

Biology SOL Review Packet

Name: KEY

I. Scientific Investigation:

A. Steps to the Scientific Method

1. **Make observations/Do research:** to determine what problem you want to address
2. **Develop a Research Question:** what specifically do you want to determine?
3. **Develop a hypothesis:** based on research from a variety of sources
 - a. **scientific journals:** are the best place to locate current findings on the newest technologies
 - b. **encyclopedias:** are a good place to find information on extinct species or historical theories
 - c. **state/local agencies:** can help with local policies or local research (example: can help research the effects of pesticides on the squirrel population)
4. **Conduct a Controlled Experiment-** testing the hypothesis and collecting data and observations
5. **Interpret and Analyze Data:** using tables and graphs
6. **Draw Conclusions-** including improvements for future experiments
7. **Communicate Results:** so others can build on the experiment

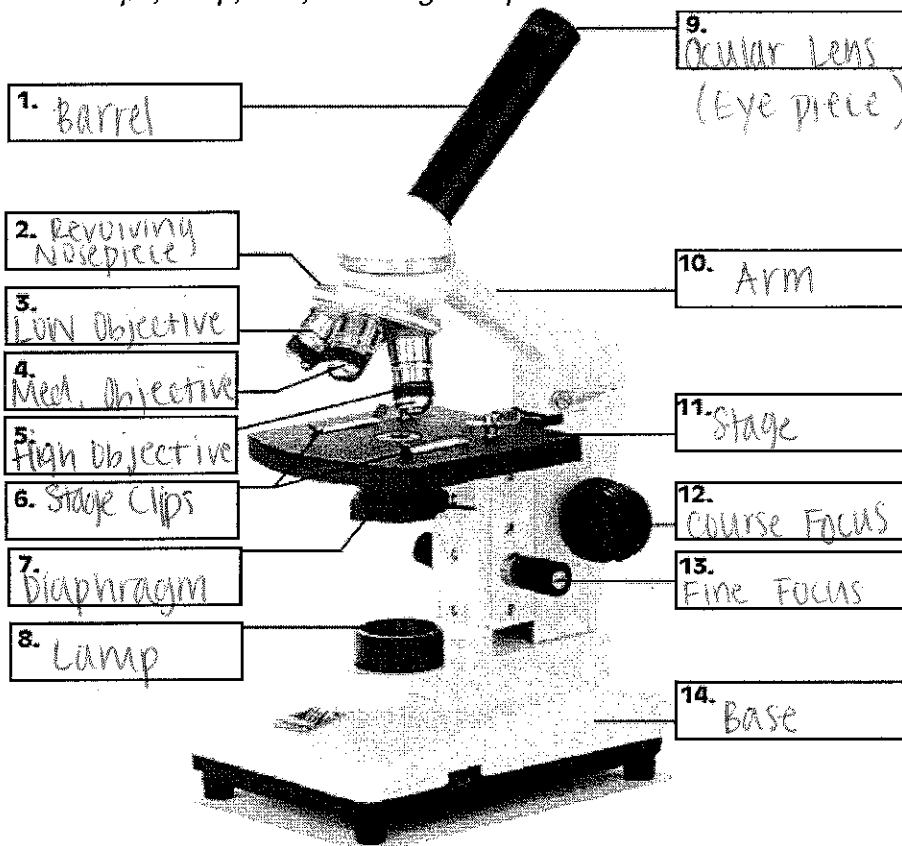
B. Terms: Word Bank: *experiment, variables, hypothesis, constants, control, independent variable, dependent variable*

1. Hypothesis - is an educated guess/prediction; usually in "IF...THEN" form.
2. Variables - are the factors that are measured in an experiment.
3. Independent Variable - is the variable that you purposely change...variable "I" change.
4. Dependent Variable - is the variable that changes as a result of changing the IV.
5. Control - is the baseline measurement that you compare your data to.
6. Constants - the thing(s) that are purposely kept the same in the experiment.
7. Experiment - is a structured way to test a hypothesis.

C. Scientific Tools - Identify the tool used for each of the following tasks: *Word Bank: beaker, graduated cylinder, balance, light microscope, electron microscope*

1. Balance - used for measuring mass
2. Electron Microscope - used for examining extremely small specimens
3. Light Microscope - used for examining small specimens, was used to discover cells
4. Graduated cylinder - used for measuring precise volumes of liquids
5. Beaker - less accurate tool for measuring volume

D. Microscope – Fill in the names of the parts of the microscope. *Word bank: objective lens, ocular lens, diaphragm, fine focus, course focus, stage, barrel, base, stage clips, lamp, arm, revolving nosepiece*



★ **Total Magnification**

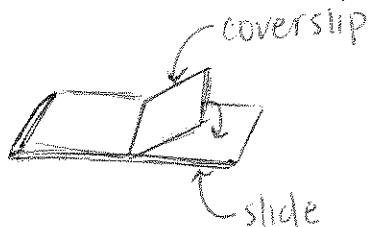
Ocular Lens x Objective Lens

Example:

Ocular – 10x
Objective – 100x

Total = 10 x 100 = 1,000

1. Course Focus - used to make BIG changes in focus
2. Diaphragm - adjusts the amount of light
3. Objective Lens - changes the magnification
4. Stage Clip - holds down the slide
5. Ocular lens - what you look through
6. Draw a picture demonstrating how to properly put on a coverslip to avoid bubbles.



II. Characteristics of Living Things

A. List the 7 Themes of Biology: Word Bank: cells, metabolism, homeostasis, reproduce, heredity, evolution, interdependence

1. Cells - smallest unit of all life
2. Metabolism - get and use energy in order to carry out life functions
3. Interdependence - organisms rely on each other to survive
4. Reproduce - either asexually or sexually
5. Homeostasis - maintain a constant internal environment, ex. body temperature
6. Heredity - pass on traits to offspring
7. ~~Evolution~~ Evolution - populations of organisms change over time

B. Biological terms in order from smallest to largest

Cell → tissue → organ → organ system → organism → population → species → community → ecosystem → biosphere

1. cell: the smallest unit of life
2. Tissue: a group of cells that carry out a similar function
3. organ: a group of tissues that carry out a specialized function in the body
4. organ system: a group of organs that work together to perform body functions
5. organism: a single living thing
6. Population: a group of organisms of the same species that live in the same area and can interbreed
7. Species: a group of organisms that look similar and can produce fertile offspring
8. Community: a group of different species that live in the same habitat and interact with on another
9. Ecosystem: a community of organisms and their non-living environment
10. Biosphere: all of the world and it's atmosphere that support life

III. Life at the Molecular Level

A. Inorganic Compounds~ (Typically DO NOT contain carbon)

1. **Water:** Word Bank: hydrogen bonding, floats, acids, body temperature, capillary action, water, polar, 7, 4, 14, 0, cohesion, solvent, adhesion, bases, high heat capacity, homeostasis, surface tension)

a. Water molecules have an unevenly distributed charge, this means that the molecule is

polar.

b. Hydrogen bonding is the attraction between the positive end of one water molecule and the negative end of another water molecule.

c. Many of the unique properties of water are caused by hydrogen bonding

~ capillary action is the movement of water up thin tubes, due to cohesion which means that water molecules 'stick' to each other and adhesion which means that water molecules can 'stick' to other substances.

