HSA Biology Review Packet

Student Name: _____

Biology Teacher:_____ Period:_____

My Biology H.S.A. is on: _____

Use this along with your **textbook** and **notes** to help you prepare for the HSA! This is not everything you need to know, but **most** of the big ideas!

Use the **state website** to test your knowledge:
http://mdk12.org/assessments/high_school/look_like/biology/intro.html

Check the class website for PowerPoint slides and handouts for each topic:
www.mrsreigelbiology.com OR www.commoncurriculum.com/website/j2u6/

Assignment is DUE by: Monday, May 27th

Knowledge of the following words is essential for success on the Biology HSA Exam:

Goal 1: Science Skills and Processes

Conclusion	Experiment		Microscope
Control	Experimental Design	Variable	Test Tube
Data	Hypothesis	Placebo	Petri Dish
Dependent Variable	Independent Variable	Bias	Pipette

Goal 3: Ecology

Abiotic factors	Food	Parasite-host
Air	Food chain	pH
Biotic factors	Food web	Photosynthesis
Carnivore	Habitats	Population
Commensalism	Herbivore	Predator-prey
Consumers	Light	Producers
Decomposer	Mutualism	Relationships
Ecosystem	Organisms	Scavenger
Environmental conditions	Oxygen	Succession

Goal 3: Cell Structure and Function

Asexual reproduction	Diffusion	Ribosome
Sexual reproduction	Lysosome	Endoplasmic Reticulum
Cell environment	Homeostasis	Golgi Body
Transportation of materials	Cell membrane	Prokaryote
Mitosis	Vascular tissue	Eukaryote
Cell wall	Osmosis	Nucleus
Vacuole	Passive Transport	Active Transport
Cellulose	Phospholipid	Cytoplasm

Goal 3: Nucleic Acids and Protein Synthesis

Amino acids	mRNA	Protein formation
Cloning	Mutation	rRNA
DNA	Nitrogen bases	Sequence of bases
Double helix	Nucleotide	Sugar
Gel electrophoresis	Phosphate	tRNA

Goal 3: Asexual and Sexual Reproduction

Chromosome (number)	Gametes	Nucleus
Crossing Over	Meiosis	Sexual reproduction
Fertilization	Mitosis	Diploid
Haploid	2n	n

Goal 3: Genetics

Adaptation	Gametes	Phenotype
Alleles	Genotype	Punnette square
Asexual reproduction	Heterozygous	Recessive
Chromosome number	Homozygous	Sex-linked
Cloning	Meiosis	Sexual reproduction
Dominant	Pedigree	Traits
Fertilization	Mutation	Variation

Goal 3: Biological Evolution

Adaptations	Eukaryotes	Mutations
Classification	Habitat (destruction of)	Natural selection
DNA sequence	Mutations	Nucleic acid
Enzymes	Lipids	Variations
Homologous Structures	Gel Electrophoresis	

Goal 3: Diversity and Taxonomy

Adaptations	Classification	pH
Aerobic	Destruction of habitats	Pollution
Diversity	Prokaryotes	
Anaerobic	Enzymes	Reproductive system
Binary fission	Eukaryotes	Skeletal
Capture/release of energy	Flagella	Toxins
Cellular respiration	Mitochondria	Chloroplasts
Movement	Vascular tissues	Water
Cilia	Oxygen	Waste disposal

Goal 3: Ecology

Abiotic factors	Food	Parasite-host
Air	Food chain	pH
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BASIC BIOCHEMISTRY:

1. What is an enzyme? _____

2. What group of macromolecules are enzymes in? _____

3. What is the job of an enzyme? _____

4. What are two things can cause enzymes to denature or become less effective? _____ and _____

5. An acid is a substance with a pH between _____ and _____. a base is a substance with a pH of between _____ and _____, and a neutral solution has a pH of _____.

6. Draw and label a pH scale:

6. One example of an acid is _____, an example of a base is _____, and a neutral solution is _____.

7. Draw a water molecule. Label its atoms and their associated charges.

8. **List and explain** four properties that make water unique and vital to life:

9. **Explain** two ways in which water helps maintain homeostasis in an organism's body:

10. .Fill in the chart about macromolecules:

Macromolecule	Building blocks	Function
Carbohydrate		
Lipid		
Protein		
Nucleic Acids		

11. Vitamins and minerals are two other important categories of molecules. Vitamins are _____, meaning they contain carbon, while minerals are _____, meaning they do not contain carbon.

12. List the function of each of the following vitamins:

    Vitamin C—

    Vitamin D—

    Vitamin K—

Cells and Cell Chemistry

1. Complete the following:

Organelle	Function	In Plant cells?	In Animal Cells?	In Bacteria cells?
Cell (plasma) membrane				
Ribosome				

Organelle	Function	In Plant cells?	In Animal Cells?	In Bacteria cells?
Vacuole				
Cell wall				
Chloroplast				
Cytoplasm				
Endoplasmic reticulum				
Golgi Body				
Lysosome				
Mitochondria				
Nucleus				
Cilia				
Flagella				
Pseudopodia				

2. Why is the cell membrane called “selectively permeable”?

3. Describe a hypertonic solution. What effect does it have on the cell? (Draw a picture!)

4. Describe a hypotonic solution. What effect does it have on the cell? (Draw a picture!)

5. Describe what would happen to a red blood cell in each of the following situations:
   a. It is placed in a solution with an extremely high concentration of salt.

   b. It is placed in distilled water.

6. How is osmosis related to homeostasis?

7. Osmosis is the movement of _____ from _____ concentration to _____ concentration.

8. Diffusion is the movement of _____ from _____ concentration to _____ concentration.

9. When a cell is placed in a hypertonic solution, it will _____ because _____

_____.

10.Active transport uses _____, passive transport uses no _____,

and facilitated diffusion is a form of _____ transport.

