CARD #1

Hypothesis - an informed prediction about the expected results of an experiment.

Inference – a reasonable conclusion or assumption based on data.

Independent (Manipulating) Variable - the 'CAUSE' variable controlled by the experimenter.

Dependent (Responding) Variable - the "EFFECT" variable measured by the experimenter.

Control Group - the "normal" group used for comparison in an experiment.

(Bottom)

Graphing:
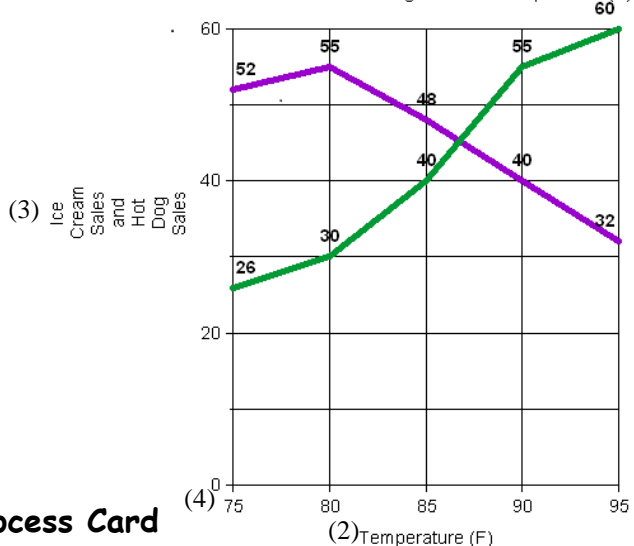
5 Parts of a graph

Remember ALL graphs should include a 1) title, 2) labeled x axis, 3) labeled y axis, 4) appropriate scales and a 5) legend.
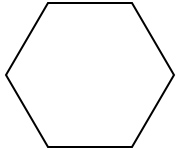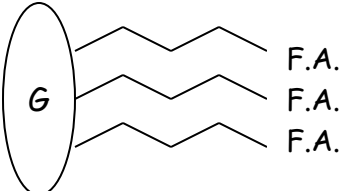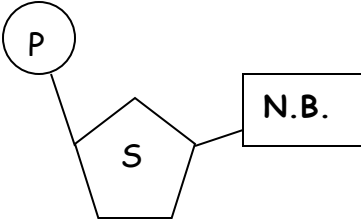
Remember: **DRY MIX**

Dependent or Responding variable on the Y axis;

Independent or Manipulating Variable on the X axis.

(1) Ice Cream and Hot Dog Sales vs. Temperature (F)

(3) Ice Cream Sales and Hot Dog Sales

(2) Temperature (F)

#1 Scientific Process Card

CARBOHYDRATES
$C, H, O – 1:2:1$

Monomer = monosaccharides (1 sugar)

Examples= glucose, starch, cellulose, chitin

Function= <u>gives</u> us energy, & makes up cell wall

Shape:

(Top)
LIPIDS
C, H, O

Monomer = fatty acids and glycerol

Examples= fats, oils and waxes

Function= <u>stores</u> energy & form membranes

Shape:

G   F.A.
F.A.
F.A.

NUCLEIC ACIDS
C, H, O, N, P

Monomer = nucleotides

Examples= DNA, RNA

Function= store and transmit genetic info

Shape:

P

S   N.B.

(Bottom)
PROTEINS
C, H, O, N

Monomer/subunit= amino acids; the order of amino acids dictates the type of protein made.

Functions= Proteins dictate cell function, build and repair muscle and bone, fight infections, and act as enzymes.

Enzymes: proteins which act as catalysts. They speed up reactions in your body by lowering the activation energy.

Substrates of molecules bind to the active site on enzymes.

Dehydration Synthesis: the joining of monomers to form polymers by the <u>removal</u> of water.
Hydrolysis: the splitting of a polymer into a monomer with the <u>addition</u> of water.

2. Biochemistry Card

Card # 3

(Top)

Organelle	Function
Endoplasmic Reticulum	Makes and transports proteins (rough) or lipids (smooth)
Centrioles	Organizes cell division
Nucleolus	Makes ribosomes
Nucleus	Controls all cell activity and contains DNA
Mitochondria	Releases ATP from glucose during cellular respiration
Golgi Apparatus	Packages materials into vesicles
Ribosome	Makes proteins
Chloroplast	Makes glucose from sunlight during photosynthesis in plant cells
Cell Membrane	Determines what goes into and out of a cell
Cell Wall	Structure and support for plant cells
Vacuole	Storage of water, proteins, carbohydrates and salts
Lysosome	Breaks down materials with digestive enzymes.