~ The property that helps bugs stand on water is called surface tension.

~ Water expands when it freezes which makes ice float.

~ Water has a high heat capacity which means it takes a lot of energy to raise or lower its temperature. This is important because it helps organisms maintain homeostasis by keeping a constant body temperature.

d. Because water is a polar molecule, it is called the universal solvent which means that it can dissolve many substances.

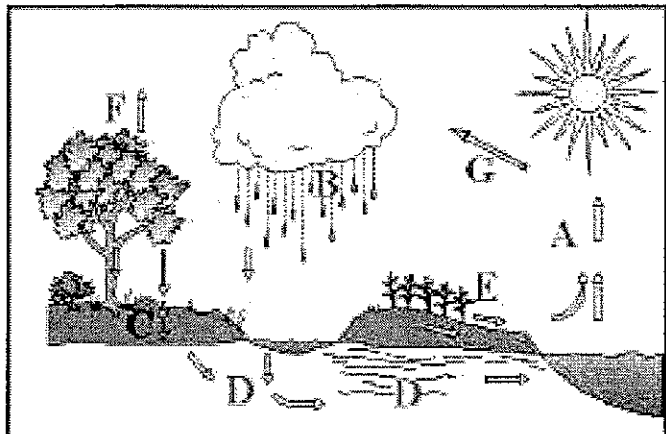
e. Cells are mostly water, therefore much of your entire body is made of water.

~The **pH scale** is from 0-14. Acids range 0-6. Bases range 8-14. A neutral solution has a pH of 7.

2. **The Water Cycle :** Fill in the blanks with letters from the diagram.

a. water falls to the ground in the form of **precipitation** (letter B)

b. it percolates through the soil to make **ground water** (letter D)



- c. water that doesn't go into the ground is called **run off** (letter E)
- d. water is taken into plants through the roots by **capillary action**
- e. **transpiration** is the process of releasing water vapor into the atmosphere from plant leaves. (letter F)
- f. **evaporation** puts water from oceans and lakes into the atmosphere. (letter A)
- g. water in the atmosphere forms droplets in clouds by **condensation**. (letter G)

3. The Carbon Dioxide/Oxygen Cycle: Word Bank: heterotrophs, CO₂, water, O₂, glucose, chloroplasts, mitochondria, photosynthesis, chemical, respiration, autotrophs, solar

- a. Autotrophs use organelles called chloroplasts in their leaves to collect solar energy.
- b. Photosynthesis occurs so plants can make glucose to use for energy
- c. photosynthesis converts solar energy into chemical energy.
- d. photosynthesis uses CO₂, water and solar energy to form glucose & O₂.

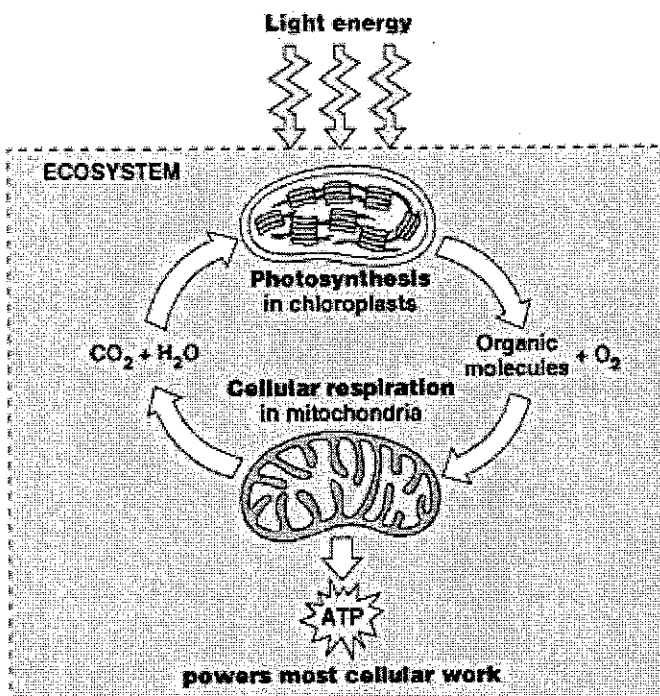
e. animals can not make their own food therefore they are called heterotrophs.

f. all organisms use organelles called mitochondria to perform a process called respiration which breaks down food molecules to produce ATP for energy.

g. respiration uses O₂ and glucose to produce water and CO₂. (ATP!)

h. the gas made by respiration is CO₂; the gas taken in by photosynthesis is CO₂.

i. the gas taken in by respiration is O₂; the gas produced by photosynthesis is O₂.



B. Organic Compounds: There are 4 (number) different organic compounds.

All organic molecules contain carbon and are necessary for life !!!!

1. Carbohydrates Word Bank: *monosaccharides, built, glucose, broken down*

a. Carbohydrates are built to store energy in plants and are broken down to be used as cellular energy to accomplish the characteristics of life.

b. Monosaccharides are the building blocks of carbohydrates, example glucose

2. Lipids Word Bank: *fat, cuticle, oil, store, wax, insulate*

a. lipids are organic compounds that include include fat, oil, and wax.

b. lipids are used to store energy in animals

c. leaves have a protective lipid layer called the cuticle that prevents water loss.

d. lipids like those in whale blubber and human fat help insulate organisms, protecting them and keeping them warm

3. Proteins: Word Bank: *unchanged, amino acids, active sites, peptide, enzymes, speed up, substrate*

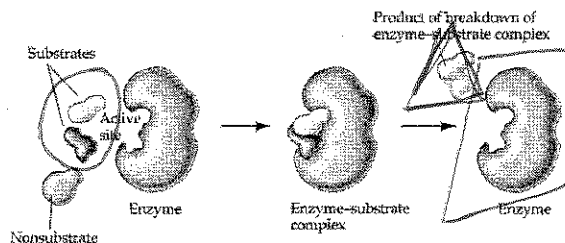
a. Proteins are made up of amino acids joined together by peptide bonds.

b. Enzymes are a special group of proteins that speed up reactions.

c. Enzymes have active sites with specific shapes that allow them to interact with only one type of substrate.

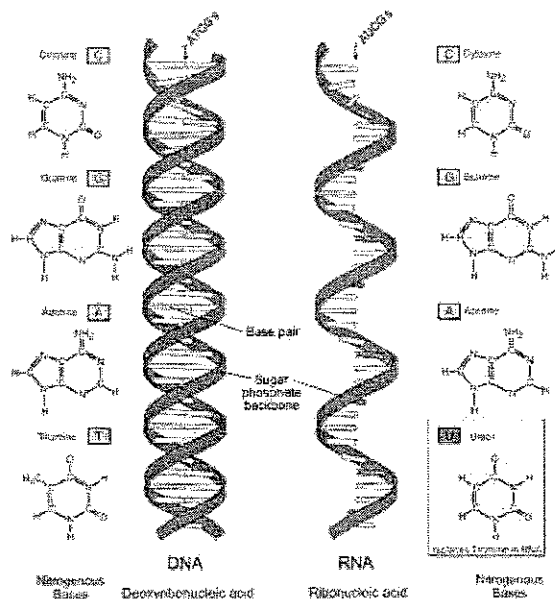
d. Enzymes are unchanged during reactions.

e. **Circle** the substrates. **Box in** the enzyme AFTER the reaction. Draw a **Triangle** around the products.