11. Fill in the blanks with the following terms:

Pseudopodia *Flagella* *Skeletal* *Cilia* *Movement*

The movement of organisms is dependent upon the relationship between its muscular and its _____system. The muscles are required to pull the bones in order for movement to occur. Protozoa are classified according to their method of locomotion, or _____. One type of movement is through the twirling or lashing of the _____, which are long, whip-like structures on the surface of a cell. Another type of movement is amoeboid, which is a creeping caused by _____. The third type of movement is _____, which is the synchronized beating of short hair-like projections.

Body Systems

1.Fill out the following chart

System	Functions	How functions help maintain homeostasis
Circulatory		
Nervous system		
Digestive		
Excretory		
Skeletal		
Muscular		
Endocrine		

Photosynthesis and Cellular Respiration

1. Write the photosynthesis equation below:

2. Write the cellular respiration equation below:

3. What organelle carries out photosynthesis? _____

4. What organelle carries out cellular respiration? _____

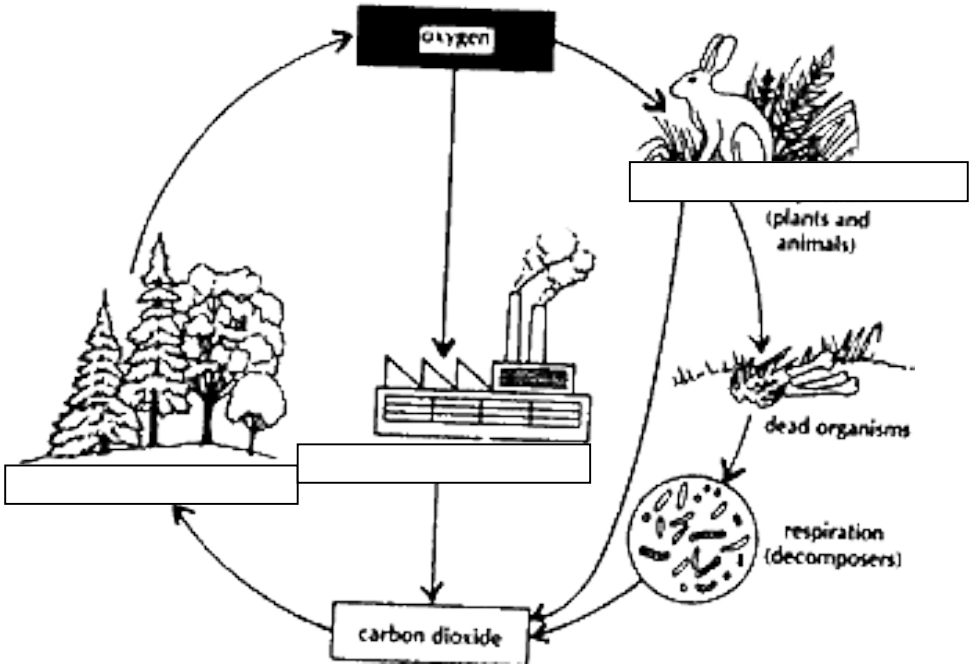
5. **Fill in the chart below**

Type of Respiration	Conditions in which it occurs	How much energy does it produce? (a lot or a little)
Aerobic respiration		
Anaerobic respiration		

6. What do reactants to humans/animals provide plants?

7. What reactants do plants provide humans/animals?

8. Label the carbon-oxygen cycle using the following terms:
Respiration *Photosynthesis* *Combustion*



Cell Division and Genetics

1. The DNA must replicate before mitosis in order to _____

_____

2. The cell will complete mitosis when making _____ cells.

3. What happens to the number of chromosomes in mitosis?

4. The cell will complete meiosis when making _____ cells.

5. What happens to the number of chromosomes in meiosis?

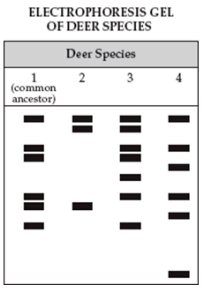
6. List four differences between mitosis and meiosis:

7. Summarize how sexual reproduction, which includes meiosis and fertilization, affects genetic variation within an offspring.

8. What are the three components of a nucleotide?

9. Draw a picture of the structure of DNA that (at least) includes the terms: base, 1 sugar, phosphate, nucleotide, and helix.

10. Describe gel electrophoresis using the following terms: electrophoresis, agarose gel, DNA bands, banding pattern, lane, DNA fragment, common ancestry, relatedness



11. What do the bands in the gel pattern represent? What causes some bands to move further than other?

12. RNA/ DNA Comparison: Fill in the chart

Characteristic	DNA	RNA
Type of Sugar present (ribose or deoxyribose)		
Number of strands (1 or 2)		
Location(s) It Can Be Found (nucleus and or cytoplasm)		

Function(s)		

13. **Mutations:** Mutations and crossovers create different genes and gene sequences. Explain how mutations are an important and normal part of sexual reproduction.

14. Protein Synthesis Definitions

Word	Definition/Picture
Codon	
Nucleotide	
Replication	
Anticodon	
Clone	
mRNA	
tRNA	

16. What happens during transcription? _____

_____

17. What happens during translation? _____

_____

18. What is a chain of amino acids called? _____

19. Genetics Definitions

Word	Definition	Example
Allele		
Autosomal		
Dominant		

Gene		
Genotype		
Heterozygous		
Homozygous		
Phenotype		
Recessive		
Sex-chromosome (Sex-linked)		

Complete the following punnett squares. Give the genotype and phenotype of each.

20. Autosomal Cross a heterozygous right handed person with a left handed person. Right is dominant over left.

21. Sex-linked Cross a female who is a carrier for hemophilia with a hemophiliac male.

22. Answer the following questions.

In *Pisum sativum*, a pea plant, the allele for purple flower (P) is dominant over the allele for white flowers (p). A cross between two purple-flowered plants in both purple-flowered and white-flowered offspring, as shown in the table below.