(Bottom)

Eukaryotic Cell		Prokaryotic cell
Plant	Animal	Bacteria
Cell wall	NO Cell wall	Cell wall
Chloroplasts	NO Chloroplasts	No membrane bound organelles or nucleus
1 large vacuole	Many small vacuoles	

All contain: cell membrane, cytoplasm, ribosomes and DNA

Endosymbiotic Theory: states that Chloroplast and Mitochondria are descendents of early prokaryotic bacteria cells, that were engulfed (or taken in) by early eukaryotic cells.

#3 Cells and Cell Parts Review Card

Card # 4   **(TOP)**

Cell Membrane:

Function: acts as a selectively permeable boundary around the cell that regulates what goes in and out of the cell

Structure: composed of a phospholipid bilayer with polar phosphate heads (hydrophilic) and non-polar lipid tails (hydrophobic) and embedded proteins. Embedded proteins include cell recognition markers (guards), channel proteins (gates) and receptors (to bind and bring in molecules).

Types of Passive Transport – *no energy required*

Diffusion – moves **substances** from high to low concentrations.

Osmosis – the diffusion of water from high to lower **water** concentrations.

*Ex.* Cell in salt water (hypertonic) – Shrivels   *Ex.* Cell in fresh water (hypotonic) – Swells

Facilitated Diffusion – movement of a **substance** from high to low concentration through a transport **protein channel**.

Active Transport   **-**   *requires energy* – moves substances against the concentration gradient from low to high   concentrations. Uses ATP.

(BOTTOM)

Comparing Photosynthesis and Cellular Respiration		
	Photosynthesis	**Cellular Respiration**
Function	Turn solar energy to glucose	Turn glucose to ATP
Location	Chloroplasts	Mitochondria
Reactants	CO_2 and H_2O	glucose and O_2
Products	glucose and O_2	CO_2 and H_2O
Equation	$6CO_2 + 6H_2O + energy\ (sun) \rightarrow C_6H_{12}O_6 + 6O_2$	$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O + energy\ (ATP)$

ATP= Adenosine Triphosphate: the energy molecule made from cell respiration. Energy is released when the bond between the second and third phosphate is broken.
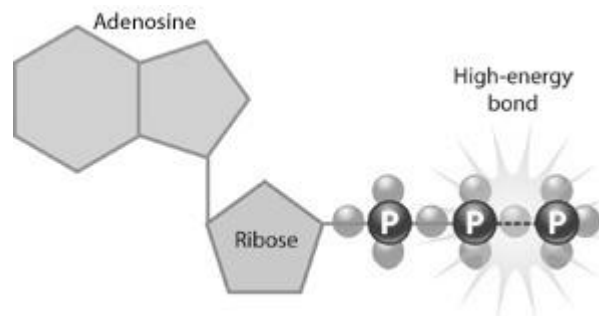
#4 Cells Energy and Transport Review Card

