

CP Biology – EOC Quick Review

The Study of Life



"That's Dr. Arnold Moore. He's conducting an experiment to test the theory that most great scientific discoveries were hit on by accident"

Parts of an experiment

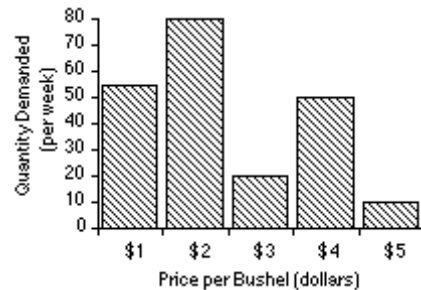
- **Independent variable** – the factor that is being tested. The factor that causes change.
- **Dependent variable** – the measurable factor that changes because of the independent variable. The factor that is measured or observed for change.
- **Control** – group under normal conditions that experimental groups are compared to.
- **Constant** – factors that are the same for all experimental groups

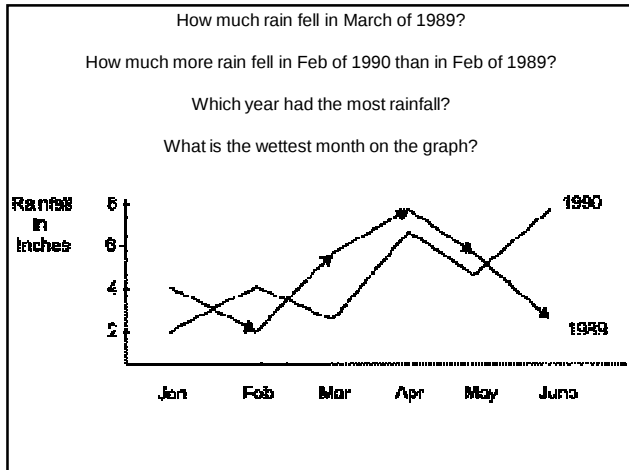
- How might you set up an experiment to test for the effect of temperature on respiration?
- What would be your:
 - Control group-
 - Constants-
 - Independent variable-
 - Dependent variable-
- What tools would you use to collect your data?
- What SI units would you use to collect data?
- How would you make a conclusion?

What is the dependent variable on this graph?

Does the price per bushel always increase with demand?

What is the demand when the price is \$5 per bushel?





What characteristics do all living things share?

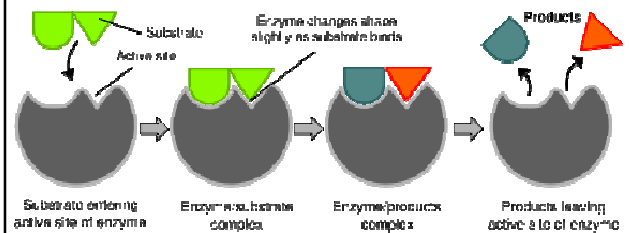
- 1) Made of one or more cells.
- 2) Organization (DNA, cells, tissues, organ systems)
- 3) Reproduces
- 4) Grows and develops (cell division, development)
- 5) Respond to stimuli (homeostasis [regulation of an organism's internal environment])
- 6) Evolves over time (favorable adaptations are inherited)

Life Substances

- Living things are made of organic compounds.
- Proteins
- Carbohydrates
- Nucleic Acids
- Lipids

Enzymes

- The target molecule is called the substrate.
- The substrate fits into a uniquely shaped active site on the enzyme that forces the desired reaction to take place.



All these observations lead to the development of **cell theory**.