RESULTS OF PEA PLANT CROSS

Flower	**Number of Plants**
Purple	103
White	35

Draw a Punnett Square that shows the cross between the two purple-flowered parent plants described above. When writing the allele pairings, underline all lowercase letters (p).

- Give the ratio of flower colors that can be expected from the cross. _____: _____
- What kind of ratio did you give? (genotypic or phenotypic)

23. A genetics study was conducted that crossed two red-flowered plants. The next generation was a mixture of red-flowered and white-flowered offspring. Which of these represents those of the parent generation?

A) rr and rr B) Rr and Rr C) RR and rr D) RR and RR

Classification and Evolution

1. Directions: Fill in the blanks using the words provided. Each paragraph is provided with a separate list of words.

Adaptations *Diversity* *Prokaryotes* *Anatomical similarities* *Eukaryotes*

In a classification system, organisms may be group according to the likenesses of their body parts, or _____ _____They may also be classified according to the type of cells they have. For example, some cells do not have a true nucleus and are called _____ some cells are _____ and have a nucleus. Classifying organisms shows that there are a wide variety of living things, that there is much _____ among organisms. Organisms exhibit a wide variety of traits. Many of these traits are _____ which enable the organisms to survive in their surroundings.

2. Complete the Classification table below:

	Archea Kingdom	Bacteria Kingdom	Protist Kingdom	Fungi Kingdom	Plant Kingdom	Animal Kingdom
Has a Nucleus?						
Has a Cell Wall?						
Autotroph or Heterotroph?						
Muticellular or Unicellular?						
Examples						

4. Does evolution occur in individuals or in population?

5. What is natural selection? Describe how it occurs in a population.

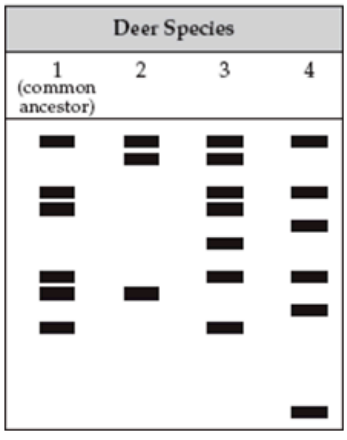
6. Evolution Vocabulary

Word	Definition	Example
Mutation		
Variation		
Adaptation		
Natural Selection		
Population		
Species		
DNA Fingerprinting/ (Gel electrophoresis)		
Fossils		
Homologous Structures		
Embryology		

7. Use the DNA sequences at the right to determine which two species are most closely related?

	DNA Sequence		
Unknown Species	ACT	GCA	GCC
Species I	ACA	GCG	CCG
Species II	ACT	GCT	GGC
Species III	ACA	GCC	GGG
Species IV	ACT	GCA	GCG

ELECTROPHORESIS GEL OF DEER SPECIES



8. Use the gel electrophoresis at the left. Which species is most closely related to the common ancestor?

Ecology

1. What is the ultimate source of energy for life?

2. What common characteristics do all producers have?

3. What common characteristics do all consumers have?

4. Predict which organism type would have the most biomass in an ecosystem (carnivore, herbivore, or producer) by drawing a food pyramid. Explain why.

5. What is biodiversity?

6. In general, how do humans affect biodiversity?

7. How does the lack of biodiversity affect an ecosystem?

8. What are the two types of factors in an ecosystem? List 3 examples of each.

9. **Relationships**

Relationship	+/ - / 0	Example
Parasite-host		
Mutualism		
Predator-prey		
Commensalism		
Competition		

10. What is ecological succession? When does it occur?

11. What organisms show up first after a disaster? Give an example.

12. **Food web**
Draw a food chain for the following organisms**:** Shark, phytoplankton, bacteria, killer whale, medium sized fish

14. Fill in the blanks with the following terms:

Habitats *pH* *Toxins* *Oxygen* *Pollution* *Urbanization*

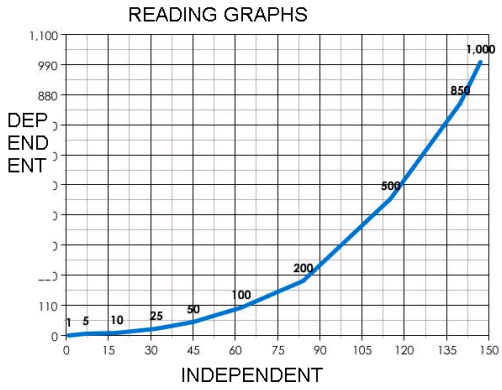
Cells exist within a narrow range of conditions. Some conditions that affect cells are the _____ or acidity, or the environment, and the amount of water and _____ or air, available. Changes in environment will affect the cell and may cause death to the cell or organism. Some events that affect the cell and organism are the release of poisons, called _____and _____ (contamination of the environment); destruction of areas where the organisms live, called _____; And _____, the change of areas of land into cities.