4. **Nucleic Acids:** *Word Bank:* adenine, cytosine, guanine, thymine, hydrogen bond, uracil, replication, sugar, ribose, Watson & Crick, nucleotides, Rosalind Franklin, double helix, genetic, deoxyribose, phosphate, DNA, RNA, nitrogen base

- The two types of nucleic acids are DNA and RNA.
- The building block of a nucleic acid is a nucleotide, which is made of a sugar, a phosphate, and a nitrogen base.
- DNA is common to **all** living things and it stores genetic information.
- In DNA, adenine bonds with thymine and guanine bonds with cytosine.
- The nitrogen bases are held together by hydrogen bond.
- The shape of a DNA molecule is a double helix, discovered by Watson & Crick.
- Rosalind Franklin took X-ray photographs of DNA that helped determine DNA's structure.
- Replication is a process that makes an exact copy of DNA.
- The sugar in DNA is deoxyribose, but the sugar in RNA is ribose.
- In DNA adenine bonds with thymine, but in RNA it bonds with uracil.
- RNA is single stranded, and DNA is double stranded.
- DNA is copied by RNA which becomes the pattern for making proteins.
- Genetic engineering involves inserting foreign DNA into host DNA to make recombinant DNA.



IV. Life at the Cellular Level

A. The Parts of the Cell Theory

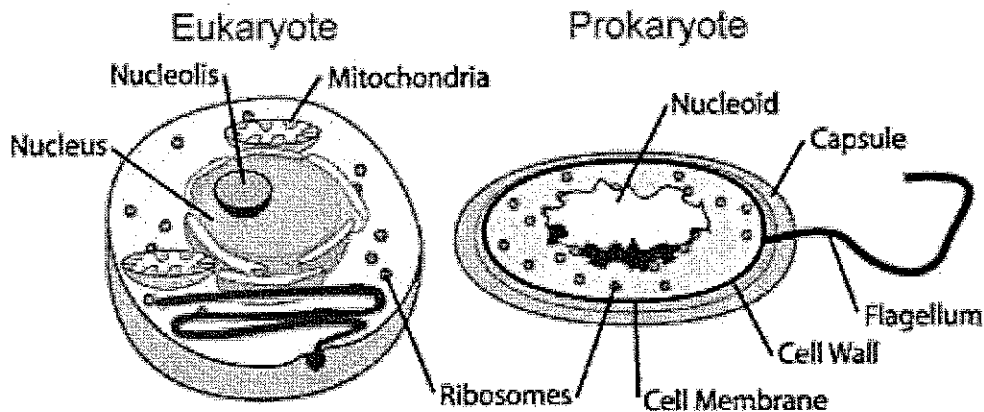
1. Cells are the basic unit of structure and function of life.
2. All living things are composed of cells.
3. All cells come from pre-existing cells.

B. Development of the Cell Theory Word Bank: Hooke, Leeuwenhoek, Schleiden, Schwann, Virchow

1. Leeuwenhoek - first to observe living microorganisms through a microscope
2. Hooke - observed cork and named cells
3. Schleiden - studied plant cells
4. Schwann - studied animal cells
5. Virchow - concluded that all cells come from preexisting cells

C. Types of Cells Word Bank: prokaryotes, eukaryotes, both

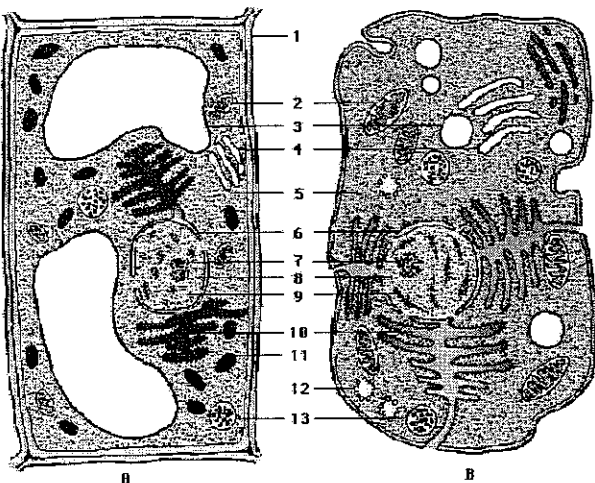
1. Eukaryotes - have a nucleus
2. Eukaryotes - have organelles
3. Prokaryotes - includes the kingdom Eubacteria and Archaeobacteria
4. Prokaryotes - do not have organelles (mini-organs)
5. Eukaryotes - includes Protists, Fungi, Plants, and Animals
6. BOTH - have DNA, (HINT: ALL kingdoms have this in common)
7. Eukaryotes - go through mitosis
8. Prokaryotes - go through binary fission
9. BOTH - have ribosomes to synthesize (make) proteins



D. Cellular Organelles: Word Bank: nucleus, mitochondria, vacuole, ribosomes, golgi body or apparatus, endoplasmic reticulum, nucleolus, centriole, cell wall, cytoplasm, chloroplast, lysosomes, cell membrane

1. Nucleus - command center of the cell; DNA in the form of chromosomes is here
2. Nucleolus - small organelle in the nucleus that makes ribosomes
4. Ribosomes - the site of protein synthesis in prokaryotes and eukaryotes
- (ER) 5. Endoplasmic Reticulum - transport system of the cell
6. Golgi - collects, packages, and distributes proteins
7. Lysosome - contains digestive enzymes to break down old cell parts
8. Vacuole - storage tank of the cell
9. Mitochondria - organelle that conducts 'respiration' for the cell
10. Mitochondria - the powerhouse of the cell
11. Chloroplast - organelle that conducts 'photosynthesis' for plant cells
12. Centriole - assists in cell division in animal cells only
13. Cytoplasm - the jelly-like material in which organelles float inside a cell
14. Cell wall - made of cellulose (plants) or chitin (fungi); boundary outside of the cell membrane in some cells
15. Cell Membrane - encloses cell, controls what gets into and out of the cell
16. Mitochondria - numerous in heart muscle cells because of need for energy
17. Ribosomes - numerous cells that produces large quantities of proteins