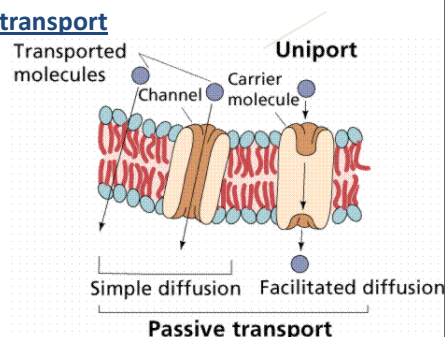
- Cell Theory:
- 1) *All organisms are composed of one or more cells.*
- 2) *The cell is the basic unit of life.*
- 3) *All cells come from preexisting cells.*

There are 2 basic types of cells

- **Prokaryotes**: cells that do not have membrane bound internal structures (no organelles). Unicellular organisms.
Ex. Bacteria
- **Eukaryotes**: cells that **do** have membrane bound internal structures (have organelles). Usually multicellular organisms.
Ex. Plants, animals, protists, fungi

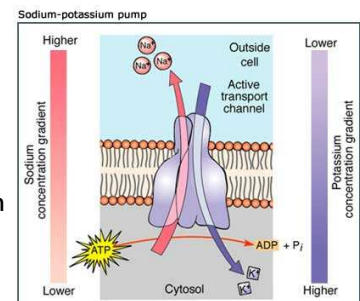
Types of Passive Transport

- 1) Diffusion
- 2) Osmosis
- 3) Facilitated transport



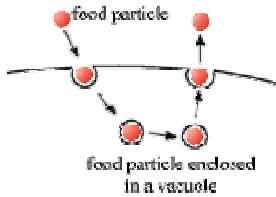
Active Transport (Ion Pumps)

- Requires energy
- Moves particles against the concentration gradient.
- Takes place through carrier proteins in the cell membrane.

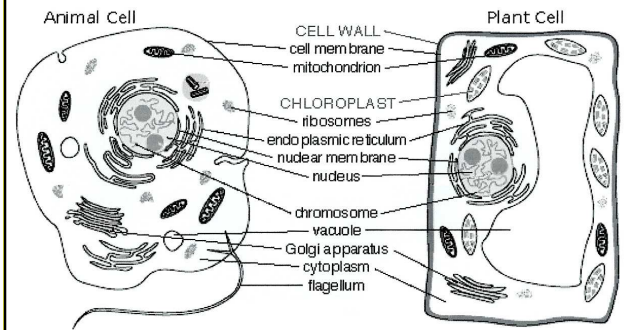


Active Transport of large particles

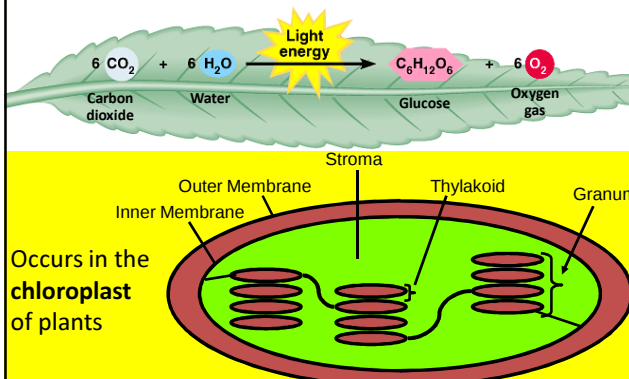
- **Endocytosis:** Process where the cell surrounds and takes in materials from its environment.
- **Exocytosis:** the expulsion or secretion of substances from a cell.
- ENTER vs. EXIT
- Both require energy



Plant vs. Animal Cell



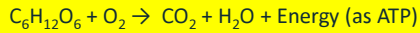
PHOTOSYNTHESIS Chemical Equation



Photosynthesis Overview

- 1) Energy is captured from sunlight.
 - 2) Light energy is converted to chemical energy (ATP and NADPH)
 - 3) ATP and NADPH power formation of organic compounds (glucose) from CO_2 .
- Light Reactions
- Dark reaction

Cellular Respiration



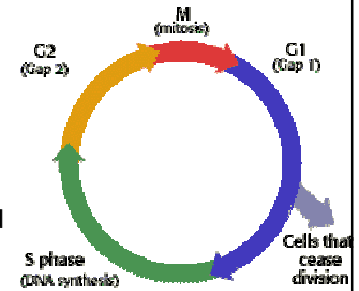
Glucose + Oxygen → Carbon dioxide + Water + Energy (as ATP)