FACTS YOU ABSOLUTELY MUST KNOW:

Scientific Method:

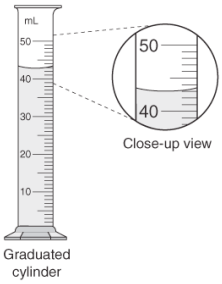
Experiments must be FAIR. This means:

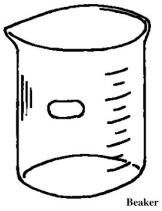
- Test one **variable** at a time
- Set one **independent variable**, measure one **dependent variable**
- Repeat the experiment several times without changing the procedures
- Have a **control group** that receives no treatment so you have something to compare your **experimental group** with
- Control as many factors as you can that might interfere with your results by making them **constants**
- Include many items in the experiment. Example: *30 plants and not 2, 100 people, not 10.*



Some things to remember about a good experiment:

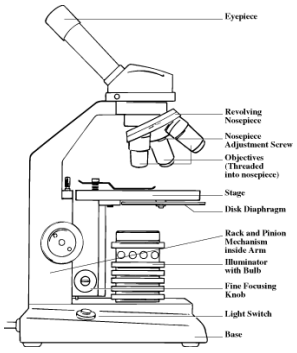
◊ Title/Purpose: Variables included. Example: The effects of fertilizer on the growth of
◊ Sunflowers. Independent variable: fertilizer. Dependent variable: growth
◊ Hypothesis: If… Then…statement that should align to what you are testing
◊ Materials: Be specific and ALWAYS use SI measuring devices
◊ Procedure: Clear, can be repeated
◊ Results: Tests **what** happened – words, charts, graphs, tables
◊ Eliminate **bias** whenever possible





Equipment:

◊ Graduated cylinder - volume, milliliters
◊ Triple Beam Balance – mass, grams
◊ Ruler – length, meters, centimeters, and millimeters
◊ Beaker – volume, liters
◊ Microscope – Magnification: The higher the magnification, the smaller the specimen
◊ Apron
◊ Safety goggles



Scientific Notation: Used to express very large or small measures

$1.0 \times 10^{5} = 100{,}000$ – Move 5 decimal places right (*There are 5 zeroes*)
$1.0 \times 10^{-5} = 0.00001$- Move 5 decimal places left

Biomolecules:

pH

◊ acids – pH below 7
◊ bases – pH above 7
◊ neutral – water, at 7
◊ pH scale – 0-14, acid < 7, base > 7

weak acid is a **6**, a strong acid is a **1**, strong base is a **14**
~ Your stomach is about a **3** ~

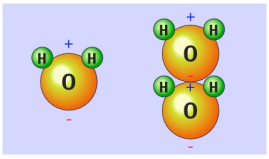
ORGANIC VERSUS INORGANIC BIOMOLECULES

Remember:

- O.C. = **O**rganic contains **c**arbon (carbohydrates, lipids, proteins, nucleic acids, vitamins)
- I.N.C. = **I**norganic contains **n**o **c**arbon (water, minerals)

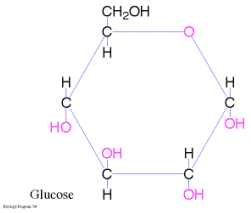
Water – Helps maintain HOMEOSTASIS

- Polar, it has oppositely charged regions that allow soluble substances to be pulled apart (dissolved). Water and sugar are polar, oil is NONpolar.
- Universal Solvent – able to dissolve **ALL** polar molecules
- High Heat Capacity – water takes longer to cool down and heat up than most other liquids
- Cohesion: Water molecules bond to other water molecules
- Adhesion: Water molecules bond to other substances (water droplets hang on leaves)

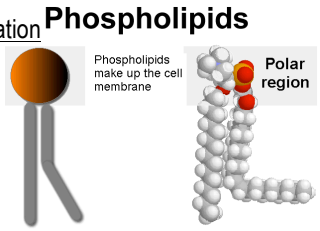


Carbohydrates – source of ENERGY

Monosaccharides – glucose, fructose, simple sugars with the formula $C_6H_{12}O_6$
Example: Glucose is blood sugar and is made by plants
Polysaccharides – complex chains of glucose
Examples: Starch – storage in plants
Glycogen – storage in animals, later turns to fat
Cellulose, fiber – makes up cell walls, insoluble



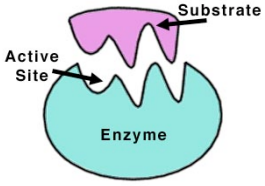
Lipids – STORE energy long-tem, make up cell membrane, insulation



Lipids are NONPOLAR and do not dissolve in water!
Examples: **fats, oils, and phospholipids**

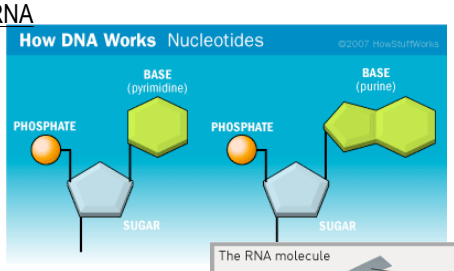
Phospholipids are the main component of the cell membrane
Building blocks are fatty acids

Proteins – ENZYMES and Building Muscles

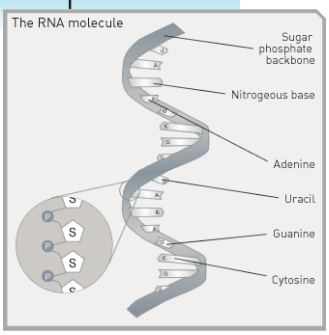


- Muscles are made of proteins
- Building blocks are amino acids
- Created at ribosomes
  - Include enzymes – lower the energy needed for a reaction to occur. Have specific shape to fit with a substrate. Are reusable. Can be deactivated or denatured with extreme heat or cold.
  - Each enzyme has an optimum pH and temperature. Outside of their optimum range, enzyme do not function

Nucleic Acids – DNA and RNA



Building blocks are nucleotides (1 sugar + 1 phosphate + 1 base) "**PBS**"
DNA: Stores genetic information/double stranded
RNA: Helps construct proteins/single stranded



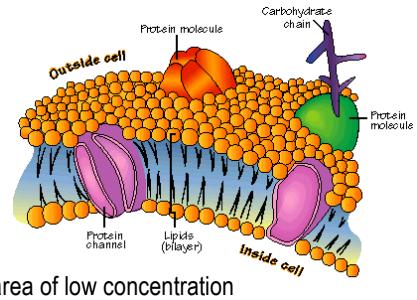
Vitamins and Minerals

- Vitamin A- prevents night blindness- fatty oily foods- is fat soluble and stored in
- body (liver)
- Vitamin C- prevents scurvy- citrus fruits- is water soluble- not stored
- Vitamin D- prevents rickets- sources- milk, eggs, sun- stored
- Vitamin K- helps the blood clot- spinach, green leafy veggies, grains- stored
- Iron – helps transport oxygen in the blood
- Calcium – helps build strong bones
- Potassium – helps regulate muscle function