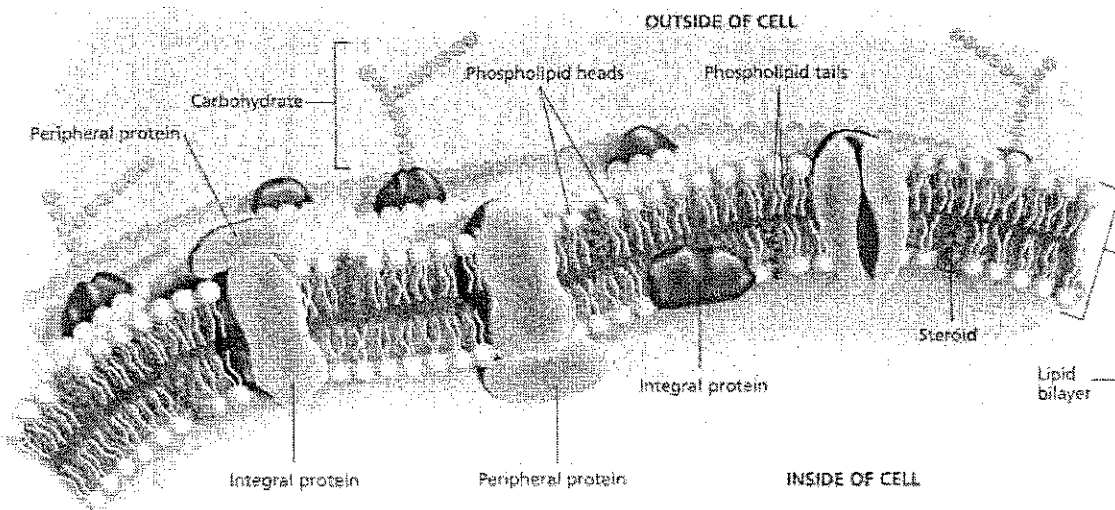
E. Differences between plant and animal cells (complete the table)



	Plant (A)	Animal (B)
Shape	Square	Round
Unique Parts	cell wall chloroplast	

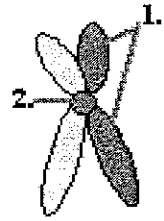
F. The Fluid Mosaic Model and Movement through the Cell Membrane: Word Bank:
diffusion, proteins, cell membrane, active transport, endocytosis, exocytosis,
phospholipids, energy, low, high, carbohydrates, water, facilitated diffusion,
pinocytosis, osmosis, phagocytosis

1. The cell membrane is composed of phospholipids, proteins,
and carbohydrates.
2. The Fluid Mosaic Model describes the cell membrane.
3. Passive transport is also called diffusion and it doesn't require
energy.
4. Passive transport moves molecules move from areas of high to
low concentration.
5. Facilitated diffusion - diffusion where carrier proteins help molecules
across the membrane.
6. Osmosis is a type of diffusion involving only the movement of water
molecules.
7. The type of transport that requires energy is active transport.
8. The movement that requires energy moves molecules from low to
high concentrations.
9. Active transport that moves substances into the cell is called endocytosis.
10. Moving solid particles into the cell is called phagocytosis.
11. Moving liquids into the cell is called is called pinocytosis.
12. Active transport that moves substances out of the cell is called exocytosis.
13. Molecules are transported across the cell membrane by carrier proteins.



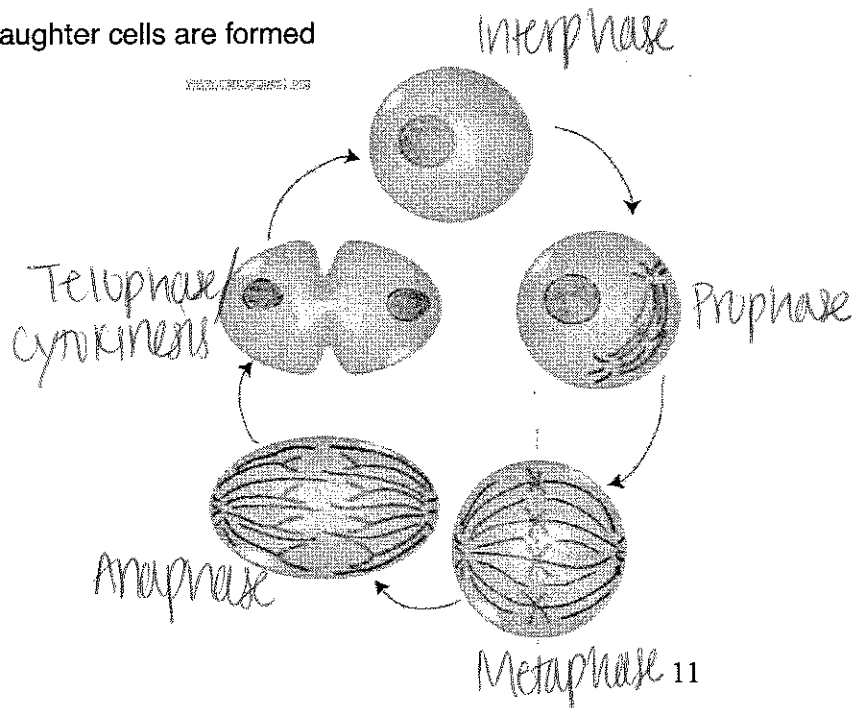
V. Cell Division

A. Mitosis (Word Bank: nucleus, replicated, interphase, prophase, metaphase, anaphase, telophase, cytokinesis, centromere, chromatids, chromatin, centrioles, spindle fibers, plate, furrow)



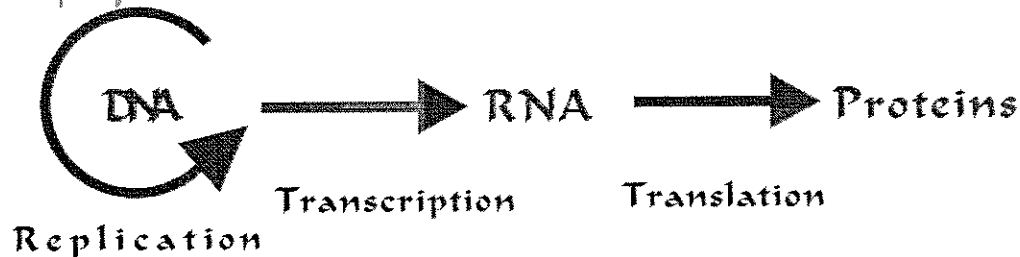
1. A chromosome is made of two identical parts called chromatids.
2. The parts of a chromosome are held together by a centromere.
3. Only animal cells have centrioles to help with chromosome movement.
4. During anaphase sister chromatids are separated at the centromere and are pulled to opposite ends of the cell.
5. DNA is replicated during interphase so each cell will have the same information
6. Chromosomes line up along the equator of the cell in metaphase.
7. Loose or uncoiled chromosomes are actually DNA in the form of chromatin.
8. During anaphase spindle fibers shorten which pulls chromosomes to the poles.
9. After the nucleus divides, cytokinesis occurs: the division of the cytoplasm
10. In plant cells only, a cell plate forms during cytokinesis.
11. In animal cells only, a cell furrow forms during cytokinesis.
12. Spindle fiber are attached to chromosomes at the centromere
13. Prophase - chromosomes become visible
14. Telophase - nuclear membrane forms around each chromosome set
15. Prophase - nuclear membrane begins to disappear
16. Cytokinesis - two daughter cells are formed