Card # 5

(Top)
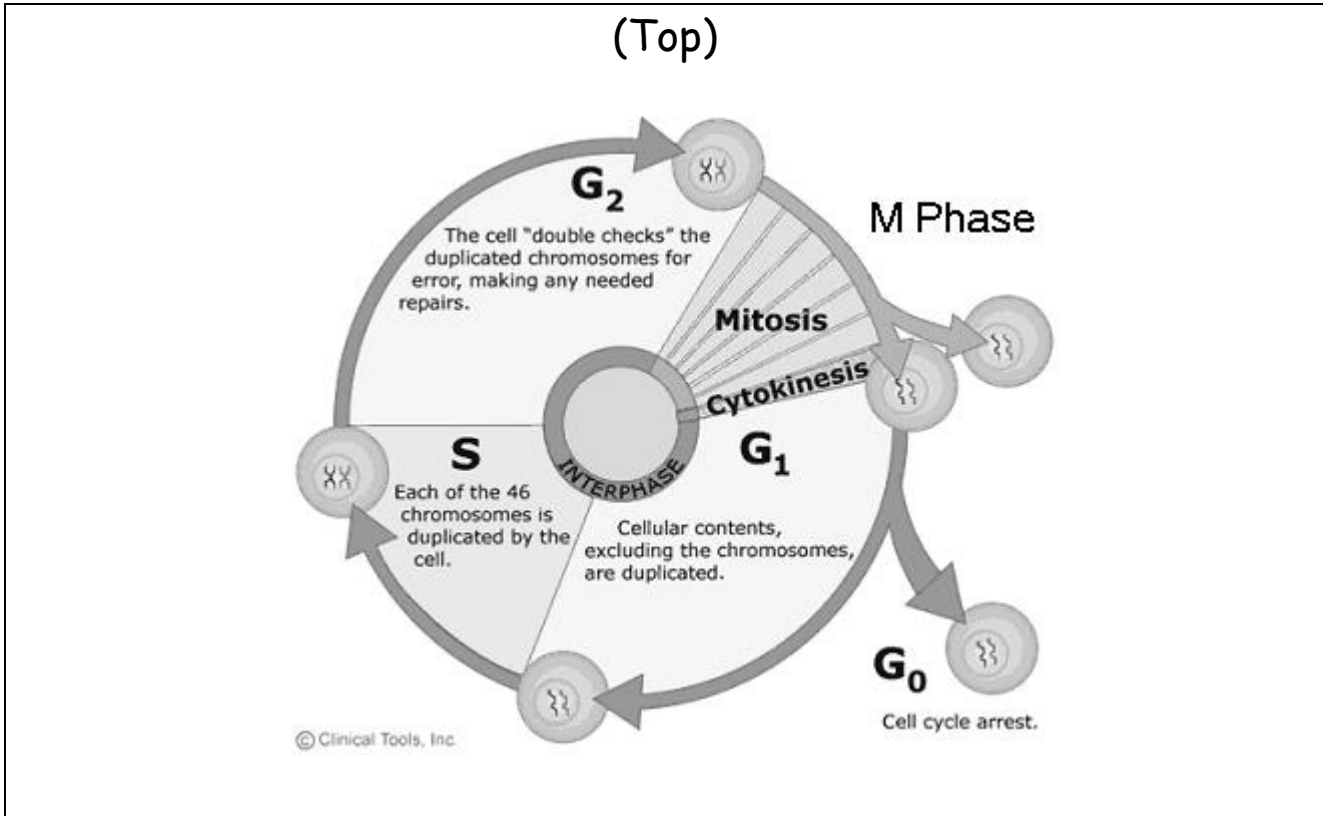
(Bottom)

<u>Interphase</u>: is made up of G1, S, G2, and G0

Resting Phase (G0): cell enters a resting state and remains unchanged until reentering G1. Some cells stay here many years

First Growth Phase (G1): Cell grows and prepares for DNA replication

Synthesis Phase (S): DNA replicated: one strand of DNA becomes two semi-conservative strands

Second Growth Phase (G2): Cell prepares to divide

<u>Cell Division (M):</u> is made up of mitosis and cytokinesis

Mitosis: Cell rearranges organelles and the nucleus divides into two new nuclei

Cytokinesis: Cell physically splits into two separate cells
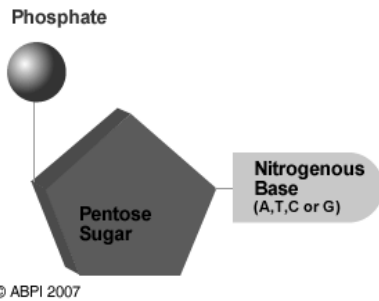
#5 Cell Cycle Review Card

CARD # 6 (Top)

Structure:
The subunit / monomer of DNA is a nucleotide and consists of 3 parts:
   1) a 5 carbon sugar, 2) a nitrogenous base and 3) a phosphate group.

A nucleotide

Phosphate

Nitrogenous Base (A,T,C or G)

Pentose Sugar

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4 Nitrogenous Bases:
Adenine, Thymine, Guanine, Cytosine

Base pairs make up the rungs
Sugar and phosphate make up the backbone

1) Hydrogen bonds: A = T (2 Hydrogen bonds)   C = G (3 Hydrogen bonds)

2) Covalent bonds: hold the phosphate and sugar together

Function:
DNA: Stores and transmits hereditary information

Eukaryotes – DNA found in Nucleus   Prokaryotes – DNA in cytoplasm

---

(Bottom)

DNA Replication
Replication – occurs during the S (Synthesis) phase of cell cycle
            - occurs in the nucleus of Eukaryotes

STEPS CARRIED OUT BY ENZYMES:
1. Helicase: unwinds DNA helix and breaks hydrogen bonds
                  between the bases
2. DNA Polymerase: finds and matches DNA nucleotides to DNA.
3. Ligase: seals the DNA Helix
4. Gyrase: winds up the DNA strand.
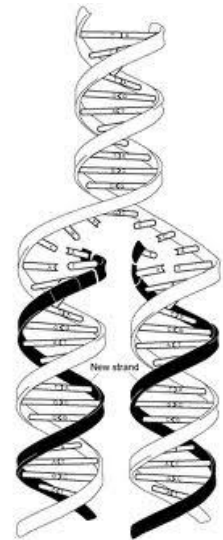
New strand

Result: 2 identical strands of DNA. Both are semi-conservative; a DNA helix with one old (original) strand and one new strand.