Cells and Their Environment:

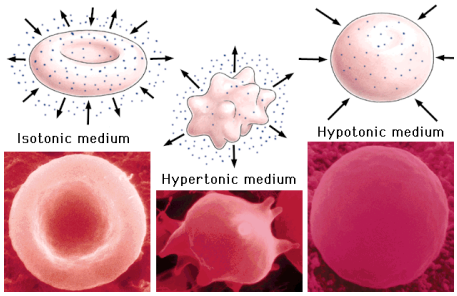
The Cell Membrane

Made of a phospholipid bilayer – phospholipids in two layers
Carbohydrates and proteins are also found in the cell membrane
Selectively permeable: allows only certain substances in and out



Diffusion: movement of particles from an area of high concentration to an area of low concentration
Osmosis: diffusion of water
Isotonic solution – dynamic equilibrium – equal movement
Hypertonic solution – water with flow out of the cell to balance its environment
The cell shrinks – fresh water cell in sugar water
Hypotonic solution – water will flow in the cell to reach a balance
The cell swells (plant) or may burst (animal) – salt water cell in fresh water

Question: What happens if you place 5% salt cell in a 10% salt solution?



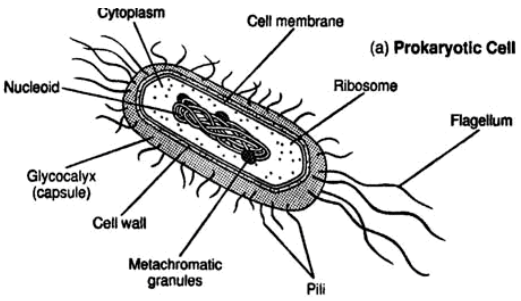
Facilitated Diffusion – still passive transport, no energy needed
Transport Proteins – carrier, gate

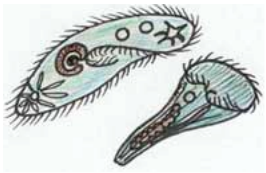
Active Transport: energy is required – movement of particles from LOW to HIGH concentration

Cell Structure and Function:

Cell Theory – cells are the basic unit of life, cells come form other cells

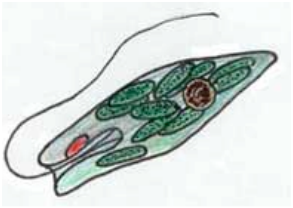
◊ **Prokaryotes** – no nucleus, DO have circular DNA
a. **Example**: bacteria
◊ **Eukaryotes** – DO have a nucleus, DNA enclosed in the nucleus
a. **Examples**: animal and plant cells



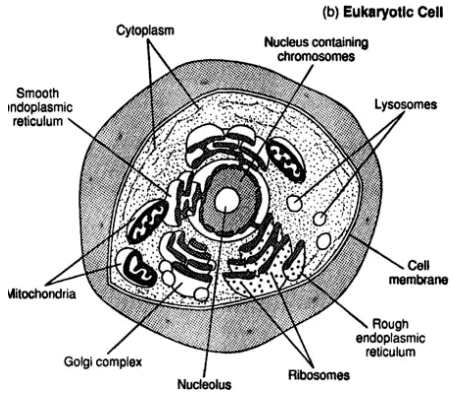


CILIA

PSEUDOPODIA



FLAGELLUM



Cell parts you MUST know:

1. Cell Membrane – plant and animal – regulates what enters and leaves
2. Cell Wall – cellulose – supports plant cell, is rigid
3. Nucleus – controls cell activities, contains DNA (genetic material)
4. Ribosomes – make proteins
5. Mitochondria – respiration, energy release, ATP
6. Chloroplast – Plants only – green pigment chlorophyll, carries out photosynthesis
7. Lysosomes – contain digestive enzymes to break down waste
8. Cilia – tiny hairs, used by paramecium for movement
9. Flagella – long tail, used by sperm cells for movement
10. Psuedopodia – ability to stretch cytoplasm, used by amoebas for movement

Cellular Respiration and Photosynthesis:

Energy on earth comes from the sun and is transferred to plants and then to animals. Much is lost as **heat**.

Respiration occurs primarily in the mitochondria of cells of plants and animals. It involves the breaking down of glucose in the presence of oxygen. (aerobic) The products of this reaction are Carbon dioxide, Water and ATP (energy). In animals, the lungs release carbon dioxide back in to the atmosphere.

Photosynthesis occurs in the chloroplasts of plant cells. It involves a reaction in which carbon dioxide and water combine in the presence of light energy to form glucose and release oxygen.

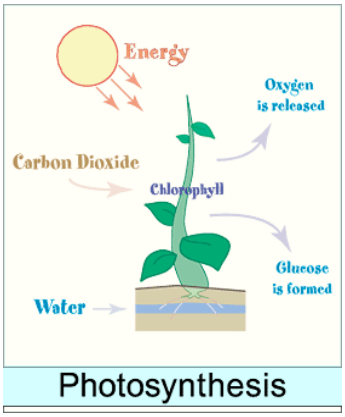
Respiration and photosynthesis are continuous and opposite processes.

Equations:

Respiration: $C_6H_{12}O6 + O_2 \rightarrow CO_2 + H_2O + ATP$

Photosynthesis: $CO_2 + H_2O + \text{light energy} \rightarrow C_6H_{12}O_6 + O_2$

Humans could not live without the products of photosynthesis. They are the air we breathe and the food we eat, either directly or as part of the food chain.