17. Label each phase of mitosis in the diagram at the right.



B. Meiosis Word Bank: gametes, 1, the same, 46, 23, eggs, sperm, zygote, homologous, diploid, half, 2, haploid, prophase, fertilization,

1. Meiosis is a type of cell division that makes sex cells or gametes.
2. The two types of sex cells are sperm and eggs.
3. Mitosis consists of 1 division(s), while meiosis consists of 2 division(s).
4. Mitosis makes cells with the same number of chromosomes as the parent cell, but meiosis produces cells with half the number of chromosomes as the parent cell.
5. A human's body cells have 46 chromosomes; sex cells or gametes have 23.
6. For every chromosome your mother gave you, there is a homologous chromosome from your father with information regarding the same trait(s).
7. When a cell has a full complement of homologous chromosomes from each parent (2 complete sets of chromosomes), the cell is said to be diploid.
8. Sex cells have only ONE set of chromosomes, they are called haploid.
9. When an egg and a sperm combine during fertilization, the zygote that is formed has the normal diploid number of chromosomes.
10. Homologous chromosomes exchange information during prophase which adds to diversity. ("crossing over")



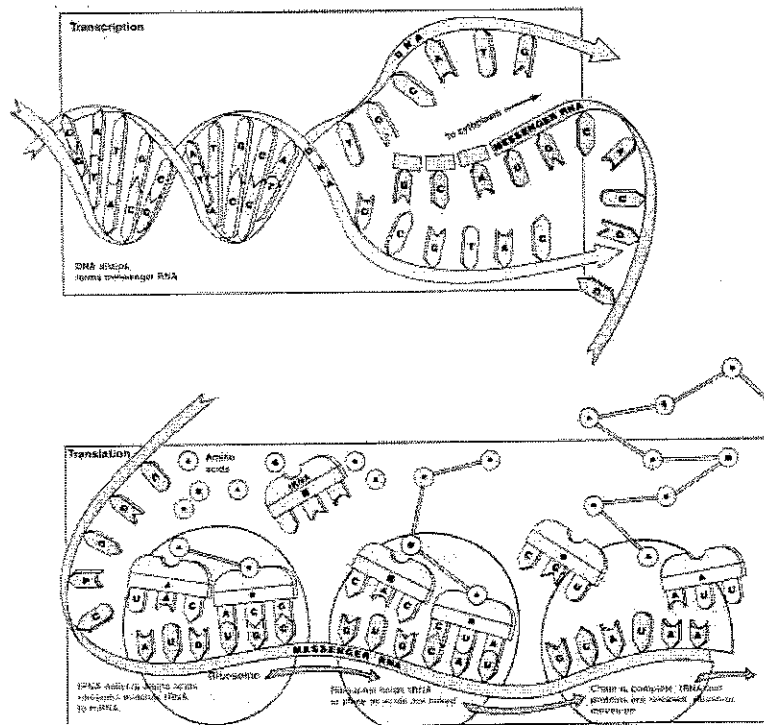
C. Making Proteins Word Bank: translation, diffusion, transcription, proteins, mRNA, amino acid, DNA, peptide, tRNA, codon, nitrogen bases, cytoplasm, ribosome, nucleus, anticodon

1. Almost everything in a living organism is made of or made by proteins.
2. The process of protein synthesis is consist of transcription and translation.
3. During transcription, the genetic code is copied from DNA to RNA.

4. Because DNA can't leave the nucleus, the message is carried out to the cytoplasm by RNA.
5. Once the message from DNA is copied, the RNA leaves the nucleus and travels to a ribosome in the cytoplasm.
6. A sequence of 3 bases on mRNA is called a(n) codon, but 3 bases on a tRNA molecule are called a(n) anti-codon.
7. Each codon is matched with an anti-codon and the tRNA transfers the amino acid to the ribosome.
8. Each amino acid is linked together by peptide bonds to form proteins.
9. Another name actually making proteins is translation.
10. The sequence of nitrogen bases on DNA carry the genetic code.

D. Transcription and Translation: Use a codon chart to transcribe and translate the following DNA sequence. (GGCCATTTGATTTGAGC)

1. mRNA CCGCUAAAACUAAACUCG
2. amino acids (need chart to answer)
3. This protein is made of 10 amino acids. (give the number of amino acids)



E. DNA Technology: Word Bank: DNA sequence, genes, fingerprinting, identical, fraternal, collaborative, same

1. DNA fingerprinting is used to identify crime suspects (such as murder and rape).
2. Using gel electrophoresis, scientists can determine an individual's DNA fingerprint. No two people have the same fingerprint, except for identical twins.
3. Human Genome project is considered a collaborative effort because 13 countries worked on it.
4. The objective of the Human Genome Project was to understand the human DNA sequence.
5. Scientists wanted to determine the sequence of bases to ultimately find the genes responsible for certain diseases and human traits.

VI. Genetics

A. Vocabulary Word Bank: phenotype, gene, heredity, genetics, genome, recessive, dominant, Gregor Mendel, trait, genotype, alleles, homozygous, heterozygous

1. Heterozygous - two **different** alleles, a hybrid (Tt)
2. Heredity - is the passing of characteristics from parent to offspring
3. Genotype - is the **type** of **genes** or alleles present in an organism's genome
4. Dominant - form of gene that always shows even in the presence of recessive allele.
5. Genome - all of the genes in an organism
6. Allele - are different forms of the same gene (ex: tall vs. short)
7. Homozygous - two alleles of the **same** form that make up a genotype, pure breed (TT or tt)
8. Gregor Mendel is the Father of Modern Genetics
9. recessive - form of a gene **only** expressed in a homozygous state
10. trait - is an inherited characteristic
11. phenotype - is an organism's **physical** appearance
12. genetics - is the study of heredity
13. Gene - is a segment of DNA located on a chromosome that codes for a particular protein

B. Mendelian Genetics: Word Bank: monohybrid, dihybrid, independent assortment, segregation, Punnett square, P, F1, F2, incomplete dominance, codominance, sex-linked traits

1. Punnett squares - table used to diagram the probability of getting certain genotypes
2. A monohybrid cross looks at only **one** trait
3. A dihybrid cross looks at **two** traits at a time
4. The first generation of a 'cross' is the P or parental generation
5. The offspring of the P generation is the F1 generation
6. The offspring of the F1 generation is the F2 generation
7. The Law of Independent Assortment states that each gene is inherited separately from others if they are on different chromosomes
8. The Law of Segregation states the 2 alleles for each trait separate as gametes form
9. Incomplete dominance is blending of traits; red flowers + white flowers = pink
10. Codominance - both alleles are expressed equally, as in blood typing (A+B = AB)
11. Sex-Linked traits - controlled by genes on sex chromosomes and are often more common in males than in females; colorblindness, hemophilia

C. Mutations ~ there are 2 major types 'gene' and 'chromosomal'

1. Gene Mutations Word Bank: gene, point, frameshift, mutagens, UV light, chemicals

- a. A gene mutation is a change in one or more nucleotide bases of DNA.
- b. Mutations are caused by mutagens like UV light or chemicals
- c. A point mutation is when 1 nucleotide base in DNA is changed
- d. A frameshift mutation occurs if 1 or more nucleotides in DNA are added or deleted; this causes the codon sequence to be shifted.

