soaks into the ground. Some of the underground water is trapped between rock or clay layers; this is called groundwater. But most of the water flows downhill as runoff (above ground or underground), eventually returning to the seas as slightly salty water.



IMPACT OF HUMANS ON THE ENVIRONMENT:
- caused extinction of species through hunting, fishing, agriculture, industry, urban development
- Invasive species (pythons in Florida) vs. native species
- growing population = greater demands on environment
- affected quality and quantity of land, air, water resources
- Pollution = pollutants
  - Air Pollution = smog, acid rain, dust, smoke, gases, fog, carbon dioxide
  - Water Pollution = sewers, industry, farms, homes, chemical waste, fertilizer, dirty dish water
  - Land Pollution = landfills, dumpsites, runoff, negligence, urban wastes

CONSERVATION EFFORTS:
- conserve energy resources
- protect and conserve material resources
- control pollution (recapture wastes, carpooling, solid waste neutralization)
- wildlife conservation protects animals from habitat loss, over-hunting, pollution
- reduce, reuse, and recycle programs
- sanitation and waste disposal programs

Environmental Impact of Renewable and Nonrenewable Resources-

Sources of energy
Energy is one of the requirements necessary to run day to day activities. There are many different sources of energy that are naturally available throughout the world in different forms. Depending with energy regeneration, energy can be categorized into two main different sources which are renewable and non renewable sources.

Renewable sources of energy
Renewable sources of energy are obtained from different natural sources. The main common sources are sunlight, wind, tides and geothermal. Statistics has indicated that renewable sources of energy comprise approximate 16% of total global energy that is consumed on daily basis. One advantage about this form of energy is that it can be replaced and used continuously without becoming depleted. Renewable sources of energy are mostly used in three different areas which include electricity generation, heating by use of solar hot water and motor fuels through the use of renewable bio-fuels.

Nonrenewable sources of energy
Nonrenewable sources of energy have continued to produce constant energy throughout the world. This is because of their high availability. Sources of nonrenewable energy can be attributed to natural sources that are not regenerated once the source is depleted. Sources include fossils fuels such as coal and petroleum products e.g. natural gas and diesels.

Pros of renewable sources of energy

1. Renewable sources of energy are renewable and easily regenerated. This is unlike fossil fuels which are perishable once used.
2. Renewable source of energy such as solar produce clean energy that does not pollute the environment. This is because no burning is required during usage of the energy.
3. Most importantly, renewable energy are available everywhere throughout the world thus there is no chance of the sources becoming depleted in future. For example, solar energy is everywhere as the sun will always be there every day.
4. Maintenance cost needed to install and use the renewable energy is relatively cheap. Solar energy can be trapped easily and used for domestic needs.
5. Renewable sources of energy boost economic growth and increase job opportunities. This includes electrical energy which is used to run many industries.

Cons of renewable sources of energy

Some of these limitations include

1. Difficult to produce the energy quantity that is equivalent to that produced by nonrenewable fuels
2. Technology required to trap renewable energy is costly. Setting of dams requires high initial capital to construct and maintain
3. Most renewable sources of energy are affected by weather thus reducing their reliability. For example, hydro generators need constant rainfall that will overflow the dams, wind turbines only rotate if there is wind of a given speed.

Pros of nonrenewable sources of energy

Some such as natural gas burns without any soot hence less environmental pollution.

1. Most nonrenewable sources of energy are easy to transport from one area to another. For example petroleum oils which can be transported via pipes.
2. Cost of producing nonrenewable energy is low since they are naturally available. Furthermore they are cheap to transform from one form of energy to another.
3. Most of this energy sources are abundantly available in different areas. Their availability is not affected by climatic condition.

Cons of nonrenewable sources of energy

1. Produce harmful green house gases which contribute global warming. Coal once burnt produces carbon dioxide harmful to the environment.
2. Once they are depleted they cannot be replaced making them expensive to obtain.

Unit Title: Body Systems/ SC.912.L.14.26 & SC.912.L.14.36

Blood Flow

• Blood flow: Amount of blood that flows through any tissue in a given period of time (mL/min)
• Total blood flow: Volume of blood that circulates through the systemic and pulmonary blood vessels each minute → Cardiac Output (CO)

Distribution of CO into different body tissues:
1. Pressure difference of different parts of the body

Pressure ↑ → Blood Flow ↑
2. Resistance of specific blood vessels to blood flow

Resistance ↑ → Blood Flow ↓
Size of the lumen of a blood vessel ↓ → Resistance to blood flow ↑
*Diabetes is one of the many medical conditions that slow down blood flow. In diabetes, there is an elevated level of sugar in the blood. This increase in glucose causes the blood to be viscous or thicker causing the flow to decrease.
*Blood flow is also altered when the pathway for blood flow in the blood vessels is blocked
*Factors affecting blood flow not only slows down the flow but also, some factors can cause an increase in the blood flow. An example is the use of marijuana. Because of this increased blood flow to the brain, marijuana users find it difficult to think or remember recent events because their brain is functioning too fast.
***Blood flow can be affected by the composition of the blood itself (i.e. concentration of solutes), the diameter of blood vessels, and presence of chemical substances that can alter blood flow

THE BRAIN

The Cerebrum: The cerebrum or cortex is the largest part of the human brain, associated with higher brain function such as thought and action. The cerebral cortex is divided into four sections, called "lobes": the frontal lobe, parietal lobe, occipital lobe, and temporal lobe.

- **Frontal Lobe**- associated with reasoning, planning, parts of speech, movement, emotions, and problem solving
- **Parietal Lobe**- associated with movement, orientation, recognition, perception of stimuli
- **Occipital Lobe**- associated with visual processing
- **Temporal Lobe**- associated with perception and recognition of auditory stimuli, memory, and speech