#6 DNA Structure and Replication Review Card

Card # 7

(Top)

Cell Division - Mitosis and Cytokinesis: the M phase of the cell cycle

Mitosis – 4 steps to divide nucleus
1. Prophase = nuclear envelope dissolves and chromatin condenses to form chromosomes
2. Metaphase = chromosomes line up in the middle
3. Anaphase = sister chromatids are pulled apart and move away to the poles
4. Telophase = two new nuclei form around the separated chromatids

Cytokinesis – The entire cell divides (not a step in mitosis)

End result of mitosis: 2 identical diploid daughter cells that are also identical to the original cell. Mitosis occurs in somatic / body cells

Diploid (2N) - A somatic cells containing both sets of homologous chromosomes (Humans=46)

(Bottom)

Meiosis – takes place in gametes (sex cells). Meiosis produces eggs and sperm **(gametes)** for sexual reproduction.

End result of meiosis:
4 genetically different daughter cells.
Eggs and sperm will have <u>HALF</u> the number of chromosomes as the parent cell (haploid)
Eggs and sperm are <u>NOT</u> genetically identical to parent cell

Haploid (N)- Gamete cells containing only one set of chromosomes (Humans=23)
Homologous chromosomes - every cell has 23 pair of chromosomes where one from each pair is from the Mom and one from each pair is from the Dad
Crossing over - homologous chromosomes exchange portions, resulting in new combinations of genes in their gametes
Independent Assortment - ensures that chromosomes are randomly assorted which contributes to genetically different offspring

#7 Cell Division: Mitosis & Meiosis Review Card

Card # 8

TRANSCRIPTION: (DNA to mRNA) occurs in the NUCLEUS
1. Helicase: unwinds DNA helix
2. RNA Polymerase: finds and matches RNA nucleotides to DNA.
3. Ligase: seals the DNA Helix
4. Gyrase: winds up the DNA strand.

TRANSLATION: (mRNA to Protein) occurs on a RIBOSOME in the cytoplasm.
-A codon is 3 bases long and forms messenger RNA or mRNA nucleotide triplet (ex. AUG)
-The order of bases in a codon determines an amino acid.
-Transfer RNA or tRNA, carries amino acids to the ribosome.
-The tRNA has an anticodon, which is a three nucleotide sequence, which is complementary to mRNA codons.

Transcribe: DNA: TAC   TTT   ATC
            mRNA: AUG AAA UAG
Translate: Amino Acid: MET – LYS - STOP
            tRNA: UAC UUU AUC

MUTATION: Random changes in DNA
  Point Mutation – a <u>single</u> base is changed to another. This can cause a silent mutation with no
    change to the protein or a significant mutation that can change or ruin the protein.

  Frameshift Muatations – a <u>deletion</u> or <u>addition</u> of a base that may significantly change the
    function of a protein. This changes every codon after the deletion or addition.

  Inversion Mutation- a reversal of a sequence of nucleotides

Only mutations that occur in the <u>DNA of sex cells </u>are transferred to offspring.

#8 Protein Synthesis Review Card

(Top)

Gene: a sequence of DNA that codes for a protein and determines a trait
Allele: the different or alternate form of a gene (trait) represented by one letter: A or a
Homozygous: two identical alleles for a particular trait **Ex:** AA or aa
Heterozygous: two different alleles for a particular trait **Ex:** Aa
Dominant: trait expressed no matter what the second allele is; capital letter **Ex:** A
Recessive: trait only expressed when both alleles are recessive; lower case letters **Ex:** a

Monohybrid Crosses: looks at the genetic possibilities for one trait

Example: Parental Genotypes: Ee x ee

What would the offspring's phenotypic ratio be? 2:2

What would the offspring's genotypic ratio be? 2:2

	E	e
e	Ee	ee
e	Ee	ee

(Bottom)

Dihybrid Crosses: looks at the genetic possibilities for two traits

1. FOIL= ** **F**irst, **O**utside, **I**nside, **L**ast**

a) RrYy __RY, Ry, rY, ry__   b) FFBb ____FB, Fb, _____
c) ttGG _____tG_____   d) AaBb __AB, Ab, aB, ab_____

2. Steps to make a dihybrid cross
      a. Draw 16 boxes (4x4)
      b. FOIL the father genotype to get 4 genotypic possibilities
      c. FOIL the mother genotype to get 4 genotypic possibilities
      d. Write in gametes on the top and side of the punnett square
      e. Cross and combine the alleles into the boxes

