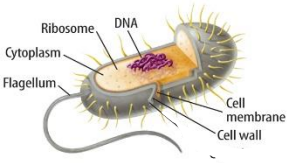
BIOLOGY STAAR REVIEW NOTES

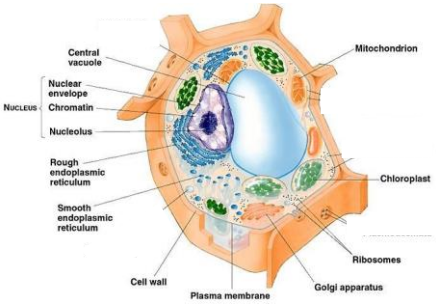
Types of Cells

- **Cells** are the smallest unit of living things.
- Simple cells are **prokaryotes** (bacteria) they have **NO NUCLEUS**,
  BACTERIA = PROKARYOTE
- Complex cells are **eukaryotes** (Everything else! protists, fungi, plants & animals) they **HAVE A NUCLEUS and membrane-bound organelles**.
  Organelles are structures in the cell

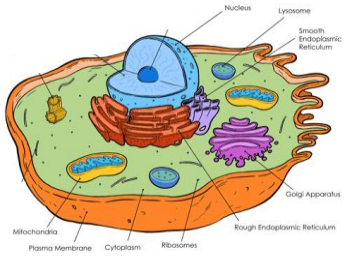
Prokaryote



Eukaryote Plant Cell



Eukaryote Animal Cell



Cell Parts and Organelles:

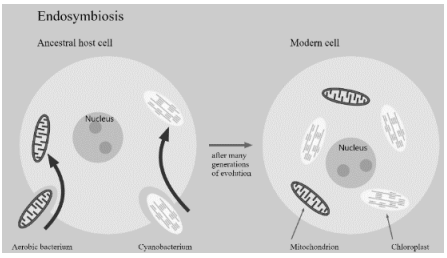
Found in both prokaryotes and eukaryotes:

- **Cell membrane** –also called **plasma membrane**. It surrounds ALL cells and lets some things in and some things out to keep **homeostasis**
- **Cytoplasm – fluid** in the cell
- **Ribosomes –** synthesize (this means to make) **proteins**
- **Cell Wall –** surrounds most cells and gives them support – NOTE: not found in animal cells or animal-like protists

Found ONLY in eukaryotes:

- **Membrane-bound organelles** – organelles surrounded by a membrane. These organelles include the **nucleus, chloroplast, mitochondria, endoplasmic reticulum, golgi, vacuole, lysosome**

Origin of Eukaryotes

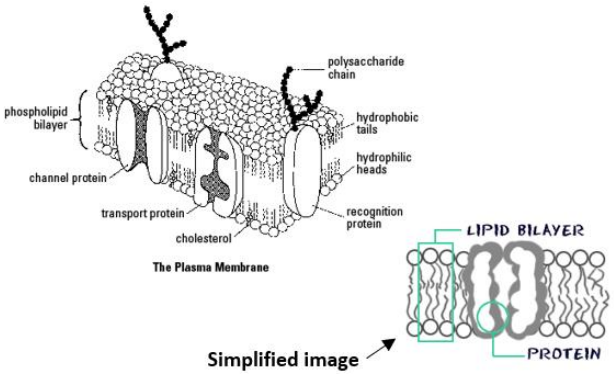


Endosymbiotic theory explains the origin of the mitochondria and chloroplast in eukaryotes. Long ago, free living bacteria were taken in by a larger eukaryote and lived symbiotically. Over time, the engulfed bacteria became a part of the cell in the form of the mitochondria and chloroplast.

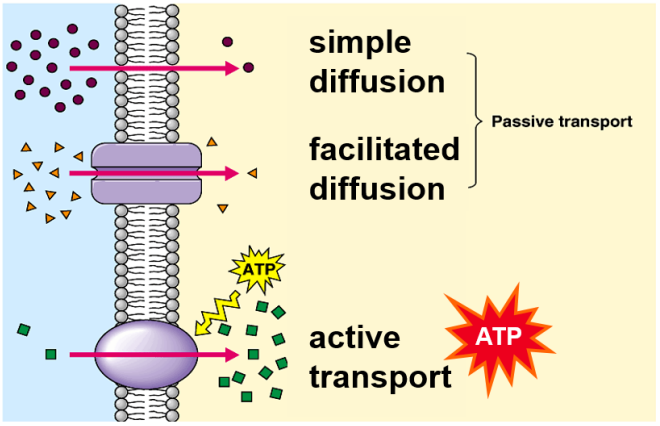
Cellular Transport

Homeostasis refers to the ability of an organisms or a cell to maintain a balance or equilibrium within its internal environment with dealing with external change. EXAMPLE: Water in the soil enters a plant cell with little water through the plasma membrane.

Cell Membrane



- surrounds **ALL** cells and lets some things in out some things out to maintain cellular **homeostasis**
- Made up of a phospholipid bilayer with proteins between the phospholipids
    - **Proteins** include protein channels and protein carriers. They allow specific substances in and out of the cell. They are used during **passive transport** (facilitated diffusion [H→L]) and **active** transport [L→H].
- **Semi-permeable** – some but not all material can get in or out
- Some molecules that go **IN** the cell through the membrane → Food, oxygen (diffusion), water (osmosis),
- Some molecules that go **OUT** of the cell through the membrane → Waste, carbon dioxide (diffusion), water (osmosis), products like proteins

Types of Cellular Transport		
Passive Transport	**Active Transport**	
• Includes: **Diffusion, Osmosis, Facilitated Diffusion** • Movement of molecules from **HIGH to LOW** concentration gradient • Requires **NO ENERGY** • Molecules move **with** the concentration gradient (high concentration to low concentration) • **Osmosis**→Diffusion of **water** • **When cell changes size** it is due to **WATER moving**, not solutes. • **Facilitated diffusion** → diffusion of solutes through transport **PROTEINS** (still H to L, so no energy used)	• Movement of molecules from **LOW to HIGH** concentration gradient • Requires **ENERGY (ATP)** • Molecules move **against** the concentration gradient (low concentration to high concentration) • Carrier <u>PROTEINS</u> move molecules using ATP	

Which way will the water go in osmosis?

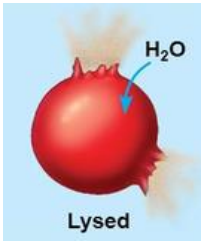
- Think: SOLUTES "SUCK" WATER
- This means water flows toward the higher concentration solute (and the lower concentration water) Water flows high to low – this is what changes the shape of a cell.
- Water is the universal solvent
- **<u>Solvent</u>**- Substance (usually in greater amount) that dissolves another substance
- **<u>Solute</u>** – Substance (usually in lesser amount) that is being dissolved

What happens to a cell in different environments?

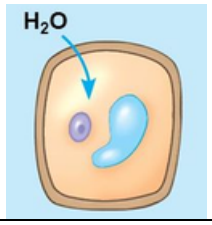
Remember: If a cell is changing size, it is due to water moving into or out of the cell. Movement of solutes will NOT change the size of the cell.

Cell swells (enlarges)→ Concentration of solute is greater inside the cell than outside. Water concentration is lower inside the cell, so water rushes into the cell.

Cell with NO cell wall

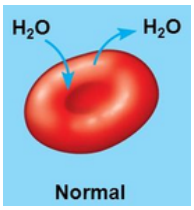


Cell with cell wall

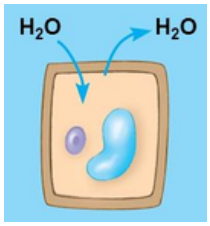


No change in cell size → Concentration of solute is equal both outside the cell and inside. Water concentration is also equal on both sides of the cell, so water does not change amounts. Cell is at equilibrium.

Cell with NO cell wall

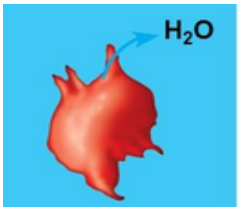


Cell with cell wall

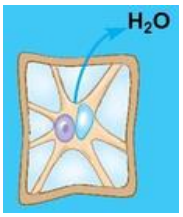


Cell shrinks → Concentration of solute is greater outside the cell than inside. Water concentration inside the cell is higher, so water leaves the cell.

Cell with NO cell wall

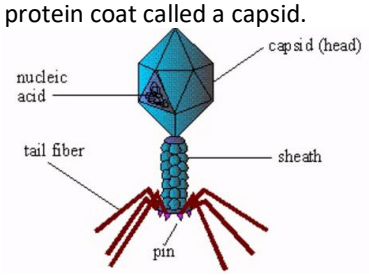


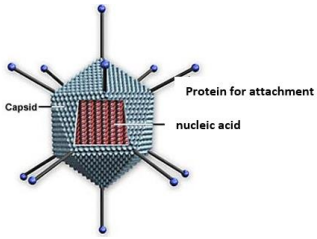
Cell with cell wall



Virus

A virus is a non-living, parasitic, infectious particle. It MUST invade a host cell to replicate. ALL viruses include genetic material (DNA or RNA) surrounded by a protein coat called a capsid.