- The conversion of glucose into ATP.
- Takes place in the mitochondria.
- **Aerobic respiration** is what happens in the presence of oxygen. It is more efficient than **anaerobic respiration** (occurs without oxygen)

The Cell Cycle IPMATC

I Play Music At The Club

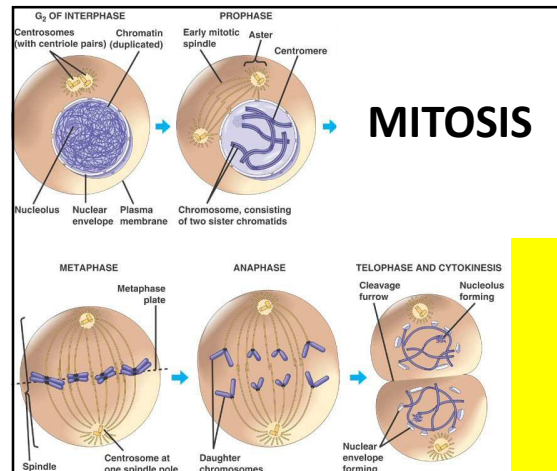
- The majority of a cell's life is spent in the growth phase called **interphase**.
- The purpose of interphase is cell growth.
- Interphase is divided into three phases: **G1, the S stage, and G2**



Mitosis

- **Mitosis** is the part of the cell cycle where the nucleus divides to form two nuclei, each new cell contains a complete set of chromosomes.
- 4 Stages of Mitosis
 - 1) Prophase
 - 2) Metaphase
 - 3) Anaphase
 - 4) Telophase

Interphase is **NOT** a stage of mitosis because the nucleus is not dividing at that time.

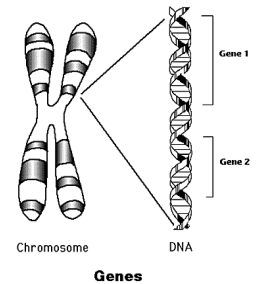


Uncontrolled cell division

- Can occur during the cell cycle if:
 - Cells fail to produce enzymes.
 - Cells overproduce enzymes.
 - Cells produce enzymes at the wrong time.
- Damaged DNA may cause these things to occur.
- **Cancer** is one result of uncontrolled cell division

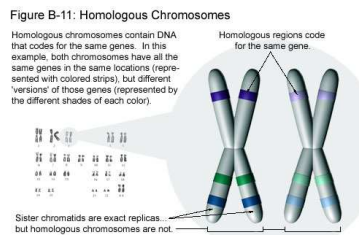
Chromosomes

- Characteristics such as hair and eye color are called **traits**.
- The instructions are found on short lengths of DNA on chromosomes called **genes**.
- Each chromosome consists of hundreds of genes.



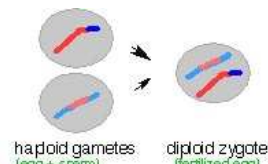
Homologous chromosomes

- Each of the 23 pairs of chromosomes consist of two **homologous chromosomes**.
- Each are similar in shape, size and content.



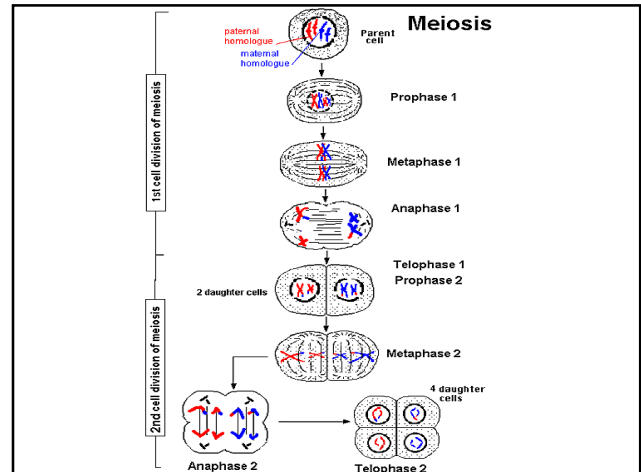
- **Diploid** – a cell with two sets of chromosomes such as somatic cells. (2n)
- **Haploid** – A cell with one set of chromosomes such as **gametes**. (n)
- **Gamete** = sex cells (eggs and sperm)