#9 Mendelian Genetics Review Card

(Top)

Incomplete Dominance: The dominant trait does not completely cover the recessive trait, the heterozygous condition results in a "blending" or mixture of the two traits.
(ex: red+white= pink) (R +r =Rr)

Codominance: Both alleles in the heterozygote express themselves fully. (**Ex:** spots or stripes)
Black (B) + White (W) = Black and White Stripes (BW)

Multiple Alleles: A gene that has more than two possible alleles. (**Ex:** blood types)

Polygenic Traits: Traits controlled by two or more genes that interact. (**Ex:** multiple genes control eye color)

Sex Linked Traits: Traits carried on sex chromosomes (usually on the X)
Colorblindness is a sex-linked recessive trait.   Carrier woman = X^BX^b Colorblind Dad – X^bY

	X^B	X^b
X^b	X^BX^b	$\underline{X^bX^b}$
Y	X^BY	X^bY

(Bottom)

Karyotype: a picture of the chromosomes that an individual has. It shows the <u>sex</u> of the person with XX being a <u>girl</u> and XY being a <u>boy</u>. It also shows genetic abnormalities. A normal human will have <u>46</u> chromosomes or <u>23</u> pairs.

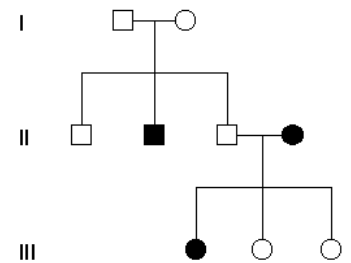**Pedigree:** a chart that shows the relationship within
a family of a single trait.
   In a pedigree, <u>squares</u> = <u>Males</u>
   In a pedigree, <u>circles</u> = <u>Females</u>
   In a pedigree, roman numerals represent: <u>generations</u>
   In a pedigree fully shaded expresses the trait

#10 Non-Mendelian Genetics Review Card

(Top)
- **Autotroph**: (producer) – makes own food
- **Heterotroph**: (consumer) – has to consume (eat) to get energy
- **Ecological Niche**: the range of physical and biological factors in which an organism lives and the way in which it <u>uses</u> those conditions.
- **Biotic Factor**: Living vs **Abiotic Factor**: non- living
- **Biome**: ecological community with similar climate, precipitation and ecological community.
- **Primary Succession**: occurs with no soil; occurs on an entirely new habitat never colonized before. (Ex. Volcanic Eruptions)
- **Secondary Succession**: occurs where soil exists/or remains; takes place on a previously colonized but disturbed or damaged habitat. (Ex. Wildfire)
- **Decomposer**: organisms that break down dead or decaying organisms, returning nutrients back to the soil.

(Bottom)
- **Carrying Capacity**: largest number of individuals of a population that a given environment can support
- **Limiting Factor**: environmental factor that limits the growth and size of a population

<u>Symbiotic Relationships</u>
1) mutualism :) :)   2) commensalism :) :l   3) parasitism :)   :(

<u>Example Food Chain</u>   <u>Example Food Pyramid</u>

Grass ⟶ grasshopper ⟶ mice ⟶ fox
Producer   primary   secondary   tertiary
1st   2nd   3rd   4th

Trophic Level 4 — Tertiary Consumer .1%
Trophic Level 3 — Secondary Consumer 1%
Trophic Level 2 — Primary Consumer 10%
Trophic Level 1 — Producer 100%
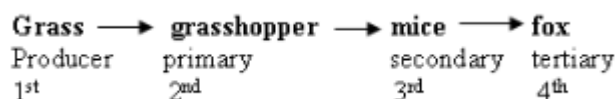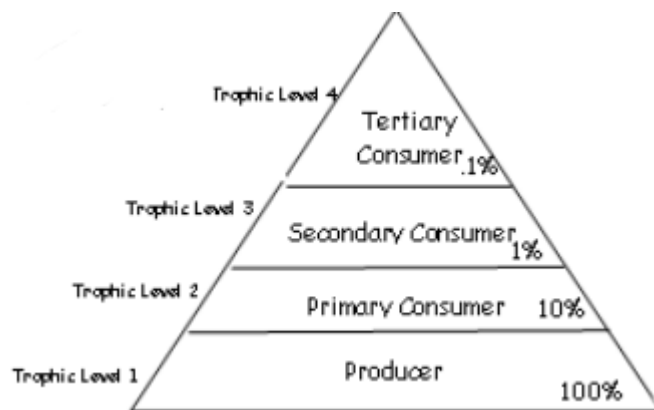
11 Ecology Review Card