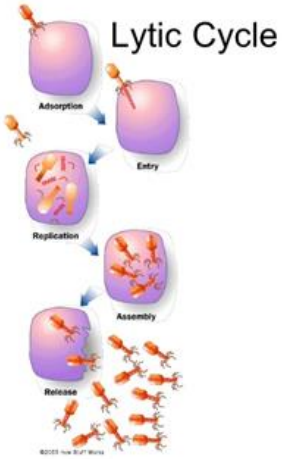
Viruses vs. Cells

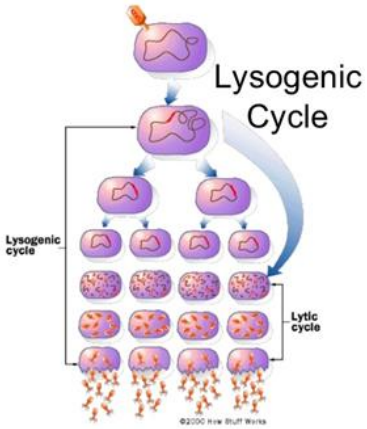
What structures do Viruses and Cells have in common? They both have **DNA** – that is it!

Viruses	Cells
• Protein capsid "head" • **DNA or RNA** inside capsid • Protein fibers to attach to a cell • NOT living	• Cell membrane • **DNA and RNA** inside cell • Specialized organelles • Living

Viral Replication

- Viruses must inject their DNA into a host cell to reproduce and survive. There are two ways a virus can reproduce:
  - **LYTIC** – active infection; show symptoms **LYSOGENIC**- latent infection; do not show symptoms



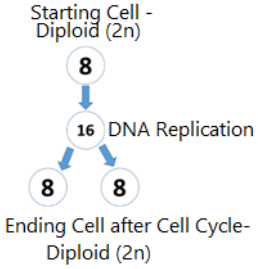


In Lytic, the virus injects its DNA into the cell it is attacking. The cell then starts copying the viral DNA making more viruses. These viruses fill up the cell and burst it open to go invade more cells. They make you sick within days to 3 or 4 weeks! INFLUENZA is an example.

In Lysogenic, the virus injects its DNA into the cell it is attacking but then it just sits in the cell. When the cell copies itself it also copies the virus inside it. You then have thousands of cells with the virus and it starts reproducing all at once in all the cells. This causes you to become very sick all at once months or years after getting the virus. HIV is an example.

HIV – <u>human immunodeficiency virus</u> – infects and destroys immune system cells called helper T cells. The destruction of these immune cells causes an HIV infected individual unable to fight off infections.

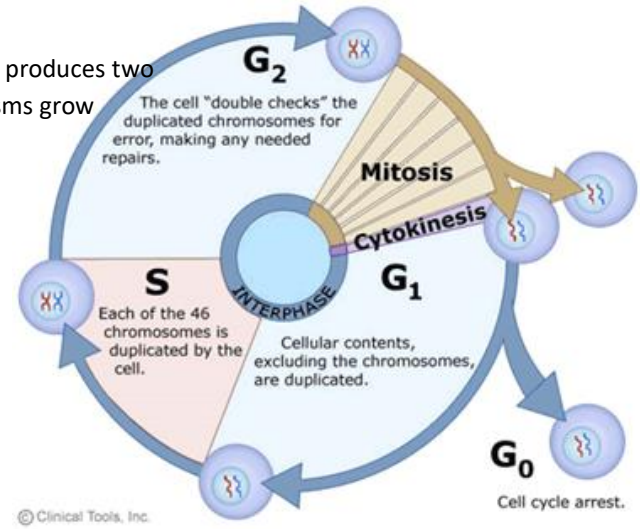
Cell Cycle and DNA Replication

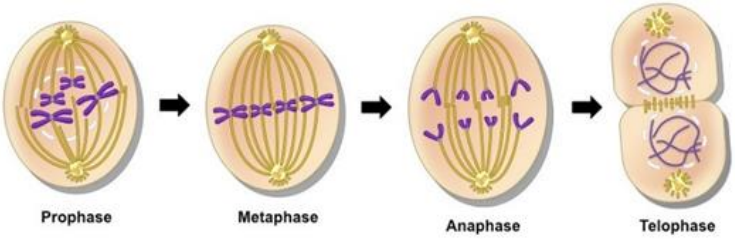


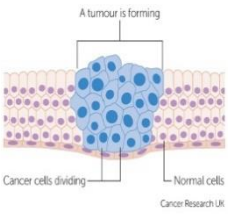
<u>Purpose of the cell cycle:</u> The cell cycle produces two identical cells. The cell cycle is how multicellular organisms grow and replace dead and damaged cells.

<u>Steps in the Cell Cycle:</u>

1. **Interphase**
   a. G_1 Phase
   b. S Phase: (DNA REPLICATION)
   c. G_2 Phase
2. **Mitosis**
   a. <u>Prophase</u>: Chromosomes get dense, nucleus disappears.
   b. <u>Metaphase</u>: Chromosomes come to the center.
   c. <u>Anaphase</u>: Chromosomes separate to the poles by **spindle fibers**
   d. <u>Telophase</u>: Cell starts form a cleave furrow in the middle to start separation. (Cytokinesis at end of telophase)
3. **Cytokinesis:** Two newly separated daughter cells.
4. **G_0 Phase:** Resting Period. Not actively dividing cell. (cells that never go to **G_0** create tumors)
5. **Cell goes back into G_1 Phase** and starts the process all over again.





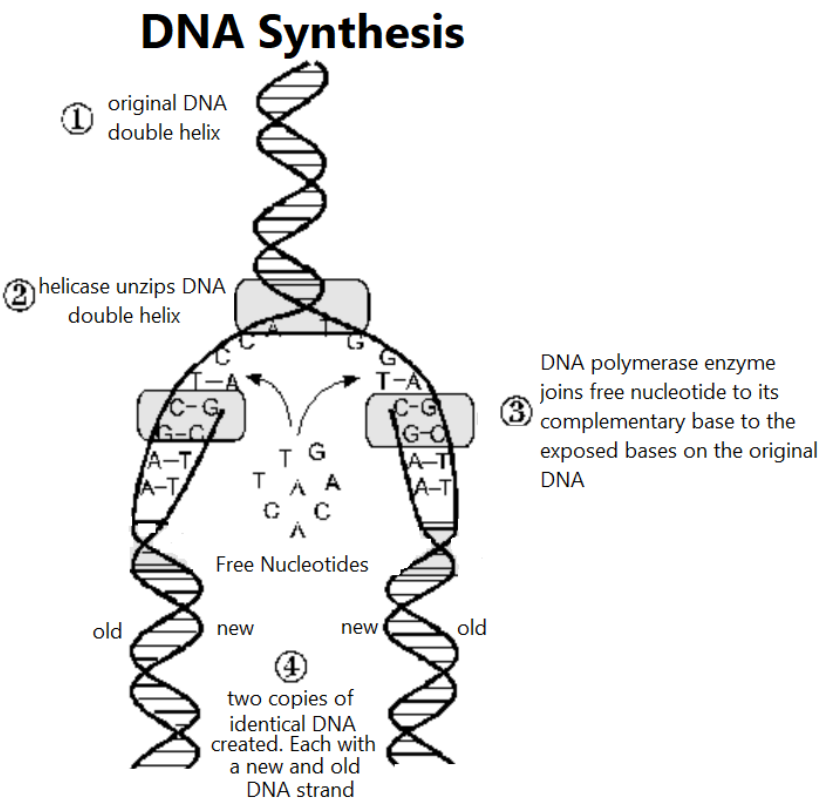


Cancer

- Exposure to carcinogens such as pollutions and radiations will cause mutation.
- The **Result of uncontrollable cellular division.**
- Cells cannot stop dividing.
- The cell never goes into the G_0 Phase and never rests.

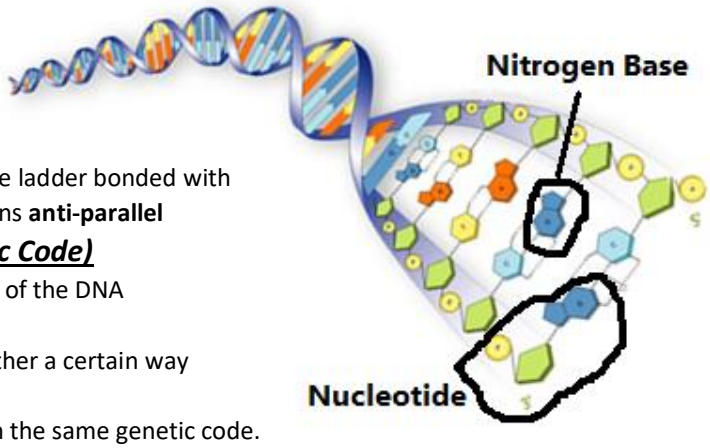
DNA Replication

- Occurs during the S phase of the cell cycle. The "S" stands for Synthesis for DNA Synthesis.
- DNA replication/synthesis is the reason why each cell after the cell cycle has the same DNA.
- ***Steps of DNA replication:***
  - Enzyme **Helicase** unzips the DNA strand by breaking the hydrogens bonds.
  - Enzyme **DNA Polymerase** attaches free floating nitrogenous bases to their complementary bases. Adenine (A) pairs to thymine (T); Cytosine (C) pairs to guanine (G)
  - **Two** new **semi-conservative identical strands** are formed. Semi-conservative replication means the each of the two replicated DNA strands contain the original DNA strand and a newly formed DNA strand.