Fertilization



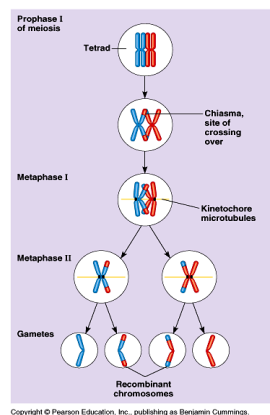
The stages of **Meiosis** are similar to **Mitosis**

- **Mitosis**
 - Prophase
 - Metaphase
 - Anaphase
 - Telophase
 - Results in **2** daughter cells with = # of chromosomes as the parent cell.
- **Meiosis**
 - Prophase I, Metaphase I, Anaphase I, Telophase I
 - Prophase II, Metaphase II, Anaphase II, Telophase II
 - Results in **4** daughter cells with $\frac{1}{2}$ # of chromosomes as the parent cell.



Crossing over creates genetic variation.

- Instead of producing only two types of chromosomes, four different chromosomes are produced. This doubles the variability of genes on gametes.



Change in Chromosome

- Being short a chromosome often results in death.
- Having extra chromosomes (trisomy) results in abnormalities such as:
 - **Down Syndrome (trisomy 21)**
 - **Klinefelter's Syndrome (extra X sex chromosome in males)**
- Trisomy is caused by **nondisjunction** - the failure of chromosomes to separate during meiosis.

How Genetics Began:

- **Gregor Mendel** –
 - Austrian Monk
 - Carried out experiments on garden peas to predict patterns of heredity.
- The patterns Mendel discovered form the basis of genetics.
- **Genetics** is the study of heredity.



The alleles an organism inherits is its **genotype**. TT or Tt

How an organism looks because of its genotype is called the **phenotype**.

TT = tall

Tt = tall

tt = short

	T	T
t		
t		

An organism with identical alleles are said to be **homozygous**. TT or tt
(*True breeding or Purebred*)

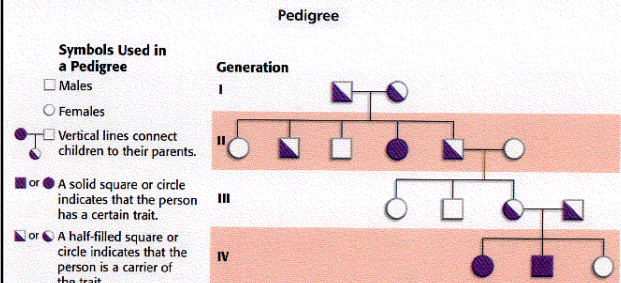
Organisms with different alleles are said to be

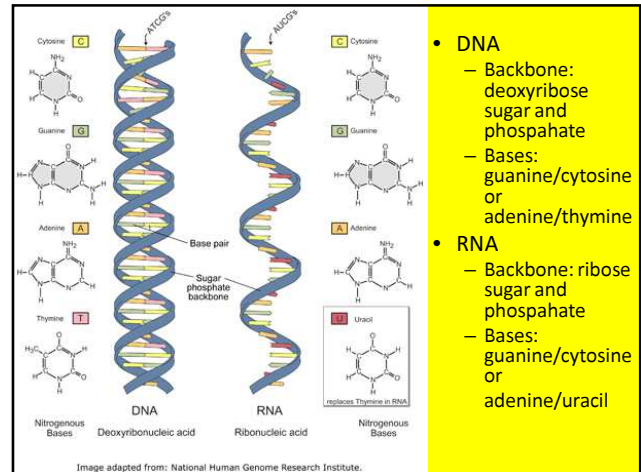
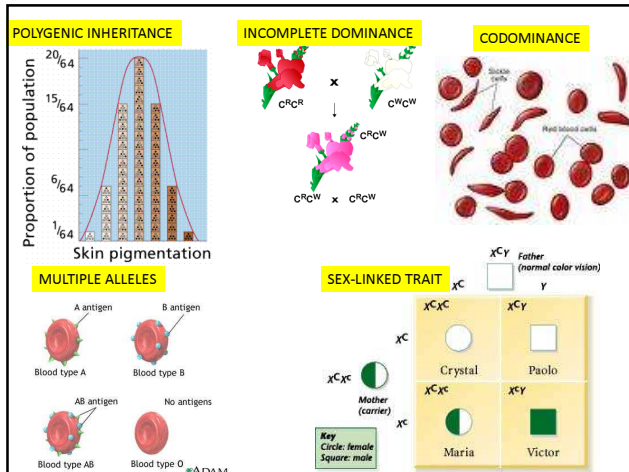
heterozygous.