Cell Reproduction:

Cell Cycle – includes interphase and mitosis

Mitosis – Reproduction of body (somatic) cells (skin, hair, bone, etc.)

4 phases: Prophase, Metaphase, Anaphase and Telophase.

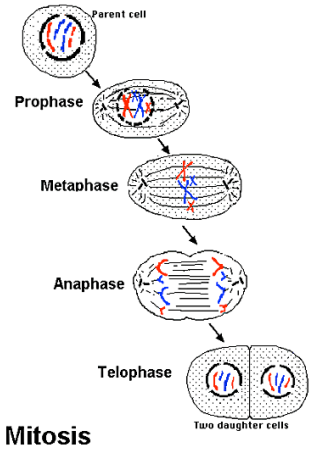
Two identical daughter cells are produced. The chromosome number stays the same.

Example: Humans have 23 pairs (46) chromosomes in each body cell. Each daughter cell will have this **diploid** number (2n)

ASEXUAL REPRODUCTION CREATES CLONES OF ONE PARENT

SEXUAL REPRODUCTION CREATES GENETICALLY DIFFERENT OFFSPRING FROM THE GENES OF TWO PARENTS

MITOSIS LOOKS LIKE:



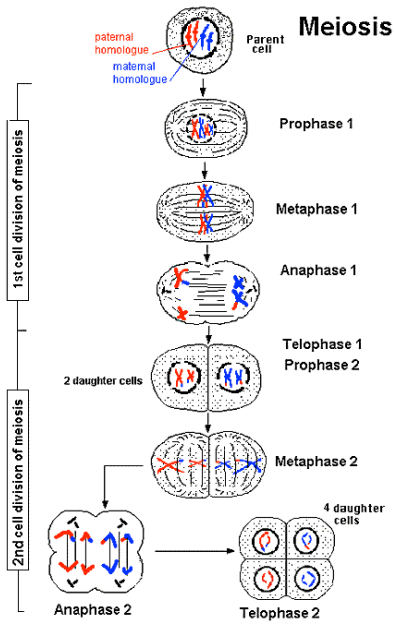
Meiosis – Reproduction of gametes (sex cells)

Each cell goes through 2 cell divisions producing **4 haploid gametes**. These cells have the number found in body cells so that when fertilization occurs, the original number is returned.

Example: 23 + 23 = 46

Allow variety through use of egg from mother and sperm from father

MEIOSIS LOOKS LIKE:



- ◊ Prokaryotes such as bacteria divide by the process of **binary fission**. These simple cells have no nucleus to surround the DNA. The cells produced are identical.
- ◊ Plants can reproduce asexually by **vegetative reproduction**. This occurs when a small part of the plant (like a branch) falls to the ground and roots.
- ◊ Hydra reproduce **asexually** by budding. A small hydra grows on the parent, buds off, and is a separate organism.

Genetics:

- ◊ Dominant genes are represented with a capital letter – D
- ◊ Recessive genes are represented with a lower case letter – d. They are often hidden by a dominant gene. Dd = the dominant trait. Must have 2 to express the recessive trait.

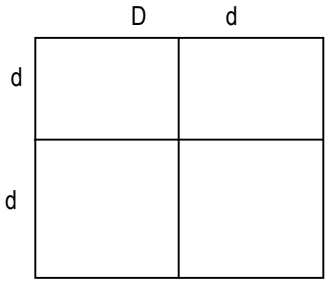
The genotype of a trait is the gene make-up – DD Dd dd
A homozygous (purebred) gene pair has 2 like genes for a trait – DD or dd
A heterozygous (hybrid) gene pair has 2 different genes – Dd

The phenotype is the expression of the genes – Tall, short, O blood
XX = female
XY = male

Sex linked traits are traits that are carried on the X chromosome. Therefore, it is easier for a male to express a recessive sex linked trait because if he inherits one gene from his mother than he will show the trait.
Ex- X^HX^h = carrier female of hemophilia
X^h Y = male with the trait

A Punnett Square is a tool used to predict the outcome of a cross:

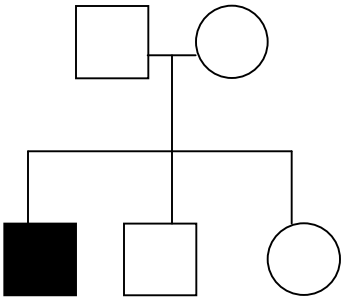
Cross a heterozygous with a Homozygous Recessive for dimples (D).

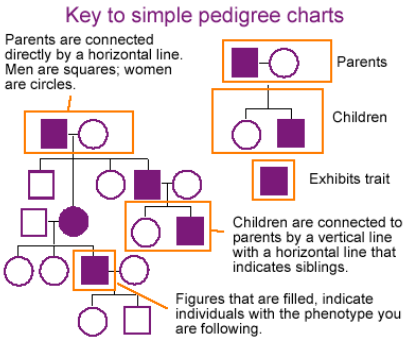


The results are expressed as a ratio or as percentages:

genotypes	**phenotypes**
DD = 0%	Dimples – 2 out of 4
Dd = 50%	no dimples – 2 out of 4
Dd = 50%	

Pedigree – chart used to trace a trait through a family history





The colored square shows the in heritance of a recessive trait. It must be hidden in each of the parents (homozygous dominant). The colored square cannot show a dominant trait because that would mean the parents are homo recessive and couldn't possibly have a child with the dominant trait.