CARD #12

Evolution- change in the allele frequency in a population over time
Vestigal Organ- organ that serves no useful function
Natural Selection- organisms best suited to their environment will survive; survival of the fittest
Homologous Structure- structures that have different mature forms in different organisms but develop from the same original tissues (ex: arm, fin, wing)
Analogous Structure- structures in unrelated organisms that have similar functions (ex: wing of bird, bat, and butterfly)
Common Descent- all living things have a common ancestor
Adaptation- inherited characteristic that increases an organism's chance of survival
Descent with Modification- each living species has descended, with changes, from other species over time
Fitness- ability of an organism to survive and reproduce in its environment

(Bottom)

Convergent Evolution– when species with different ancestral origins have developed similar features.
Divergent Evolution– when two different species share the same ancestral origins.
Gene Flow– the movement of alleles into or out of a population.
Genetic Drift– random changes in allele frequency.
Stabilizing Selection– favors maintaining allele frequencies. Selects <u>against extreme</u> phenotypes.
Disruptive Selection– selects for extreme phenotypes and <u>against the "average."</u> Can lead to speciation.
Directional Selection– favors one phenotype over another. Caused by major changes in the environment like drought or flood
Genetic Equilibrium– a situation where allele frequencies stay the same and population will not evolve.
Speciation- formation of a new species

#12 Evolution Review Card

CARD #13

(Top)

<u>Taxonomy</u>: the field of Biology that identifies and classifies organisms.

<u>Binomial Nomenclature</u>: "two-word" naming system used to identify organisms. It consists of a genus name and a species name.
- Genus is always written 1st and IS CAPITALIZED.
- Species is always written 2nd and is NOT capitalized.

*Both names are either <u>underlined</u> or in *Italics*
Ex: <u>Homo sapiens</u> or *Homo sapiens*

<u>Linnaeus' Taxonomic Levels</u>
Domain - Kingdom – Phylum – Class - Order – Family – Genus – Species
Memory Clue: <u>D</u>id <u>K</u>ing <u>P</u>hil <u>C</u>ome <u>O</u>ver <u>F</u>or <u>G</u>ood <u>S</u>oup?

<u>Three Domain System</u>: Archaea, Bacteria, Eukarya

(Bottom)

<u>Phylogeny</u>: study of evolutionary relationships among organisms.
- Biologists group organisms into categories that represent lines of <u>evolutionary descent</u>, or phylogeny, not just physical similarities.

A <u>cladogram</u>, also called a phylogenetic tree, is a diagram that shows the evolutionary relationships among a group of organisms.
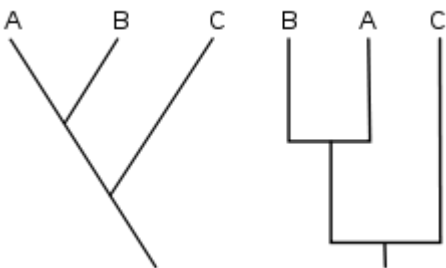
<u>Dichotomous Key</u>: A tool used for identifying organisms by using specific observable traits of the organism.

#13 Taxonomy Card Review Card

Card #14

(Top and Bottom- *you can use both for this***)**

1. **All living things are made of cells.**
   A cell is the smallest unit of life; organisms may be unicellular or multicellular.
2. **All living things are based on a universal genetic code.**
   Genetic traits are inherited through DNA.
3. **All living things must grow and develop.**
   Some remain unicellular; others differentiate and become multicellular.
4. **All living things reproduce.**
   Sexual = offspring different from parents (meiosis) ;
   Asexual = offspring identical to parents (mitosis).
5. **All living things obtain and use energy.**
   Metabolism = chemical reactions where an organism builds up or breaks down materials.
6. **All living things respond and adapt to their environment.**
   Adapting and responding to stimuli will increase their chances of survival.
7. **All living things maintain a stable internal environment.**
   Homeostasis = internal conditions are kept constant.

If something does not have ALL 7 of the characteristics listed above, then it is **NOT**
considered a living thing!

#14 Characteristics of Living Things Review Card

CARD #15

(Top)

Kingdom Eubacteria: Unicellular **prokaryotes** that can be found everywhere. They can be autotrophs or heterotrophs and move with slime or flagella.

Kingdom Archaeabacteria: Unicellular **prokaryotes** that are found in extreme environments. They can be autotrophs or heterotrophs and move with slime or flagella.

Kingdom Protista: Unicellular or multicelluar **eukaryotes** that can be found everywhere. They can be autotrophs or heterotrophs and move with flagella, cilia, or pseudopods.

Kingdom Fungi: Unicellular or multicelluar **eukaryotes** that can be found everywhere. They are heterotrophs and cannot move.