DNA Structure

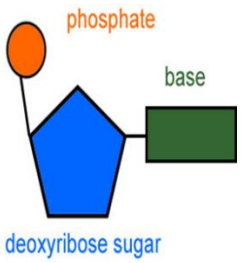
Basic Information:



- Other names for DNA
  Genetic Material
  Genome
- Forms a **double helix** with both strands of the ladder bonded with **complementary base pairs (A-T; C-G)** and runs **anti-parallel**
- ***Nitrogenous Bases (Carry the Genetic Code)***
  - These molecules make up the **ladder** of the DNA
  - Bound by **weak hydrogen bonds**.
  - 4 Different types but ONLY pair together a certain way
    A-T, C-G
  - All living organisms contain DNA with the same genetic code. This is why a gene from a human can be inserted into a bacterial gene and still produce proteins.
  - It is the order of the nitrogenous bases that determines the order of amino acid sequence which determines the protein produced which determines the trait.
- DNA's biomolecules class: N**ucleic Acid (polymer)**
- DNA's monomer: **Nucleotide**

Nucleotides:

- The basic unit to the DNA Strand.
- **DNA structures** in all living things have the **same parts**. The **difference in sequences** of the bases will determine the type of organism and their specific traits.
- Contains three parts
  1. **Phosphate**
  2. **Sugar**
  3. **Nitrogenous Bases**



Protein Synthesis

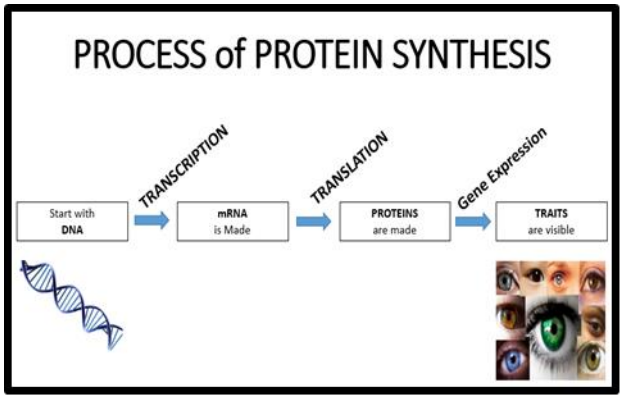
Purpose: To make new proteins.

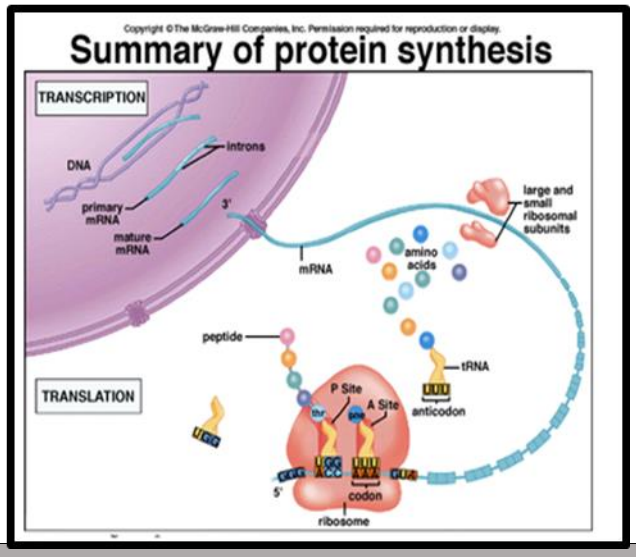
- Proteins will need to be correctly formed and fully functional in order for traits to be expressed.

STEPS

1. **Transcription**:
   - Happens In the **Nucleus**:
   - Code from DNA is used to make a messenger RNA (mRNA).
   - RNA has the base uracil instead of thymine and is single stranded.
   - **DNA → mRNA**
   - mRNA then leaves the **nucleus** through the nuclear membrane.
2. **Translation**:
   - Happens in the **ribosomes**.
   - mRNA binds to a ribosome. Transfer RNA (tRNA) brings the amino acid to the mRNA at the ribosome. For every three bases on the mRNA (called a codon) one amino acid will be brought in. The amino acids bond to form a polypeptide (protein).
   - mRNA → **Amino Acids** link up with the help of **tRNA**.
   - Chains of amino acids make **proteins**.

- **Gene Expression**
  - Traits will be expressed from the newly formed proteins.
  - **Environmental factors** can also activate the genes present in the DNA – Ex: Temperature & Light



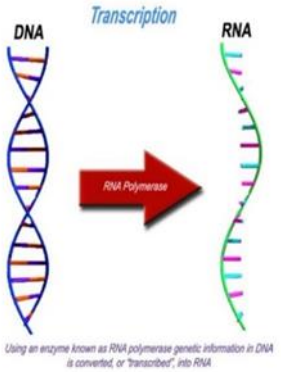


RNA Structure

- **Uracil** replaces Thymine.
- Base pairs: **A - U** **G – C**
- Sugar: **Ribose** replaces **Deoxyribose**
- Nucleic acid so made up of nucleotides

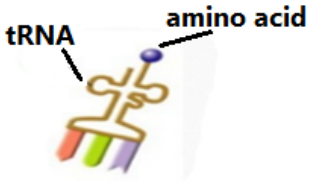
mRNA

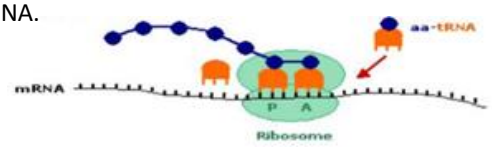
- **Messenger RNA**
- Single stranded
- Made from the **template strand** of DNA inside the nucleus with the help of the **RNA polymerase enzyme**.
- mRNA is always read in 3 bases called a **CODON**. *(1 codon codes for 1 amino acid which can be found in a Codon Chart)*
- There is no Thymine in mRNA
-



tRNA

- **Transfer RNA**
- It is the Deliverer of the Amino Acids to the ribosomes.
- **3 parts**
  - The T-Shape body
  - Amino acid is attached to the tRNA
  - Attached Anti-codon
    - The complementary codon that attaches to the mRNA.

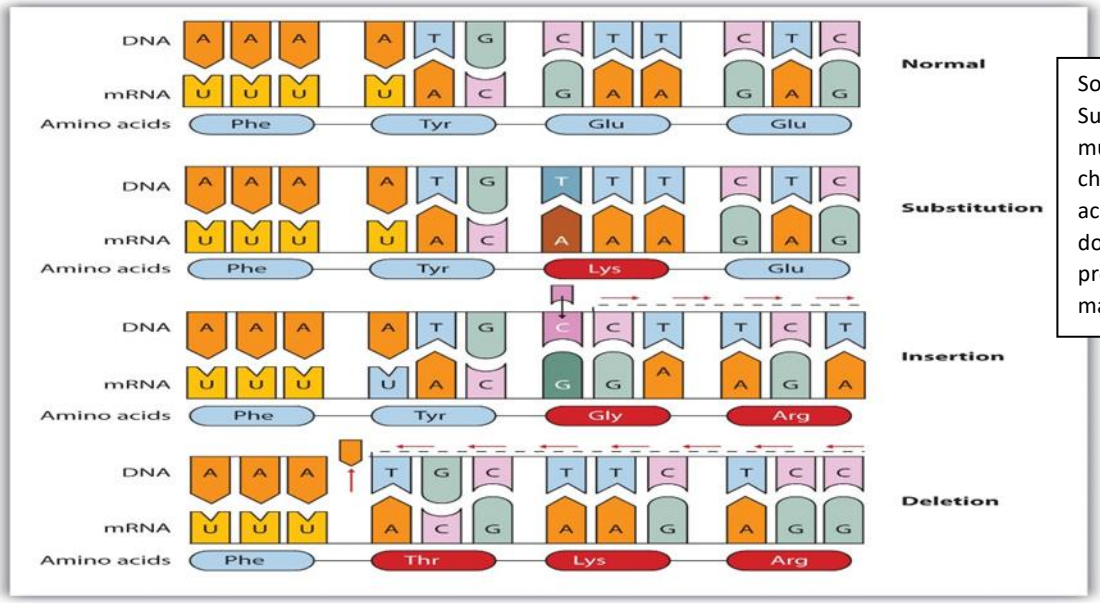




Mutations

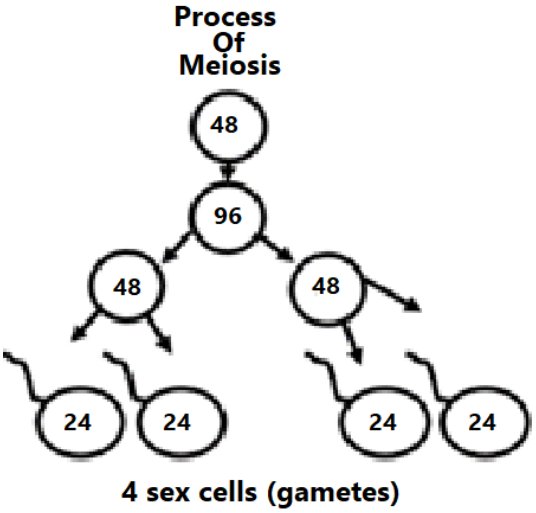
Mutation: *A change in the DNA's nitrogenous base sequences (nucleotides) during synthesis causing a change to occur*. This change could lead to a different sequence of amino acids, which will create a different type of protein. This could cause the original trait not to be expressed.