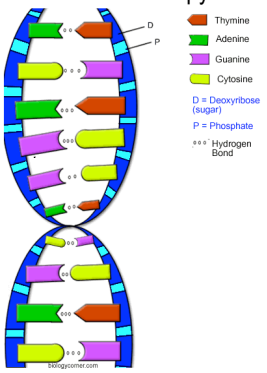
DNA:

DNA – deoxyribonucleic acid – located in the nucleus of eukaryotes and as a circle in cytoplasm of prokaryotes

Nucleotide – a portion of DNA composed of a base, a sugar and a phosphate
4 bases: A pairs with T
C pairs with G

DNA is arranged in a double helix – has 2 strands and twists like a ladder. DNA holds the code for the making of proteins needed for life.

Replication – process in which DNA makes a copy of itself – it unzips and free bases attach following the base pair rule.



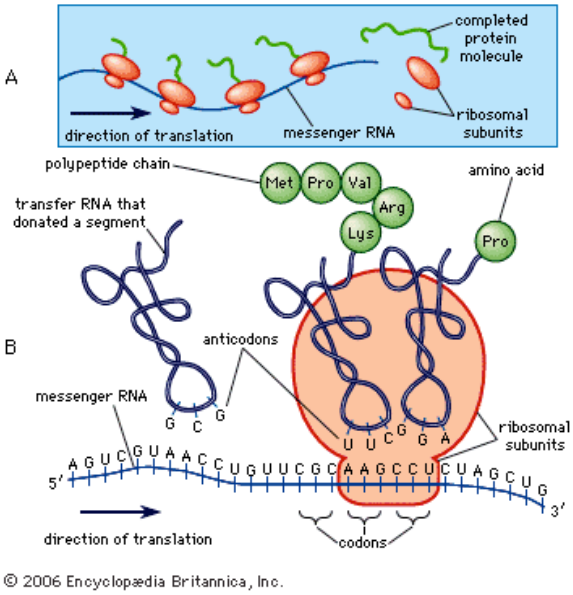
Protein Synthesis

DNA holds the codes for proteins but proteins are made at the ribosomes.

Transcription – mRNA codes for the protein by pairing with DNA bases.
There is no T in RNA language – U (uracil) is used instead. The single strand of RNA travels from the nucleus to the ribosome.

Translation – RNA attaches to a ribosome and awaits tRNA which is carrying the amino acid "ordered" by the mRNA. The amino acids are joined together to form a protein and tRNA is reused.

Example: DNA codon– TAC - in nucleus
mRNA codon - AUC - from nucleus to ribosome
tRNA anticodon - UAC – carrying the amino acid methionine

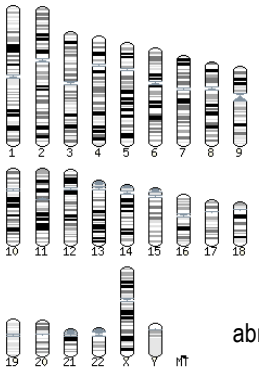


Mutation

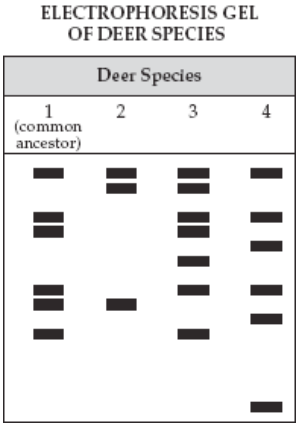
Mistakes in DNA replication
Examples are – duplication, point mutation, Etc.

A clone has exact copy of DNA – like an identical twin

- Genetic engineering – method of altering a gene to add change or delete a trait.
- Errors in chromosome number can result in genetic disorders.
  Example- trisomy 21- Downs syndrome- 3 of these chromosomes used to detect abnormalities
- A karyotype is a photograph of chromosomes used to detect abnormalities



- Gel Electrophoresis – method of identifying sections of DNA using gel. The results, shown as bands, are used to compare DNA of individuals – looking for similarities.



The more DNA bands shared by two organisms, the more closely they are related.

Natural Selection and Evolution

Evidence for evolution:

- Fossils
- homologous (similar) structures
- vestigial (no longer used) structures
- DNA similarities
- Embryos

Steps of natural selection

1. In nature, animals overproduce offspring
2. The surviving offspring have variations
3. Some variations are an advantage in a particular environment (these advantages are called adaptations)
4. The organisms with the best variations will successfully reproduce and pass of these good traits
5. Eventually, the new offspring will look different from the ancestors.
6. Over time, variations can become adaptations.

*NATURAL SELECTION IS A GRADUAL PROCESS AND DOES **NOT** OCCUR IN INDIVIDUALS!!!*

Example: In a population of fish sand-colored individuals blend in while the orange ones are eaten by predators. The sand colored fish survive, find mates and pass on the good trait.

Adaptation- Changes over time

- Structural Adaptations = body parts - ex-shell
- Behavioral Adaptations = things an organism does -ex - migration
- Physiological = chemicals contained in their boides –ex - venom

Species - can reproduce and produce offspring that can reproduce
New species can develop as a result of

- Geographic isolation - separation over time
- Adaptive radiation/divergent evolution- one species spreads out and changes to suit its new environment.

Classification

Living things are organized using Binomial Nomenclature- 2 part Latin names

6 Kingdoms of life

1. Bacteria (Monera)- unicellular- bacteria
2. Archea-unicellular-bacteria-extreme environments
3. Protist- unicellular- ameba
4. Fungi- usually multicelluar- yeast, mushroom, lives off other living things
5. Plant- usually multicellular- photosynthesis
6. Animal- multicellular- consumers

Animal is the most complex kingdom, and bacteria is the least complex kingdom

Organization:

Kingdom, **P**hylum, **C**lass, **O**rder, **F**amily, **G**enus, **S**pecies.

Remember: **KING PHILLIP CAME OVER FOR GREAT SPAGHETTI**

Ecology:

A population is a group of the organisms of the same species that occupy the same area at the same time.

Carrying capacity - a population grows steadily but is limited by a limiting factor. It is the greatest number of individuals that can be supported in an environment under certain conditions.