(Bottom)

Bacteria three basic shapes:

Cocci   Bacilli   Spirilla

Bacterial prefixes: Diplo- (pairs), Strepto- (chains) and Staphlo- (clumps)

Bacteria reproduce/survive in 3 ways: Binary Fission, Conjugation, Spore Formation

Importance of Bacteria: Decomposers, Nitrogen Fixation, Photosynthesis, Oil spill clean up, Digestion aid, and Vitamin production, Food-cheese and yogurt
Diseases include: Lyme Disease, Tuberculosis, Strep Throat, Tooth Decay, Botulism

Importance of Fungi: Antibiotics- penicillin, Food - bleu cheese, baker's yeast, Decomposer
Diseases include: Ring Worm, Athletes Foot, Candida. Can also attack and destroy crops

Three types of Protists: animal like, plant like, fungus like.
Diseases include: Malaria, African Sleeping Sickness, Red Tide
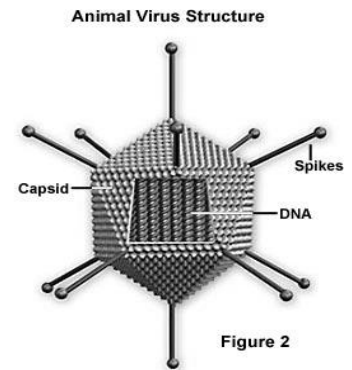
#15 Microorganisms Review Card

CARD #16

(Top)

Animal Virus Structure

Figure 2

Viruses: microscopic particles that invade cells and destroy them.

- A virus is NOT a cell and is NOT living.

Two Main Parts: Genetic Material on the inside &
Protein Coat on the outside - Also called a capsid.

Capsid: Encloses the viral DNA or RNA.

Although they have genetic information, they are not living because: they don't have cells, can't use energy, can't make proteins and can't reproduce on their own.

(Bottom)

Basic Steps of a Viral Infection

1) The genetic material of the virus enters the host cell.

2) The viral genetic material takes over its host, reprogramming the cell to copy viral nucleic acids (transcription) and manufacture proteins from the viral genetic material (translation).

3) The nucleic acid molecules then self-assemble into viral particles and exit the cell.

1.) Lytic Cycle: new viruses causes the cell to burst (or "lyses"), releasing newly made viruses that will infect other cells.

2.) Lysogenic Cycle: Viral DNA becomes part of the cell's DNA and then replicates along with the cell. (Does NOT cause the cell to burst right away.)

Examples of viral infections include: Flu, Common Cold, HIV, Hepatitis, Chicken Pox, West Nile.

#16 Virus Review Card

CARD #17

(Top)

PLANT PARTS:

<u>**Dermal Tissue**</u> is like the skin of the plant and includes the waxy cuticle to prevent water loss.

There are TWO types of <u>**Vascular Tissue**</u>:
 Xylem carries <u>water</u> and nutrients while *Phloem* carries <u>food</u>.

<u>**Meristematic tissue**</u> produces new cells by mitosis.

<u>**Roots**</u> anchor a plant and absorb minerals and water from the soil. Monocots have *fibrous roots* while dicots have *taproots.*

<u>**Stems**</u> produce and hold leaves, and transport substances.

<u>**Leaves**</u> are the main site for photosynthesis. They have *stomata* (pores) on the underside which allow for gas exchange. *Guard cells* close the stomata in dry conditions to prevent transpiration (water loss).

(Bottom)

SEED PLANTS:

Seed plants use flowers or cones for pollination, and protect their embryos in seeds to allow them to reproduce without water.

<u>**Gymnosperms**</u> use cones for pollination. <u>**Angiosperms**</u> use flowers for pollination.

<u>**POLLINATION**</u>

Filaments have *anthers* at their tip that produce pollen. The pollen is transferred by either animals or wind. The pollen will land on the sticky *stigma* of another flower. The pollen then travels down the *style* in *pollen tubes* to reach the *ovary* where the eggs or *ovules* are. The pollen fertilizes an ovule which then becomes a seed. The ovary around the ovule will ripen into a fruit.

Seeds are dispersed by wind, water, animals or ejection.

#17 Plant Review Card

(Top)

Animals are <u>multicellular, eukaryotic, heterotrophs,</u> whose cells **lack** <u>cell walls.</u>

Kingdom Animalia is broken into invertebrates (without backbone) and Vertebrates (with backbone).