- **Frameshift Mutations:**
  - **Deletion Mutation:** Removal of one or more bases.
  - **Insertion Mutation:** Addition of one or more extra bases.
- **Point Mutation/Silent Mutation:**
  - **Substitution Mutation:** (Sometimes known as point mutation) Change in one single base for another.

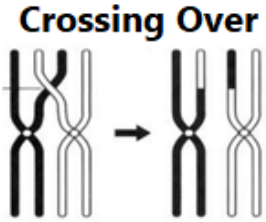


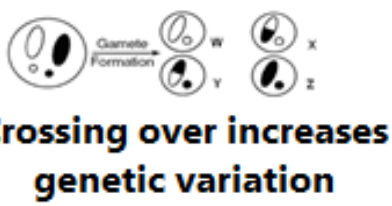
Sometimes Substitution/Point mutations don't change the amino acid and therefore don't change the protein being made.

Meiosis



- **Meiosis** Is a type of cellular division that produces sex cells (**Gametes**).
- Cell goes through **2 divisions** and produces 4 cells.
- **Haploid (n)** cells are a result of meiosis. They have half the number of chromosomes.
- After meiosis an egg is formed with half the DNA of the original "mom" cell and sperm is formed with half the DNA of the original "dad" cell. When the egg and sperm come together during sexual reproduction, the original chromosome number is restored. This is why you get half of your chromosomes from your mom and the other half from your dad.
- ***IMPORTANT for GENETIC VARIATION:*** Crossing Over occurs in PROPHASE I. Homologous chromosomes exchange parts of their genes. This process called crossing over increase genetic variation.



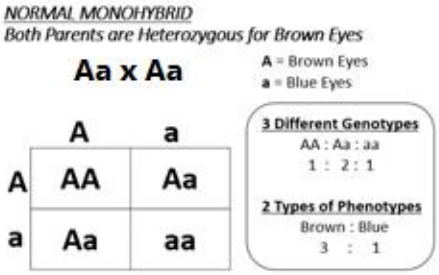


Genetics

Key Vocabulary in Genetics			
Gene	Segment of DNA that codes for a specific trait. All traits have two genes.	**Homozygous (purebred)**	When 2 alleles are the same for a trait; AA (homozygous dominant); aa (homozygous recessive)
Allele	Different form of a single trait; example- blue and brown are two alleles for eye color.	**Heterozygous (hybrid)**	When 2 alleles are different for a trait; Aa is heterozygous
Dominant trait	Trait that will be expressed if at least one dominant allele is present; represented by a capital letter (A)	**Phenotype**	The physical trait; example eye color
Recessive trait	Trait that will only be expressed if two recessive alleles are present; represented by a lowercase letter (a)	**Genotype**	The genetic make-up of the genes; represented with letters (Aa)

Monohybrid Cross

- Uses Punnett Square to predict the offspring's phenotypes and genotypes in ONE trait



Dihybrid Cross

- Uses Punnett Square to predict the offspring's phenotypes and genotypes in TWO traits

Cross a homozygous long hair, heterozygous black bunny with a heterozygous long hair, white bunny.

AA – long hair	BB – black coat
Aa – long hair	Bb – black coat
aa – short hair	bb – white coat

AABb x Aabb
(Parent's genotypes)

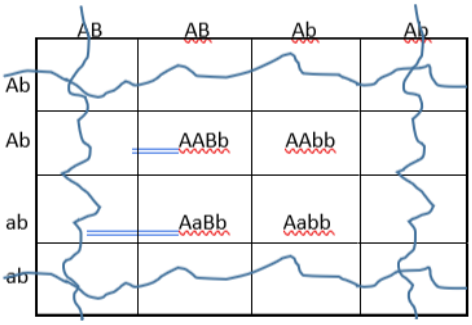
STEP 1:

IMPORTANT!!! IMPORTANT!!! You must first figure out the parent's allele combinations in the gametes. These different combinations are what you use on the outside of yoru Punnett square.

Get possible parent gametes:

AABb x Aabb

Notice there is ONLY ONE of each letter (A and B) on the outside of each row and column. This is because of the step 1.



Remember your short cut: If the parent genotype is repeated on the outside of the Punnett square, you can mark through that row or column.

Possible Outcomes

Long hair, black coat = 2/4 = 50%
Long hair, white coat = 2/4 = 50%
Short hair, black coat = 0/4 = 0%
Short hair, white coat = 0/4 = 0%

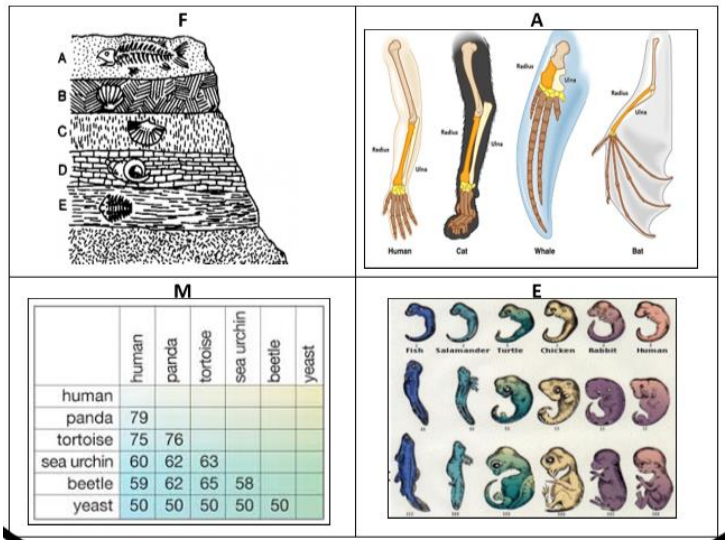
Non-Mendelian

- **Incomplete dominance** – one allele is NOT completely dominant; heterozygous will have blending of the two alleles; example is Red flower and white flower produce pink flower
- **Co-dominance** – both alleles are expressed in the heterozygous form; example black feathers and white feathers produce speckled (black and white) feathers

Evolution

- Changes in populations over time. Populations evolve NOT individuals.
- Leads to variations and potentially new species.
- Charles Darwin was the first to propose the concept of descent by modification. He explained natural selection was the driving force behind evolution.

Evolutionary Evidence



	human	panda	tortoise	sea urchin	beetle	yeast
human						
panda	79					
tortoise	75	76				
sea urchin	60	62	63			
beetle	59	62	65	58		
yeast	50	50	50	50	50	

F – **Fossils Evidence** (minerals/rock – NO DNA, they show evolutionary age and structures)

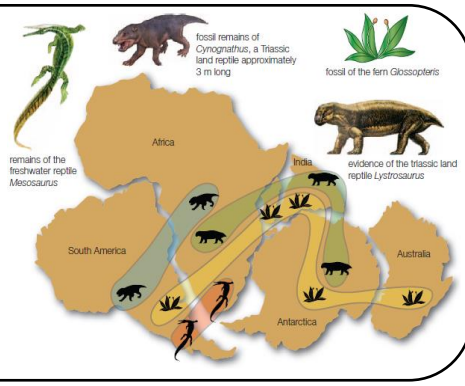
A – **Anatomical Structures** (homologous show common ancestry, analogous same function different structure no relationship)

M – **Molecular Evidence** (more similarities in amino acids/DNA sequences closely related)

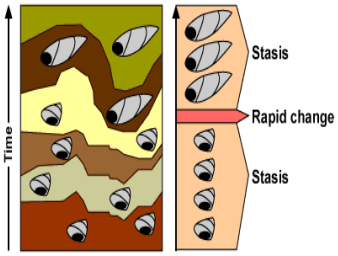
E – **Embryology** (similar developmental stage of embryos – common ancestry) f

Biogeography

Pangea super continent movement to current day continents explains how similar species' fossils are found on different continents when the organism couldn't swim or fly.
Leads to speciation – one species develops into two.

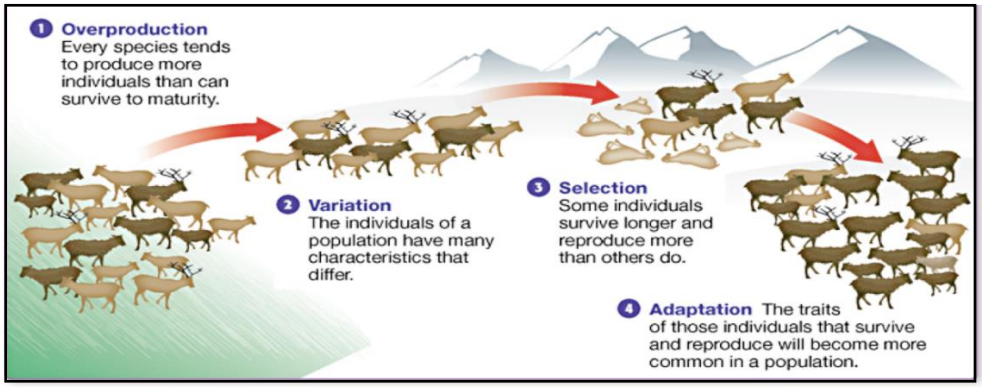


Fossil Stasis



Fossils remain in a period of no change. A rapid change can cause the stasis to end and new fossils appear suddenly.