	T	t
T		
t		

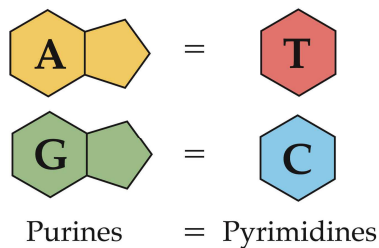
Pedigree

- Chart of family history that shows how a trait is inherited over several generations.
- Helpful in predicting genetic disorders.





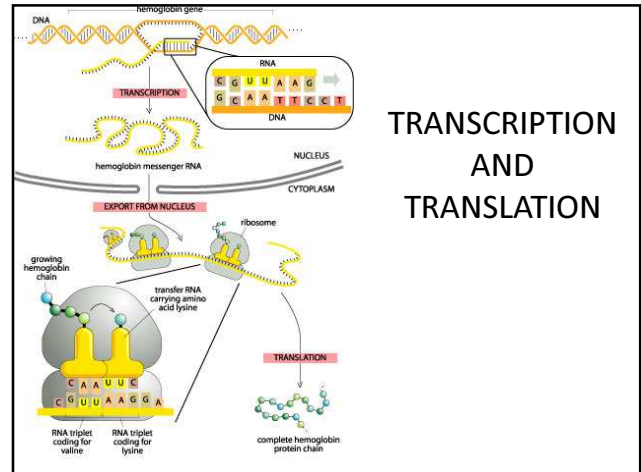
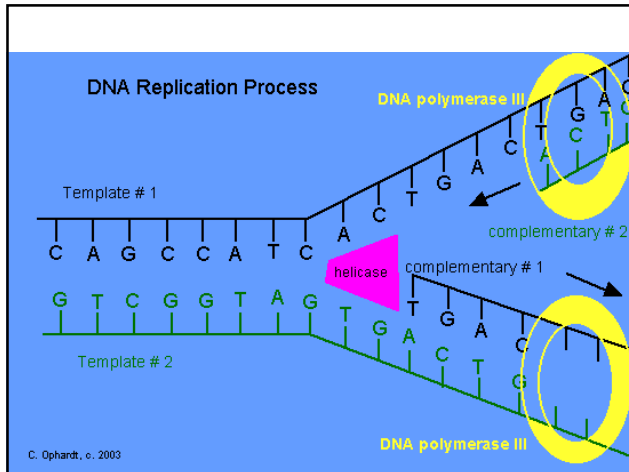
Amounts of adenine in DNA from any one species always equals the amount of thymine ($A = T$) and that the amount of guanine always equals the amount of cytosine ($G = C$).



Central Dogma of Genetics

DNA → RNA → Protein

- DNA** is replicated to provide identical genetic material to all cells (**DNA Replication**) **Nucleus**
- RNA** is built from the genes on DNA (**Transcription**) **Nucleus**
- Proteins** are built from RNA (**Translation**) **Cytoplasm**