Invertebrate PHYLUM	EXAMPLE
Porifera	Sponge
Cnidaria	Jellyfish
Platyhelminthes	Flatworm
Nematoda	Roundworm
Annelida	Earthworm
Mollusca	Octopus
Arthropoda	Butterfly
Echinodermata	Starfish

Vertebrate PHYLUM	EXAMPLE
Fish	Bass
Amphibians	Frog
Reptile	Snake
Bird	Robin
Mammals	Human

(Bottom)

Term	Definition
Cephalization	concentration of sense organs and nerve cells at the front of an animal's body
Exoskeleton	external support structure
Endoskeleton	supportive structure on inside of body
Endotherm	body temp controlled from within and can generate and retain heat inside body
Ectotherm	body temp. usually determined by environmental temp.
Sexual Reproduction	two different parent cells unite to produce new organism cell
Asexual Reproduction	single parent reproduces by itself

#18 Animal Review Card

CARD #19

<table>
<tr><td colspan="3" align="center">(Both Top and Bottom)</td></tr>
<tr><th>System</th><th>Definition</th><th>Structures</th></tr>
<tr><td>Muscular</td><td>Voluntary movements like running; Involuntary movements like circulating blood and moving food through digestive tract</td><td>Skeletal, smooth, and cardiac muscles</td></tr>
<tr><td>Skeletal</td><td>Support, protect internal organs, allow movement, stores minerals, blood cell formation</td><td>Bones, cartilage, ligaments, tendons</td></tr>
<tr><td>Digestive</td><td>Converts food to be used by cells, eliminates wastes</td><td>Mouth, esophagus, stomach, small and large intestines, rectum</td></tr>
<tr><td>Endocrine</td><td>Growth, development, metabolism, maintain homeostasis</td><td>Hypothalamus, pituitary, thyroid, adrenals, ovaries, testes</td></tr>
<tr><td>Nervous</td><td>Response to external and internal stimuli</td><td>Brain, spinal cord, nerves</td></tr>
<tr><td>Integumentary</td><td>Barrier against infection, temp regulator</td><td>Skin, hair, nails</td></tr>
<tr><td>Respiratory</td><td>Provides oxygen, removes carbon dioxide</td><td>Nose, pharynx, larynx, lungs, trachea, bronchi, alveoli</td></tr>
<tr><td>Excretory</td><td>Eliminates wastes, maintains homeostasis</td><td>Skin, lungs, kidneys, ureters, bladder, urethra</td></tr>
<tr><td>Circulatory</td><td>Brings oxygen, nutrients, and hormones to cells; fights infection, removes waste</td><td>Heart, blood vessels (veins and arteries), blood</td></tr>
<tr><td>Reproductive</td><td>Produces reproductive cells (egg /sperm), protects & develops fertilized egg to baby</td><td>Testes, penis, ovaries, vagina</td></tr>
<tr><td>Lymphatic</td><td>Helps protect body from disease</td><td>White blood cells, thymus, spleen, lymph nodes</td></tr>
</table>

#19 Body Systems Review Card

CARD #20

(Top)

Cells:
Robert **Hooke**: Came up with the name "cells" while observing cork from a tree.
Anton **van Leeuwenhoek**: Used single-lensed microscope to observe pond water.
Matthias **Schleiden**: Discovered that all plants are made of cells.
Theodore **Schwann**: Discovered all animals are made of cells.

DNA:
Watson and Crick: Built a double helix model of DNA.
Erwin **Chargaff**: Discovered that in DNA the # of A's = the # of T's and # of G's = the # of C's.
Hershey and Chase: Confirmed DNA carries the genetic code.
Rosalind **Franklin**: Used X-ray to discover the helix shape of DNA.

Genetics:
Gregor **Mendel** (Father of Genetics): Studied inheritance of traits in pea plants, created laws of dominance, segregation and independent assortment.

(Bottom)

Evolution:
-James **Hutton**: Proposed that the Earth is millions not thousands of years old.
-Thomas **Malthus**: In his *Essay on the Principle of Population,* predicts that the human population will grow faster than the space and food supplies needed to sustain it.
-Jean-Baptiste **Lamarck**: Through the use or disuse of organs, organisms acquired or lost certain traits in their lifetime.
-Charles **Darwin** (Father of Evolution): Wrote "*On the Origin of Species*" proposing Natural Selection as the mechanism of evolution.
-Charles **Lyell**: Wrote "*Principles of Geography*" and explained that scientists should use current processes to explain past events in geology.
-Alfred **Wallace**: wrote that the most fit of a species survived and that the traits which enabled them to survive were then passed down to future generations eventually creating a new species.

Taxonomy:
Carolus **Linnaeus**: Developed the classification system. The format went from the very broad groups (least amount of similarities) to very specific (most similarities) groups.

#20 Scientists Card