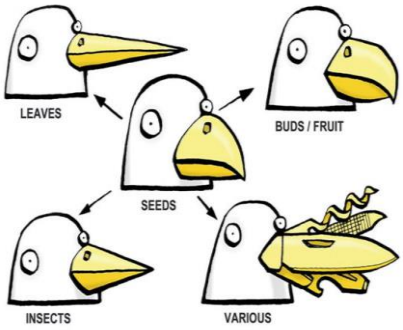
Natural Selection

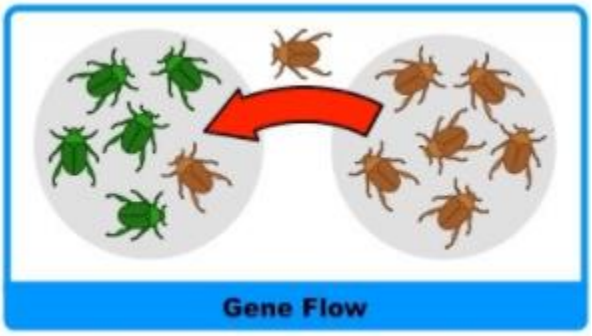


- Natural selection produces changes in the populations not individuals.
- The individual born with beneficial adaptations (the fittest) will survive and have a better chance to pass on their beneficial traits to their offspring. Fitness refers to the ability to survive and reproduce.
- Natural selection leads to adaptations within an organism.
- Natural selection needs inherited variation to "select" survivors.

Genetic Variation

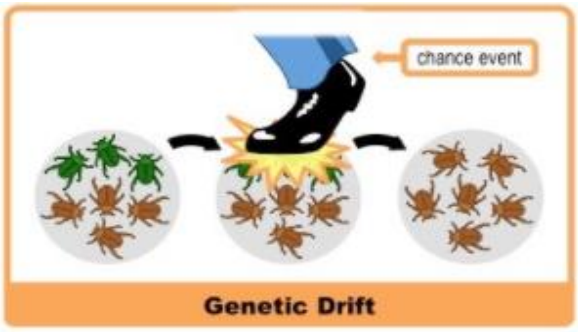
Genetic variation is the driving force in introducing new traits/adaptations. The better ones will help a species to survive, allowing the gene to be passed to the next generation. The origin of genetic variation are **mutations.**





Genes flow between different populations. **Increases** genetic variation.

Random change in population by chance events, leads to a **decrease** in genetic variation. This is known as **genetic drift**



Reproductive Success and Adaptations

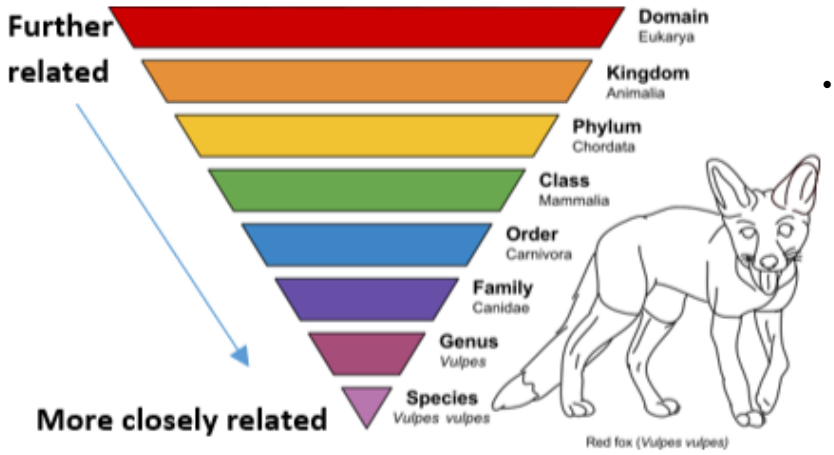
- Not all offspring will survive to reproduce. Some will inherit better traits than others giving them a better chance to survive and pass on their traits to offspring.
- Organisms with similar reproductive structures show common ancestry. Mammals nurse their young with mammary glands, marsupials carry offspring in a pouch and reptiles have leathery eggs. All suggest common ancestry within each group.
- Reproduction can also be improved through delayed implantation for delaying birth for better resources and reproductive isolation to allow different species to breed at different times of the year, decreasing competition among all offspring.
- Surviving predators leads to ability to reproduce:
  Camouflage – hide from predators
  Mimicry - bright colors signify poison or venom to predators. So by mimicking these a harmless organism can fool a predator and survive.

Classification

Importance of a standard taxonomic naming system

- Assigns scientific name
- Used to help identify organisms.
- **To avoid confusion** between organisms when classifying them.
- **Find evolutionary relationships between them**
- **All scientists can use the same name** for the same organism
- Leads to **equal understanding of the classification system**.

Taxonomy Pyramid



- The more related organisms are to each other the further down the pyramid they will travel together and share more and more characteristics.
- Binomial nomenclature – AKA scientific name. First word is the Genus taxon and second is the species. ALWAYS use the scientific name and NOT the common name to look at relationships.

Common Name: Pebble Crab

Genus ↓ Species ↓

Scientific Name: *Xanthias lamarckii*

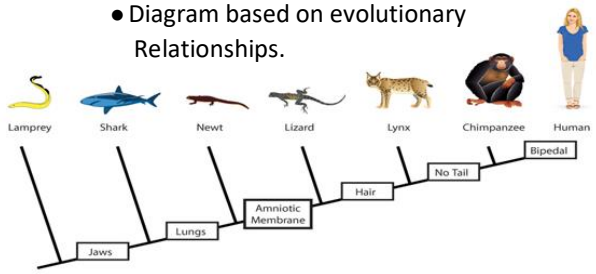
Dichotomous key

- Guide used to identify organisms.

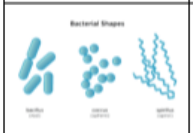
1	a. 6 legs	Class Insecta
	b. 8 legs	Go to step 2
2	a. Has a stinger on abdomen	Order Scorpiones
	b. No stinger on abdomen	Go to step 3
3	a. No claws	Order Araneae
	b. Has large claws	Order Amblypygi

Cladograms

- Diagram based on evolutionary Relationships.



6 Kingdoms

Characteristic	Eubacteria	Archaebacteria	Protist	Fungi	Plant	Animal
						
heterotrophs/autotrophs	H A	H A	H A	H	A	H
unicellular/multicellular	U	U	U M	M (one U)	M	M
prokaryotic/eukaryotic	P	P	E	E	E	E

H = **Heterotroph** (consumes food for energy)
A = **Autotroph** (makes its own food)

U= **Unicellular** (one cell)
M= **Multicellular** (two or more cells)

P= **Prokaryotic** (no nucleus)
E= **Eukaryotic** (nucleus & organelles)

Biomolecules

- Biomolecules are molecules made up of smaller building blocks that are found in all living things. Each building block is called a **monomer.** The monomers link up together to form a **polymer.**
- Each biomolecule class has a specific structure and function.
- The four classes of biomolecules are: Carbohydrates, Lipids, Proteins, and Nucleic Acids


Carbohydrates


Proteins

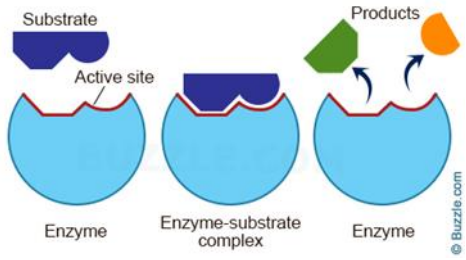

Lipids

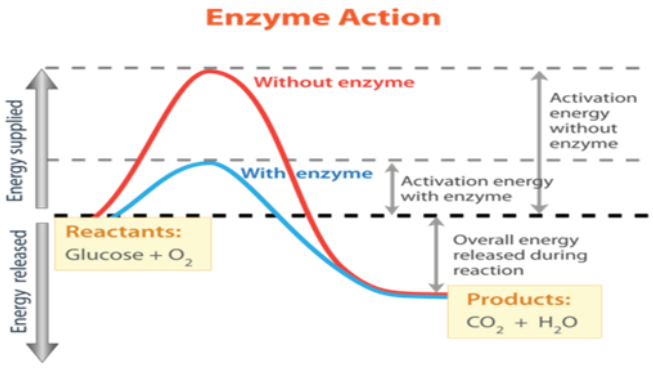

Nucleic Acids

4 Types of Biomolecules				
	Carbohydrates	**Lipids**	**Proteins**	**Nucleic Acid**
Function	• **Monomer Function:** provide the cell/organism with **quick energy**. Glucose is a carbohydrate monomer and is broken down to release energy. • **Polymer Function: energy storage**. Starch is a polymer made up of a lot of monosaccharides that stores energy for a plant.	• **Long term energy storage** • Provides insulation • Water proofing material	• Enzymes (speed up chemical reactions) • Hormones that regulate the body • Used in cellular transport • Antibodies fight off infection • Structural uses •	• Contains the blueprint for life • It is the genetic code • The genetic code determines your traits by coding for a specific protein
Names associated with the biomolecules	Monosaccharide (the building block of carbohydrates), polysaccharide, sugar	Fats, oils, wax, fatty acids	Polypeptide, amino acid (the building block of a protein)	Nucleotide (the building block of nucleic acid)
Examples	Glucose, starch, lactose, usually end in -ose	Triglyceride, wax, oils	Antibody, insulin, amylase (an enzyme), hair, nails	DNA, RNA