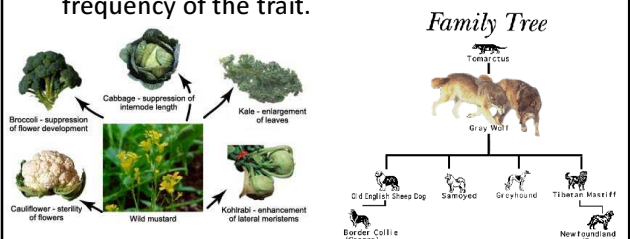


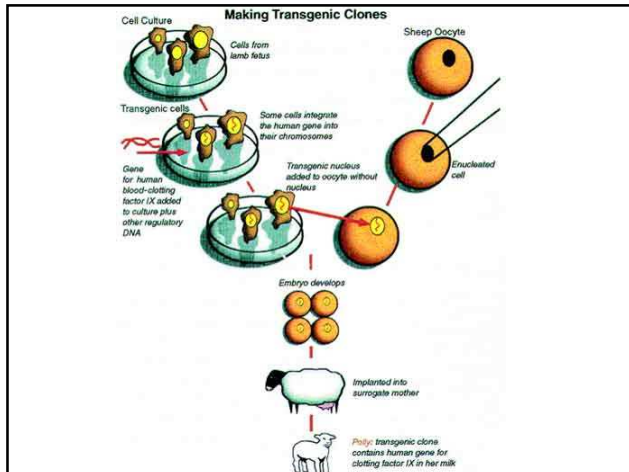
Mutations

- **Mutation** is any change in the DNA sequence that also changes the protein it codes for.
- Mutations can affect sex cells or somatic (body) cells.
- **ONLY** mutations occurring in the sex cells can be passed on to offspring.
- Causes of mutations:
 - Mistake during DNA replication
 - **Mutagens**: gamma radiation, x-rays, ultraviolet light, dioxin, asbestos, cyanide, formaldehyde

Genetics was used before it was fully understood.

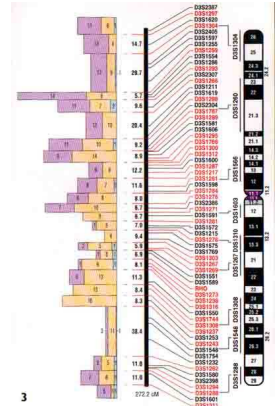
- **Selective breeding/Artificial selection**—breeding livestock, plants, or pets that display desired traits in an effort to increase the frequency of the trait.





The Human Genome

- A **genome** is the complete set of genes in an organism's DNA.
- The Human Genome project was completed in 2003



Organisms and Their Environment

- **Ecology** is the study of interactions among organisms and their environment.
- The Earth's **biosphere** (the portion of the Earth that supports life) is composed of **biotic** and **abiotic** factors.
- Abiotic factors:
- Biotic factors:

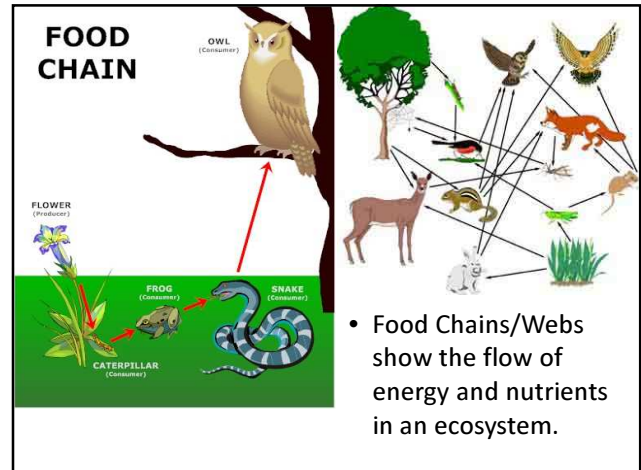
Living Relationships-some organisms enhance their chances of surviving by forming symbiotic relationships

- Commensalism
- Mutualism
- Parasitism



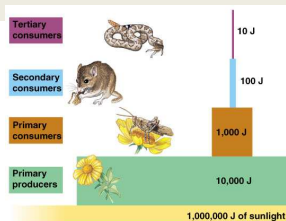
Energy Flow in an Ecosystem

- **Autotrophs (producers):** Organisms that make their own food. Ex. Plants, some bacteria, algae
- **Heterotrophs (consumers):** Organisms that must eat other organisms for energy.
 - *Herbivores* – feed on producers/autotrophs
 - *Carnivores* – feed on other heterotrophs/animals
 - *Scavengers* – feed on dead heterotrophs/animals
 - *Omnivores* – feed on producers and heterotrophs
 - *Decomposers/Detritovores* – break down dead organisms



Energy and Trophic Levels

- Each organism in a food chain represents a trophic level in the passage of energy and materials.
- Higher levels on the food chain receive only 10% of the energy of that of the lower level.