~ if the original DNA is ATAACGCCTATT...

~ then the number of codons is 4

~ then the mRNA sequence would be UAUUGCGGAAUAA

~ if the original DNA were replicated and the "G" was deleted...

~ then the DNA sequence would be ATAACCTATT

~ then the number of complete codons would be 3

~ then the mRNA sequence would be UAUUGGGAAUAA

~ if the original DNA is replicated and "C" was added to the beginning...

~ then the DNA sequence would be CATAACCTATT

~ then the number of complete codons would be 4

~ then the mRNA sequence would be GUAUUGCGGAUAA

2. Chromosomal Mutations Word Bank: duplication, inversion, insertion, deletion, translocation, nondisjunction, polyploidy, haploid, triploid, diploid, chromosomal

a. A ~~chromosomal~~ ^{chromosomal} mutation occurs if there is a change in the number or structure of a single chromosome or whole sets of chromosomes

b. nondisjunction - chromosomes don't separate during meiosis

c. translocation - chromosome pieces are moved onto another chromosome

d. inversion - chromosome segment is inserted in reverse order

e. duplication - a segment of a chromosome is repeated

f. deletion - segment of a chromosome is removed

g. insertion - segment of chromosome is inserted into another

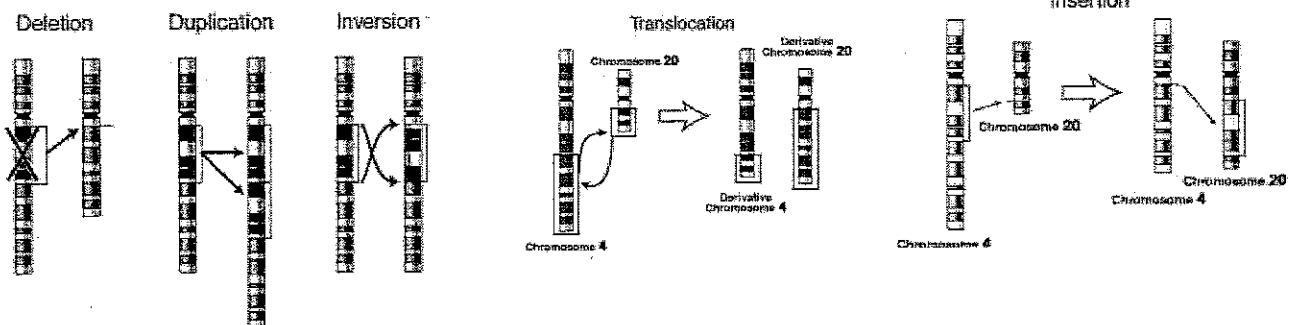
h. polyploidy - whole extra sets of chromosomes in the same cell

i. In plants and animals, sex cells are haploid which means that they have half the number of chromosomes that a body cell has

j. diploid - a cell with 2 sets of chromosomes (1 from mother; 1 from father)

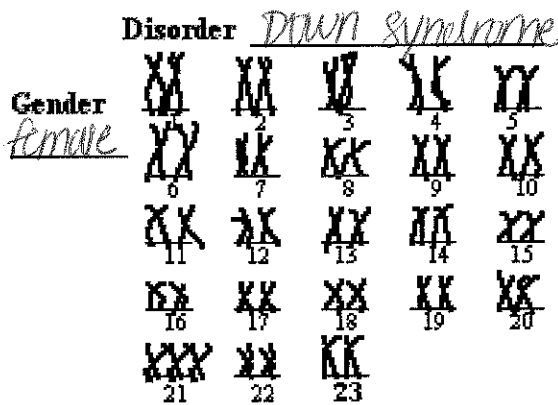
k. triploid - a cell with 3 sets of chromosomes

Types of mutation



D. Genetic Disorders: Word Bank: 21st, karyotype, trisomy, chromosomes, Monosomy

1. Only a karyotype detects mutations affecting the number of chromosomes
2. Down Syndrome is trisomy on the 21st chromosome pair
3. Trisomy occurs when there is an extra copy of a chromosome in a diploid cell
4. Turner Syndrome is caused by only have one sex chromosomes, one X. pair. This condition is called a monosomy.



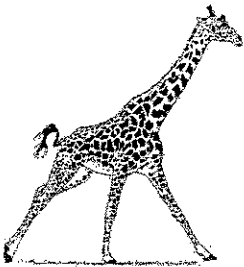
VII. Taxonomy- is the naming and organization of organisms developed by **Carolus Linneaus**, based on structural similarities

A. Classification: Complete the table by arranging the terms largest (1) to smallest (8) (use these terms: Domain, Genus, Kingdom, Species, Phylum, Class, Family, Order)

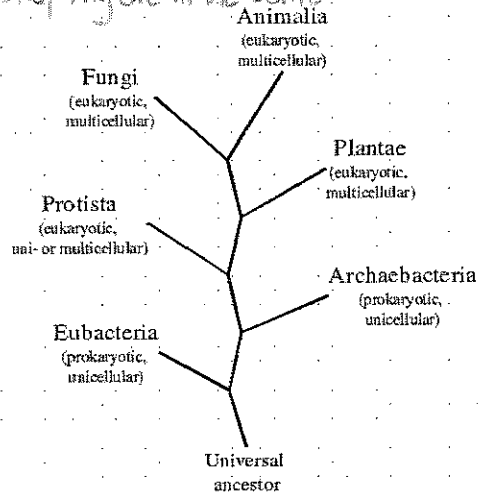
	Classification Level		Trick to Remember
1.	Domain	1.	Dear
2.	Kingdom	2.	King
3.	Phylum	3.	Phillip
4.	Class	4.	Came
5.	Order	5.	Over
6.	Family	6.	For
7.	Genus	7.	good
8.	Species	8.	spaghetti

B. Naming Organisms: Word Bank: genus, Linneaus, species, different, the same, binomial nomenclature, kingdom

1. Binomial nomenclature, or '2 name naming' was developed by Linneaus.
2. An organism's scientific name is made of its genus then its species.
3. If 2 organisms are in the same genus, they must be in the same family.
4. *Clostridium tetani* and *Clostridium botulinum* are two types of bacteria from the Eubacteria kingdom. They are in different species, but they are in the same genus.
5. The **Class** of Mammals includes organisms such as rabbits and elephants which are in the same **Phylum** but different **Species**.
6. Only organisms that interbreed and produce fertile offspring are in the same species.