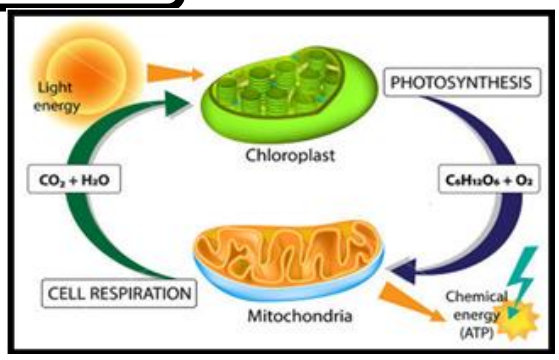
Enzymes

- Enzymes belong to the **PROTEIN** biomolecule family.
- **Enzymes** are **catalysts.** Catalysts **speed up chemical reactions by lowering the activation energy** (The amount of energy needed to perform a chemical reaction)
- Enzymes are specific to a **substrate** (what it attaches to).
- The specific **substrate** binds to an **active site** causing the reaction to occur, resulting in products.
- Enzymes can either break down or build molecules.
- They have the ending **–ASE** to their name.
- Enzymes can **denature** (break down and lose their function forever) by being exposed to extreme temperatures and being outside their optimum pH range.





Photosynthesis and Cellular Respiration



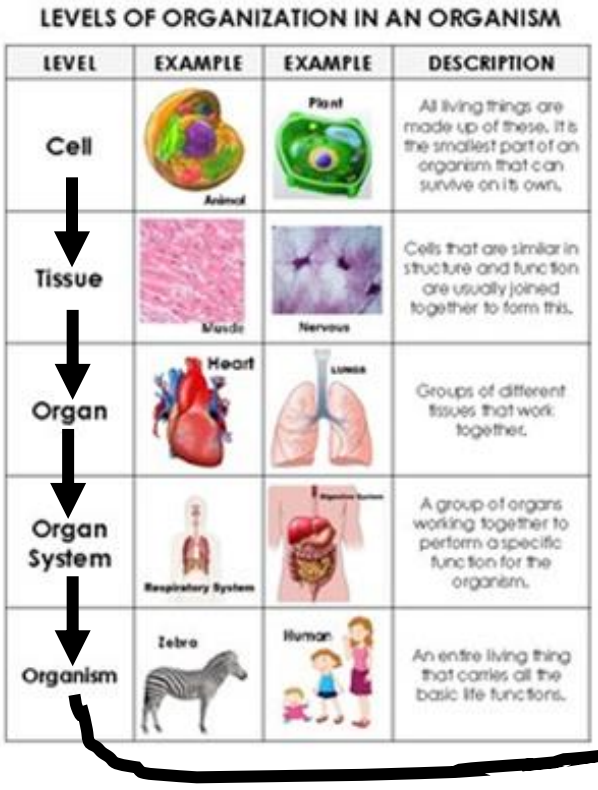
- **Reactants** are the **ingredients** for the chemical reaction. **Products** are the substances being **produced** from a chemical reaction.
- **Reactants always make products.**
- **The products of one process become the reactants of the other process.**
- **Photosynthesis:** Reactants (carbon dioxide, water)
  Products (glucose, oxygen)
  Energy conversion (radiant energy to chemical energy)
- **Cell Respiration:** Reactants (glucose, oxygen)
  Products (carbon dioxide, water, ATP)
  Energy conversion (chemical energy to ATP energy molecule for the cell)

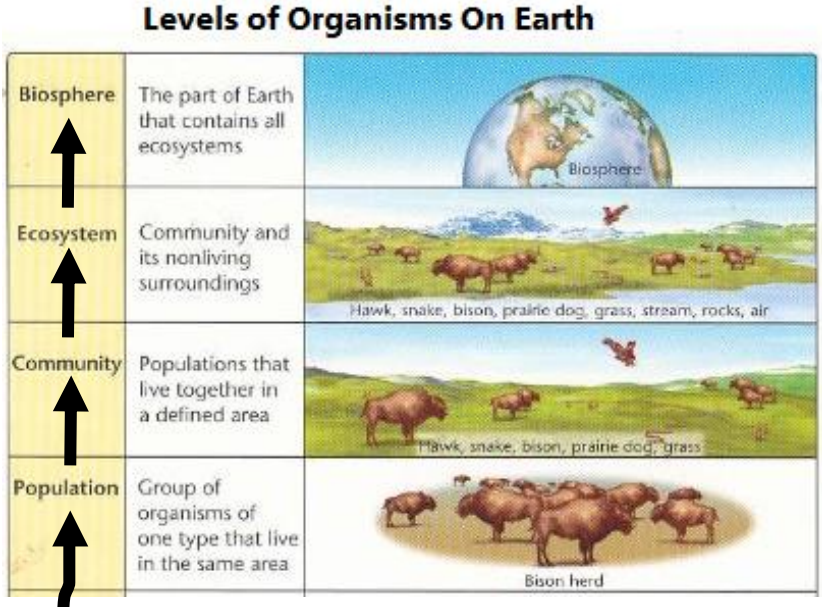
Photosynthesis: CO_2 (Carbon Dioxide) + H_2O (Water) + **Radiant energy** → $C_6H_{12}O_6$ (Glucose) + O_2 (Oxygen)

Respirations: $C_6H_{12}O_6$ (Glucose) + O_2 (Oxygen) → CO_2 (Carbon Dioxide) + H_2O (Water) + **ATP**

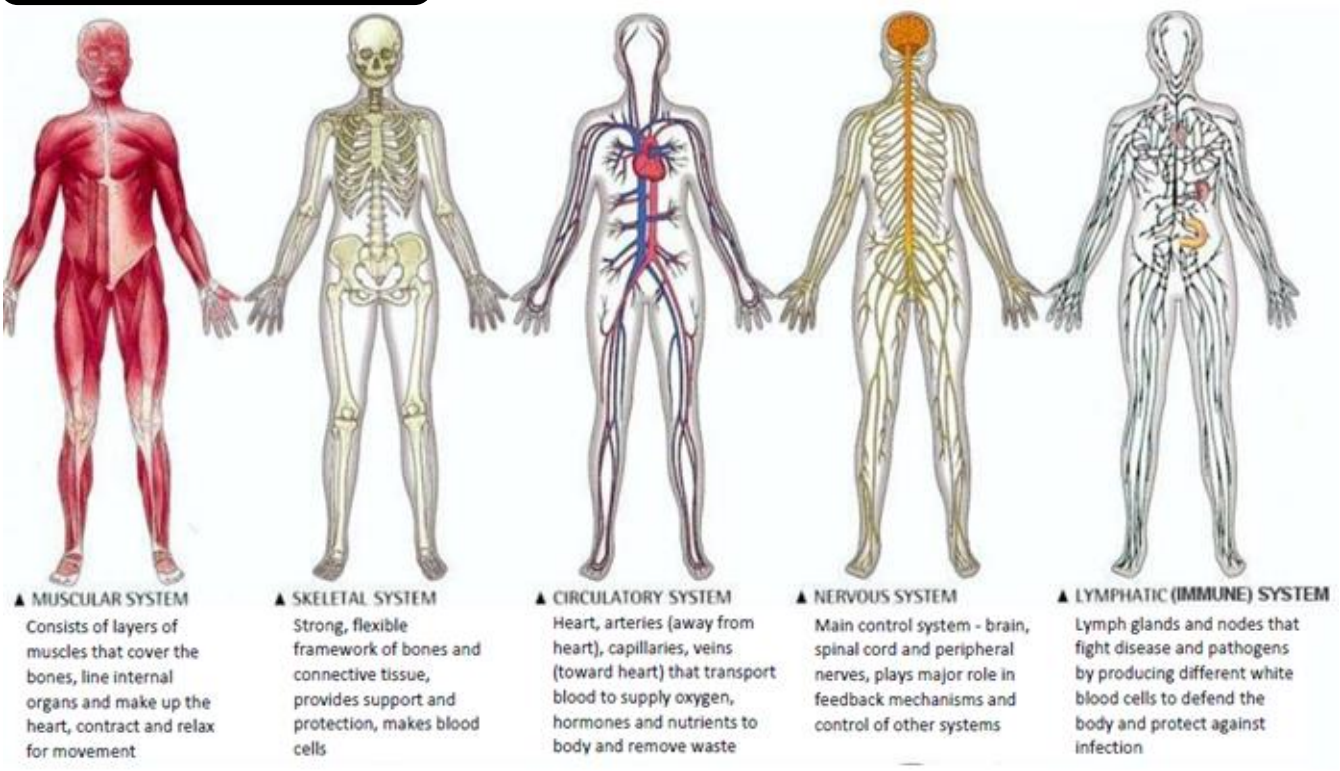
Two Types of Respiration	
Aerobic Respiration	**Anaerobic Respiration**
• **Oxygen Present** • Releases a **lot of energy** • Produces carbon dioxide, water, and energy • Occurs in the mitochondria	• **Oxygen Absent** • Releases **little energy** • Produces lactic acid or alcohol, carbon dioxide, and energy • Occurs in cytoplasm