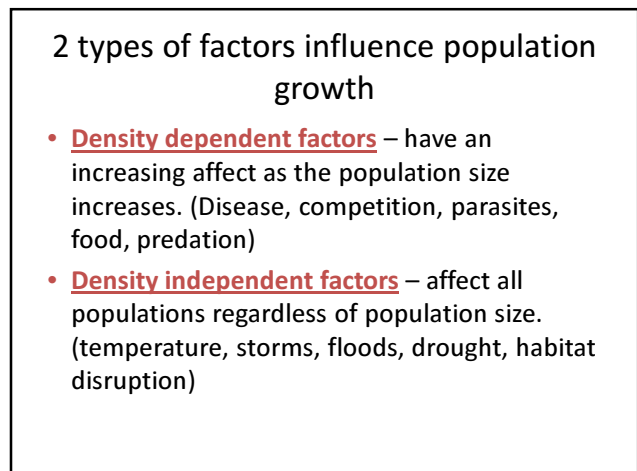
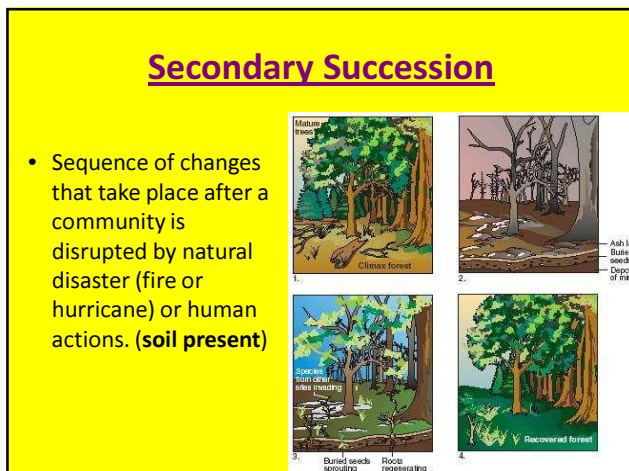
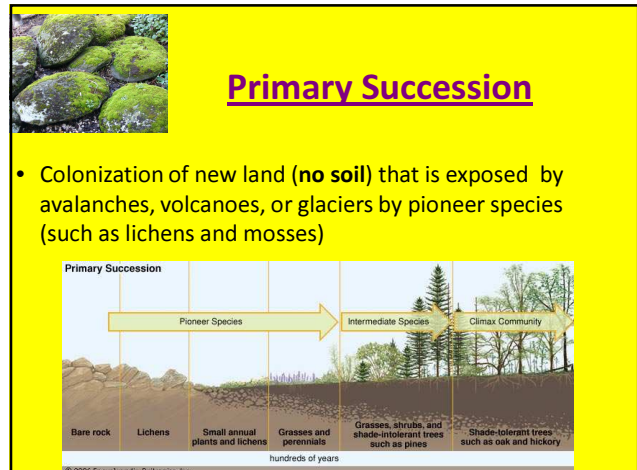
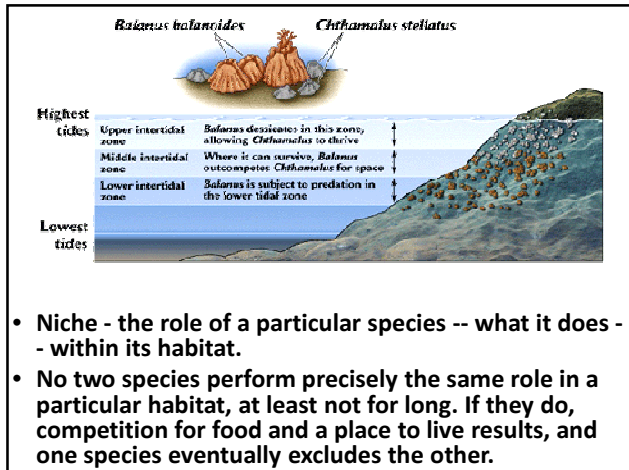