Abiotic factors = nonliving factors in an environment
Examples: water, weather
Biotic factors = living factors in an environment
Examples: predators, prey, trees

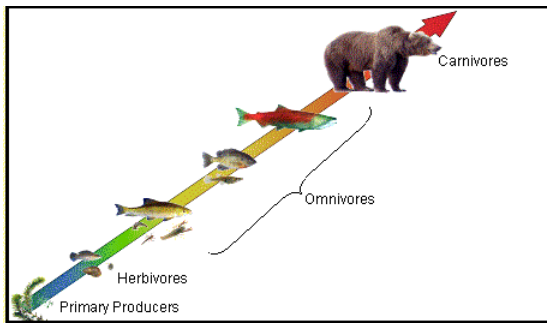
Ecosystems
An ecosystem is made up of all of the biotic (living) and (nonliving) things in an environment

- Producers- autotroph – plants - make their own food by photosynthesis
- Consumers- heterotrophs - rely on producers for life. Include animals, decomposers, and scavengers

Food Chains/Webs

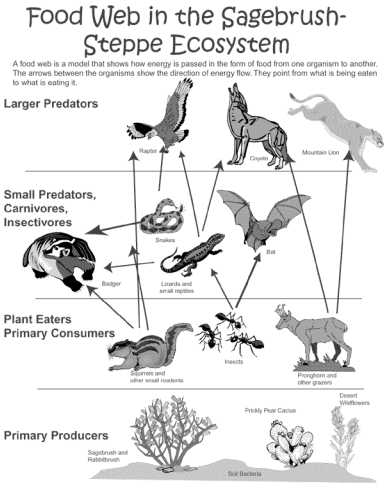
Food chain - shows a simple food relationship and energy flow

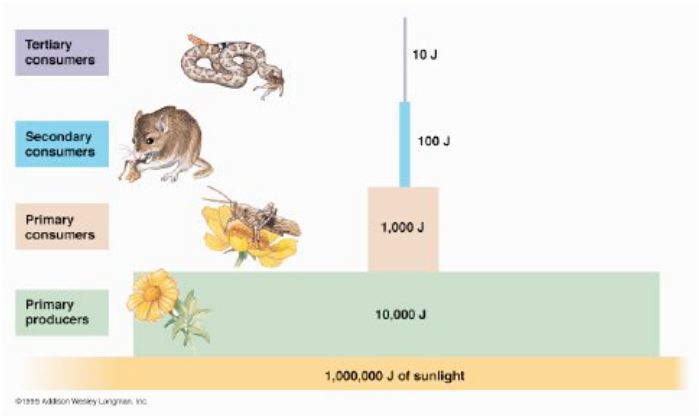
Sun → ® → plant ® → mouse ® → snake ® → hawk
Source of Energy Producer 1st consumer 2nd consumer 3rd consumer



A **food web** is complex, showing how different organisms feed off of the same foods and are connected. Any change in the web can affect many others.

A **trophic level** is a feeding step. These steps are shown on a Pyramid of Energy (or Biomass or Numbers). This pyramid shows how the members of a food chain are organizes by available energy, mass, and actual number. The greatest of all of these is found on the 1st trophic level made up of producers. Only 10% of the sun's energy is transferred because most is lost as heat.





Cycles

- Carbon Cycle- Carbon is released during respiration, burning of fossil fuels, burning of trees and as decomposers break down dead organisms.
  Carbon is used by plants to do photosynthesis.

The carbon is recycled continuously and is not lost.

- Nitrogen Cycle- Nitrogen makes up most of the air it is not a usable form for plants. Bacteria can fix nitrogen to make it available for plants. Nitrogen is also released as decomposers break down dead organisms and recycle it into the soil. Nitrogen is released in animal urine and waste. Animals take in nitrogen through food. The nitrogen is continuously recycled.

Succession

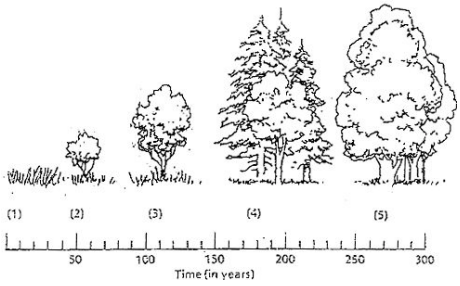
Succession- the natural changes and species replacements that take place in the communities of an ecosystem. Succession occurs in stages, some species move in as others die out.

Primary succession- the colonization of barren land by communities of organisms. Takes place where there are no living organisms- land after a lava flow. The 1st species to arrive is the pioneer species. They are soon replaced by other species.

A **climax community** is a mature stable community that undergoes little or no change- may take hundreds of years to form.

Ex- rock---moss---small plants, fungi,---soil builds---seeds arrive—trees

Secondary Succession - a sequence of changes occurring after a natural disaster or other disruption affects an existing community. It differs than primary because soil already exists- less time is taken to reach a climax community.



Ex- fire in Yellowstone park. Without the large pine trees, wild flowers grew, grasses and then pine seedlings again.

Major Body Systems:

- ◊ Respiratory system - involves the exchanges of oxygen and carbon dioxide.
- ◊ Circulatory system - involved in transporting oxygen and picking up carbon dioxide as waste. Also transports nutrients to the cells and picks up wastes.
- ◊ Endocrine system - involved in the production of hormones
- ◊ Digestive system - involves the mechanical and chemical breakdown of food so that it can be transported to the cells
- ◊ Nervous System – regulates chemical signals such as pain and hunger
- ◊ Skeletal system - bones and their connections that allow movement
- ◊ All systems work to maintain **homeostasis**. Homeostasis is the internal balance of nutrients, water, temperature, hormones, etc. Homeostasis works like a thermostat: when something is too high, the systems kick in to bring levels down. When something is too low, the systems kick in to raise levels.