Levels of Organization





Animal Systems



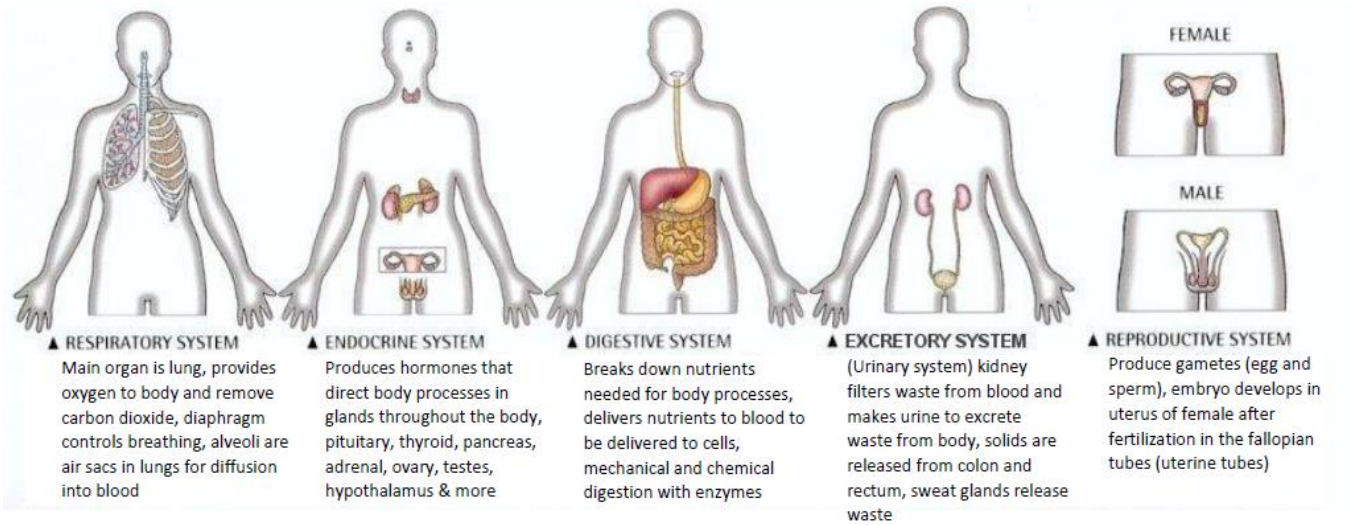
▲ MUSCULAR SYSTEM
Consists of layers of muscles that cover the bones, line internal organs and make up the heart, contract and relax for movement

▲ SKELETAL SYSTEM
Strong, flexible framework of bones and connective tissue, provides support and protection, makes blood cells

▲ CIRCULATORY SYSTEM
Heart, arteries (away from heart), capillaries, veins (toward heart) that transport blood to supply oxygen, hormones and nutrients to body and remove waste

▲ NERVOUS SYSTEM
Main control system - brain, spinal cord and peripheral nerves, plays major role in feedback mechanisms and control of other systems

▲ LYMPHATIC (IMMUNE) SYSTEM
Lymph glands and nodes that fight disease and pathogens by producing different white blood cells to defend the body and protect against infection



▲ RESPIRATORY SYSTEM
Main organ is lung, provides oxygen to body and remove carbon dioxide, diaphragm controls breathing, alveoli are air sacs in lungs for diffusion into blood

▲ ENDOCRINE SYSTEM
Produces hormones that direct body processes in glands throughout the body, pituitary, thyroid, pancreas, adrenal, ovary, testes, hypothalamus & more

▲ DIGESTIVE SYSTEM
Breaks down nutrients needed for body processes, delivers nutrients to blood to be delivered to cells, mechanical and chemical digestion with enzymes

▲ EXCRETORY SYSTEM
(Urinary system) kidney filters waste from blood and makes urine to excrete waste from body, solids are released from colon and rectum, sweat glands release waste

▲ REPRODUCTIVE SYSTEM
Produce gametes (egg and sperm), embryo develops in uterus of female after fertilization in the fallopian tubes (uterine tubes)

Interactions of body systems:

Examples –

Nutrient absorption – muscular uses peristalsis to move food, digestive breaks down, circulatory transports

Giving birth – reproductive system in use, endocrine releases hormones, muscular contracts muscles

Cellular respiration – respiratory brings in O_2 releases CO_2, circulatory transports both to and from cells

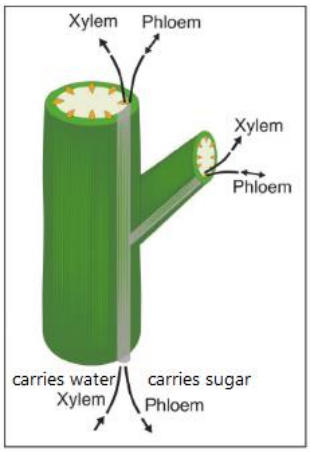
Fighting illness/disease – integumentary is first barrier, immune system produces immune cells and antibodies, circulatory system transports them

Reflexes – nervous system sends signals, muscle system causes response

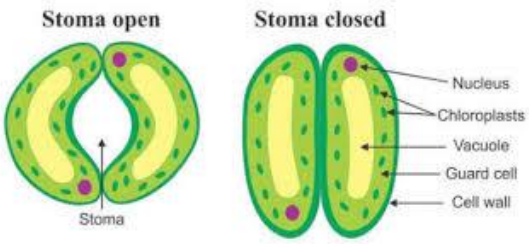
Response to fear – nervous system sends signal to respiratory system to speed breathing and increase oxygen intake, circulatory increases blood pressure to provide more oxygen to cells, muscular system has more energy to respond

Plant Systems

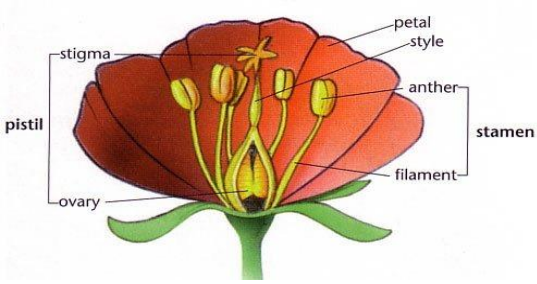
Transport in Plants



- The **root system** (below ground) in plants absorbs water and minerals. The water and minerals is transported throughout the **shoot system** (above ground).
- Vascular tissue extends throughout the entire root and shoot system. There are types of vascular tissue: xylem and phloem
  - **Xylem** - carries water from the roots up to the leaves
  - **Phloem** – carries sugar (food) made in the leaves
- **Leaves** are the photosynthetic organ of the plant.
- On the underside of leaves are two special cells called **guard cells**. These guard cells surround an opening called a **stomata.** The guard cells open and close the stoma based on the availability of water. The stoma is the site of gas exchange for the plant. **Carbon dioxide enters** through the stoma**. Oxygen leaves** through the stoma. Water will also leave through the stoma. This is known as **transpiration**.



Reproduction in Plants



Plant Reproduction: Pollen is made by meiosis in the anther and is transferred to the stigma. A pollen tube forms and grows through the style. The pollen tube reaches an ovule/egg (made by meiosis) within the ovary, where the sperm fertilizes the egg.

Response in Plants

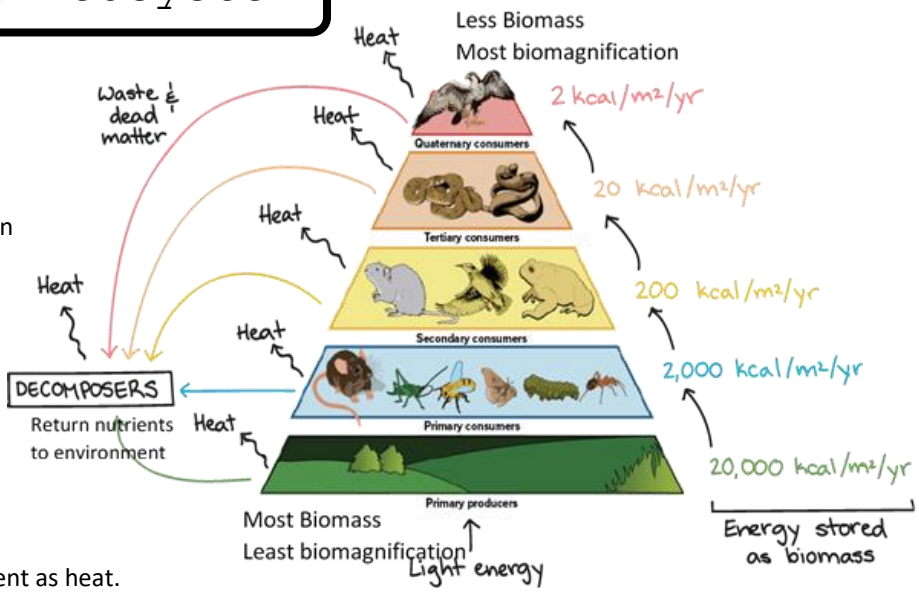
Tropisms

Tropisms occur when plants respond to external stimuli. Tropisms are movements caused by a change in a plant's growth pattern. Tropisms can be negative or positive. If the plant moves toward the stimulus, the tropism is defined as positive. If the plant moves away from the stimulus, the tropism is considered negative.