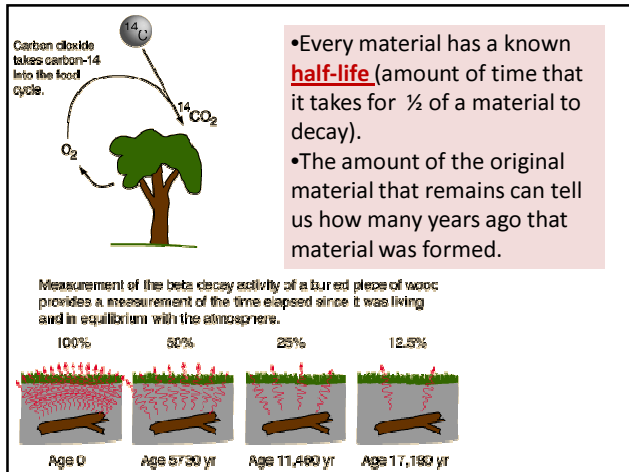
Limiting Factors are environmental factors (biotic or abiotic) that affect an organism's ability to survive.

- Such as: food availability, predators, temperature, elevation, competition, types of vegetation, soil.

- These factors can restrict the existence or reproduction of Organisms → **carrying capacity**

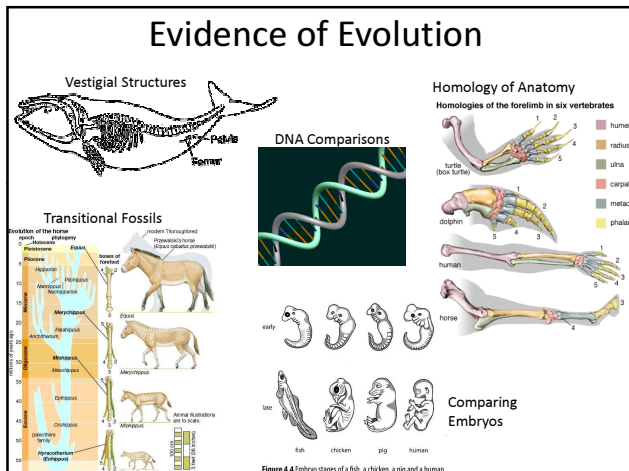






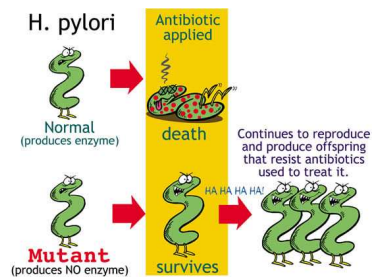
Natural Selection

- Organisms always produce more offspring than can survive.
- Only the organisms in a population that have traits desirable to life in a particular environment will survive to reproduce.
- Those desirable traits will appear in their offspring. These desirable traits are called **adaptations**.



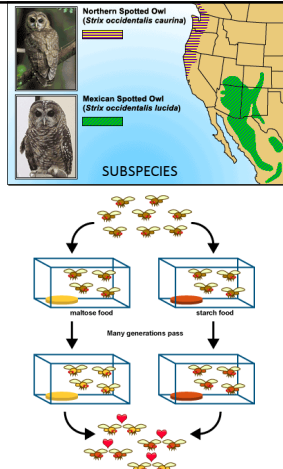
Mechanisms of Evolution

- 1) Natural Selection
- 2) Mutation
- 3) Genetic drift
- 4) Migration



Speciation by Geographic Isolation

- **Speciation** is a lineage-splitting event that separates one species into two.
- Populations of the same species in different geographic locations would be affected by different selective pressures, eventually making them genetically different.



Taxonomic Rankings