Giraffe –
Scientific Name =
Giraffa camelopardalis
(genus) (species)



C. Kingdoms (complete the chart using the terms: eukaryotic, unicellular, multicellular, autotroph, heterotroph, prokaryotic)

Kingdom	Cell Type	Cell Structure	Number of cells	Nutrition	Examples
Eubacteria	P	Cell wall (Peptidoglycan)	Uni	Autotroph or heterotroph	All common bacteria
Archeabacteria	P	Cell wall	Unicellular	Autotroph or heterotroph	Extremophiles
Protista	Eukaryotic	Mixed	Uni or Multicellular	Autotroph or Heterotroph	Ameoba, Paramecium
Fungi	E	Cell wall (chitin)	Uni or Multicellular	Heterotroph	Mushrooms, yeast
Plantae	E	Cell Wall (cellulose)	Multicellular	Autotroph	Grass, Flowers
Animalia	E	No cell wall	Multicellular	Heterotroph	Cats, Jellyfish

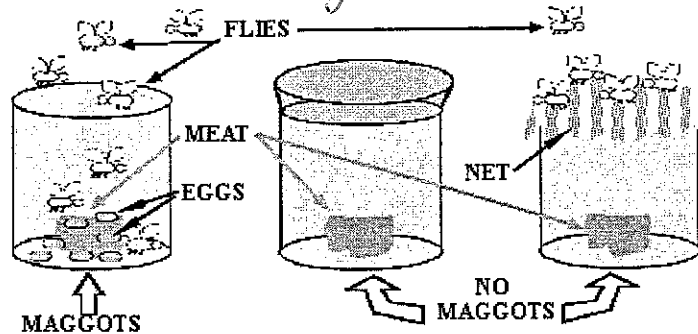
VIII. Evolution- the theory that there is a gradual change in characteristics over time.

A. Origin of Life – Scientists Hypotheses

1. Disproving Spontaneous Generation (Word Bank: air, sealed, open, bacteria, gauze, spontaneously)

a. Through the early 1800s, people believed organisms could spontaneously develop, an idea know as spontaneous generation.

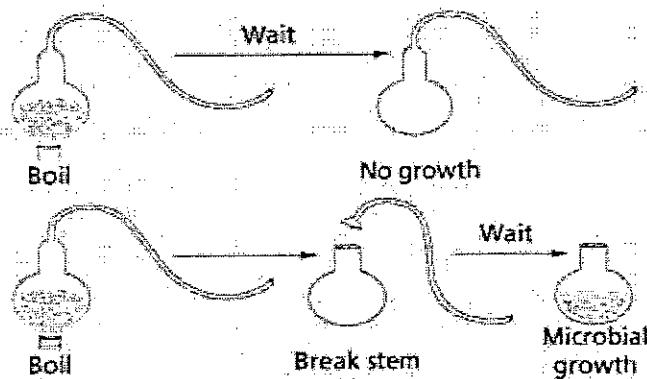
b. In 1668, many believed maggots spontaneous generated from rotting meat. Francis Redi's experiment disproved this by experimenting with meat in open jars, sealed jars and jars covered with gauze.



c. It was also believed that bacteria spontaneous generated in broth. Lazzaro Spallanzani removed the air from a flask, boiled the broth and sealed the flask. No bacteria generated without exposure to the air.

d. Some people still supported spontaneous generation but thought that air was a life force, necessary for it to occur.

e. In 1859, Louis Pasteur completely disproved spontaneous generation by using a special flask that allow air in but captured bacteria before it could get to the broth. No bacteria grew in the flask after boiling = no spontaneous generation.



2. First Life (Word Bank: eukaryotes, prokaryotic, variety, self-replicating, organic, photosynthesis, oxygen)

a. Earth's atmosphere had to be very hot and with little oxygen for the first

organic self-replicating molecules to first form.

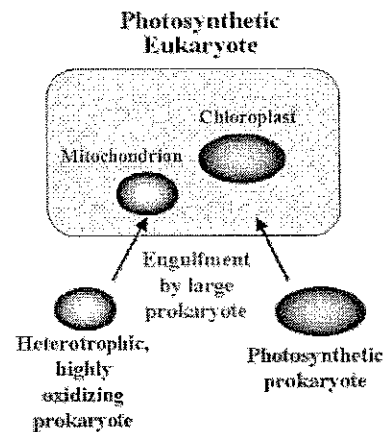
b. Organic molecules clumped together for form self-replicating structures that later evolved into cells.

c. Prokaryotic cells were the first to evolve.

d. When cells gained the ability to do photosynthesis, they used up carbon dioxide and put more oxygen into the atmosphere.

e. With more oxygen in the atmosphere, a wider variety of organisms evolved on land.

6. Some cells engulfed each other leading to the formation of more complex cells that we now call eukaryotes.

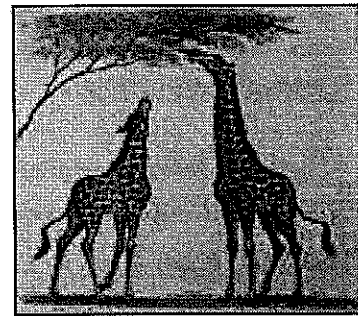


B. Early Theorists

1. **Lamarck** Word Bank: Inheritance of Acquired Traits, Law of Use and Disuse

a. Law of Use and Disuse - if you don't use it, you lose it

b. Lamarck believed that giraffe's long necks were a result of being stretched because they were trying to reach tall trees, and the one's who didn't stretch died out



c. Inheritance of Acquired Characteristics -

was his belief that if a characteristic occurs and is beneficial to an organism's survival, then it will be passed on; ex. if a toe gets cut off and it's helpful, then that trait gets passed on to offspring.

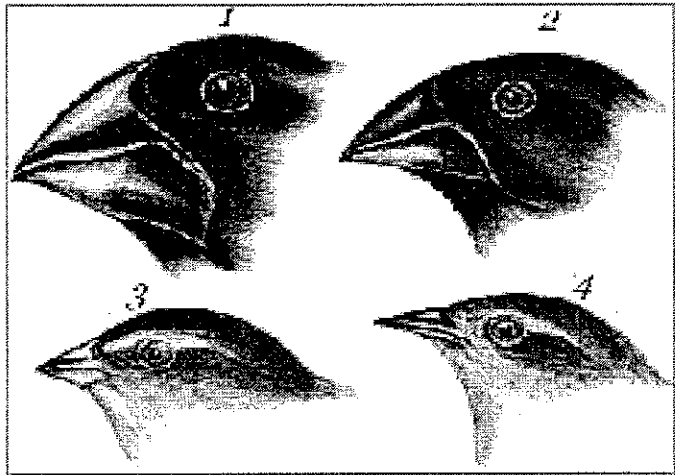
d. **NO evidence** to support this theory so it was **thrown out**

2. **Charles Darwin** Word Bank: The Origin of Species, finches, Galapagos Islands, Natural Selection)

a. Natural selection - only the organisms that are best suited to their environments will survive

b. The Galapagos Islands were a cluster of islands that had different food sources. Because of this, the finches had different beaks to help eat the food.

c. The Origin of Species was his book that compiled his evidence for evolution



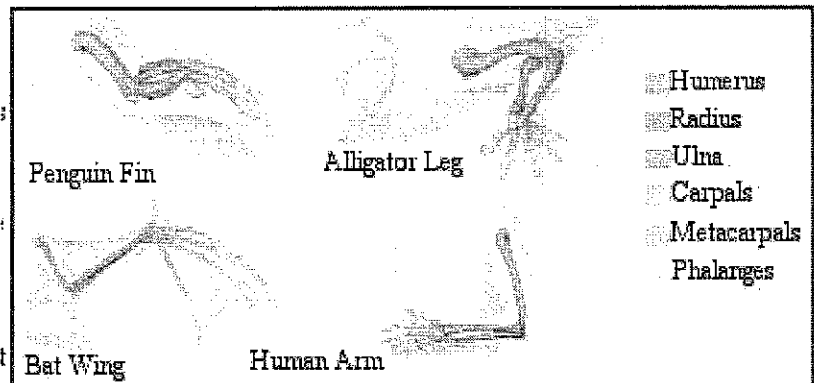
C. Rates of Evolution Word Bank: gradualism, punctuated equilibrium)

1. Gradualism - organisms evolve as a result of small adaptive changes *over time*
2. Punctuated Equilibrium - short periods of rapid change followed by long periods of little or no change.