Geotropism	Hydrotropism	Thigmotropism	Phototropism
Gravity causes a response in a plants growth.	The way a plant grows or bends in response to water.	Plants bend or grow because of touch. An example would be when vines wrap around an arbor frame.	The way a plant grows or bends in response to light.
			

Energy Transfer in the Ecosystem

- The ultimate source of energy is the sun.
- **Autotroph/Producers:** an organism that uses the sun's energy to make food energy in a process called photosynthesis. EX: grass, trees, phytoplankton, algae
- **Heterotroph/Consumers:** an organism that must obtain nutrients by eating others.
    - **Herbivores –** feed on autotrophs
    - **Carnivores –** feed on animals
    - **Scavenger –** eat dead things
    - **Omnivore –** eat autotroph and heterotroph
    - **Decomposer –** break down plants and animals
- Only about 10% of energy transfers to the next level. The rest is used to power life and lost to the environment as heat.



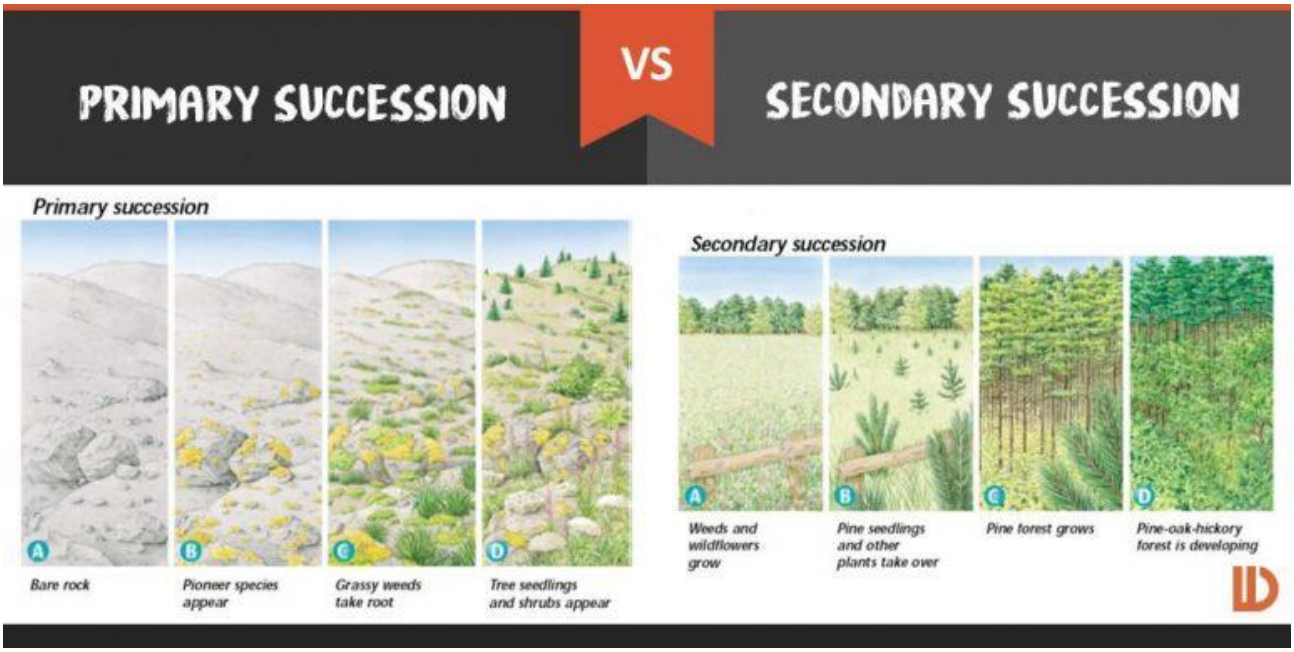
Symbiotic Relationships

INTERACTION	TYPE OF SYMBIOSIS	EXAMPLE
Benefits / Benefits	**Mutualism** Species A benefits Species B benefits	Sea anemone / Clown fish
Benefits / Unaffected	**Commensalism** Species A benefits Species B unaffected	Whale / Barnacle
Benefits / Harmed	**Parasitism** Species A benefits Species B harmed	Dog / Tick

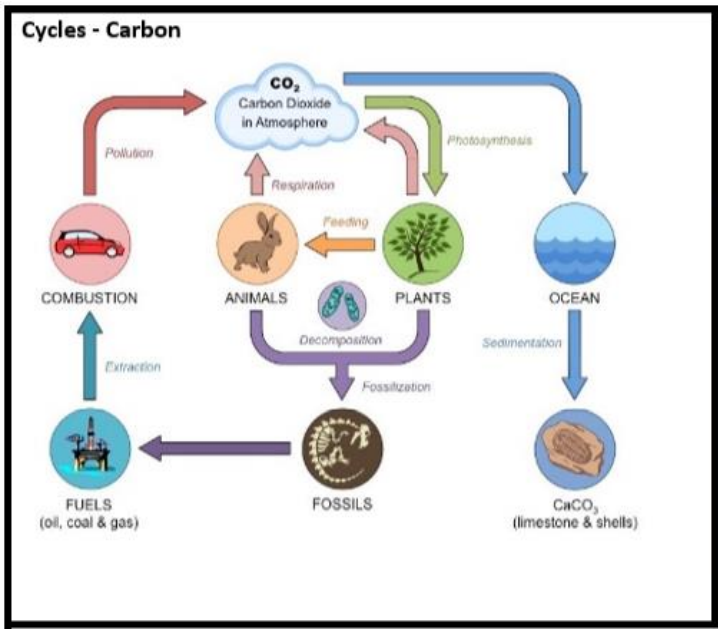
Succession

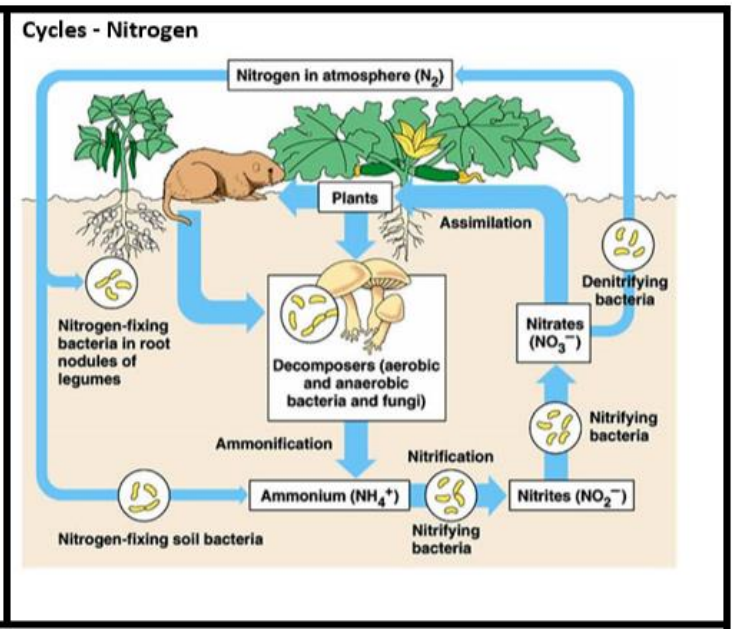
- Progression in a change of ecosystems.
- As ecosystems progress in time, different animals and plants can start to survive in the ecosystem. Biodiversity increases. The climax community is stable and has the most biodiversity.

Primary Succession	Secondary Succession
Begins with no life	Follows removal of existing biota
No soil present	Soil already present
New area (e.g. volcanic island)	Old area (e.g. following a bush fire)
Lichen and moss come first	Seeds and roots already present
Biomass is low	Biomass is higher


PRIMARY SUCCESSION
VS
SECONDARY SUCCESSION
Primary succession
A
Bare rock
B
Pioneer species appear
C
Grassy weeds take root
D
Tree seedlings and shrubs appear
Secondary succession
A
Weeds and wildflowers grow
B
Pine seedlings and other plants take over
C
Pine forest grows
D
Pine-oak-hickory forest is developing

Cycles


Cycles - Carbon
CO_2
Carbon Dioxide in Atmosphere
Pollution
Photosynthesis
Respiration
Feeding
COMBUSTION
ANIMALS
PLANTS
OCEAN
Decomposition
Sedimentation
Extraction
Fossilization
FUELS
(oil, coal & gas)
FOSSILS
$CaCO_3$
(limestone & shells)


Cycles - Nitrogen
Nitrogen in atmosphere (N_2)
Plants
Assimilation
Denitrifying bacteria
Nitrogen-fixing bacteria in root nodules of legumes
Decomposers (aerobic and anaerobic bacteria and fungi)
Nitrates (NO_3^-)
Nitrifying bacteria
Ammonification
Nitrification
Ammonium (NH_4^+)
Nitrites (NO_2^-)
Nitrogen-fixing soil bacteria
Nitrifying bacteria