D. Evidence of Common Ancestry (appendix, younger, older, homologous structures, fish, vestigial organs, common ancestors, rabbits, DNA sequence, absolute, relative, gorillas, embryology)

1. Homologous Structures: a bat's wing, whale's flipper, and human arm have the same number, type, and arrangement of bones; considered to have a common evolutionary origin.

2. The presence of the same number & type of bones in the wing of a bat and



the arm and hand of a human suggests that a bat and a human must share

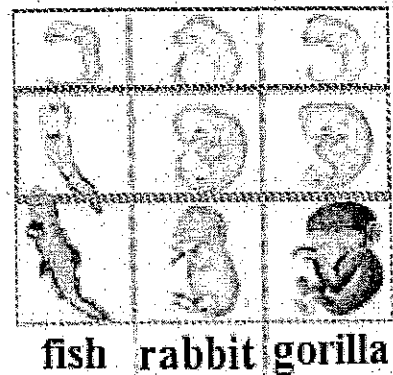
common ancestors

3. DNA sequence - similar amino acid sequences in proteins of horses and humans provides evidence of similar origin, this is the most specific way to compare organisms.

4. The fact that the DNA of humans and that of monkey species are 99% similar suggests that they probably share common ancestors.

5. The most specific way to provide evidence of common ancestry is by using DNA sequence.

6. Embryology - embryos of different organisms (chicken, human, rabbit) look similar at certain early stages, which means the same genes are working at those times.

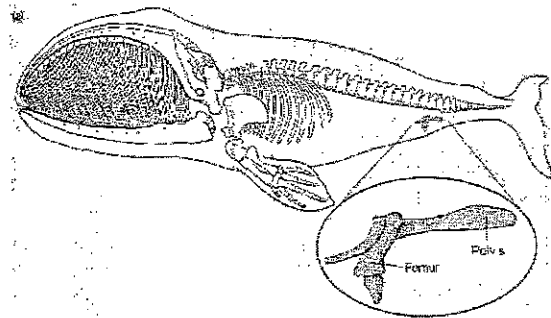


7. Use the diagram to the right, the embryological development of the stages in the green box suggest that rabbits and gorillas are more closely related because they look alike

8. Vestigial structures - are structures that have no apparent use; the appendix in humans may be a remnant of a digestive organ still found in other organisms and the pelvis and femur in a whale may be remnants of when whale ancestors had legs.

9. According to relative dating of fossils: the deeper under ground the fossil is, the older it is.

10. Absolute dating uses radioactive isotopes to determine an estimated age for fossils.



IX. Ecology - the study of organisms and their interactions with the environment

A. Ecological Succession (desert, rain forest, deciduous, coniferous, tundra, ocean, grassland, freshwater, climax community, primary succession)

1. **Ecological succession** is the sequential replacement of one ecological community with another. Succession is complete when a stable, **climax community** is established.

10. _____ biomes have little vegetation. The few plants that can survive here have shallow root systems that collect rain water as soon as it falls.
11. _____ trees have thin needle-like leaves instead of broad leaves with a lot of surface area.
12. _____ trees have broad leaves that **change color** and **fall off** in the fall.
13. In **VA**, most of the trees lose their leaves in the fall. The biome is a _____ forest.

C. Ecology Vocab: Word Bank: consumer, autotrophic, biotic, abiotic, increase, decrease, species, carnivore, omnivore, herbivore, scavengers, decomposers, producer, population, heterotrophic, community, energy, ecosystem, biosphere

1. A producer is an organism at the beginning of a food chain; produce their own food
2. Organisms, like plants, that can make their own food are autotrophic.
3. Organisms that feed off of other organisms are heterotrophic.
4. A consumer is an organism that eats producers or other organisms for energy.
5. A nonliving part of the environment is a(n) abiotic factor.
6. A living part of the environment is a (n) biotic factor.
7. A consumer that eats only producers is called a (n) herbivore.
8. A consumer that eats both plants and animals is called a (n) omnivore.
9. A species is a group of organisms that can interbreed and produce fertile offspring.
10. Many populations of different organisms living together is a(n) community.
11. A group of individuals of a species that lives together and interbreeds is a(n) population.
12. The community of organisms in an area including abiotic factors is a(n) ecosystem.
13. The Earth represents a(n) biosphere.
14. Energy is transferred through an ecosystem by eating or consuming food.
15. Scavengers eat things that are already dead (ex. vulture)

16. Decomposer break down decaying organisms and nutrients are put back into the soil by bacteria and fungi like mushrooms)

17. [A hunter <---- a fox <---- a rabbit <---- grass or plants] In food webs or food chains, the arrow ALWAYS points to the direction that energy flows.

18. [A hunter <---- a fox <---- a rabbit <---- grass] In this food chain, the rabbit is a herbivore, the fox is a carnivore, and the grass is a producer.

19. [A hunter <---- a fox <---- a rabbit <---- grass] In this example, if the rabbit population increased, then the fox population would probably increase.

D. Relationships: Word Bank: commensalism, mutualism, parasitism, symbiosis, predation, water, sunlight, extinction, limiting factors, competition for food, pollution, disease, climate

1. parasitism - one organism is harmed while the other benefits

2. mutualism - both organisms benefit

4. mutualism - buffalo and a bird that picks insects off the buffalo

5. symbiosis - organisms living together

6. Some wasps inject eggs into other organism. As the eggs develop into larvae, they use the host for nutrients. The host dies as the wasp larvae develop. When one organism benefits and the other is harmed the relationship is called parasitism.

7. Anemones release poisonous chemicals from their tentacles that paralyze prey. Clown fish are not affected by the poison & find protection from predators by living near anemones. This is called commensalism because the fish don't harm or benefit the anemone.

8. Things that limit the size of populations are called limiting factors.

9. On the rain forest floor, a limiting factor for plants would be availability of _____.

10. In the desert, a limiting factor for both plants and animals would be availability of water.

11. Hunting is encouraged for deer populations because they live in such close proximity to each other that disease is a limiting factor.

12. Only 3,000 manatee *Trichechus manatus* are left, and most of them are in the ocean around Florida. Because there is little genetic diversity, a disease that reduces fertility might cause extinction.