Gateway Biology Review

Characteristics of Living Things
- Reproduce
- Grow
- Develop
- Need food/require energy
- Made of cells
- Respond to their environment
- Adapt to their environment

Cells and Heredity

Cell Theory
1. All living things are made of cells.
2. The cell is the basic unit of structure and function
3. All cells come from preexisting cells

Organelles and Cell Parts
1. Cell Membrane (Plasma membrane)
   - ____________ cell
   - Selective barrier
   - Controls what substances enter and exit the cell
2. Cytoplasm
   - Jelly-like material that ____ the cell
3. Ribosomes:
   - Site of ___________ (where __________ are made)
4. Golgi Apparatus
   - Prepare proteins that will leave the cell or be placed in the plasma membrane
   - “Post Office” of the cell
5. Mitochondria
   - __________ of the cell
   - Site of cellular __________ which produces ATP from sugars (glucose)
6. Lysosome
   - __________ macromolecules
   - Single celled organisms—eating, digest food
   - Digest/recycle old organelles; “stomach of the cell”
   - Immune system
7. Centrosome
   - Produce microtubules during __________
8. Rough Endoplasmic Reticulum
   - __________ attached
   - Production of proteins
9. Smooth Endoplasmic Reticulum
   - _______ ________attached
   - Produce lipids
   - Detoxification of drugs and poisons
10. Nucleus
    - Stores/protects ________
11. Nuclear Envelope
    - Membrane that surrounds the __________
12. Nucleolus
    - Found in the __________
    - Produces ribosomal RNA (rRNA) which forms ribosomes
13. DNA
    - Deoxyribonucleic Acid
    - Contains genes/hereditary information
    - Determines structure of proteins
14. Chloroplast
    - Site of ____________, which stores the sun’s energy in sugars (glucose)
    - Found in __________
15. Vacuole
    - _______
    - Waste, nutrients, water, ions
16. Cell Wall
    - _______ and ____________ plant cells, bacteria, fungi, some protists
    - Allows cell to exist in hypotonic environment
17. Cilia and Flagella
    - ____________ (locomotion)
18. Microfilaments and Microtubules
    - ____________ components, “skeleton” of the cell.

Cellular Classification

Unicellular Organisms
- _______ celled
- Bacteria, archaea, some protists (euglena, paramecium, amoeba)

Eukaryote
- _______ present
- _______ DNA
- Single or multi-celled
- Membrane bound __________
- Plants, Animals, Fungi, Protists

Multicellular Organisms
- More than _______ cell
- Plants, animals, fungi, some protists

Prokaryote
- _______ nucleus
- _______ membrane bound organelles
- _______ celled
- _______ DNA
- “Primitive”
- Bacteria, Archaea
Above are the six kingdoms into which living organisms are subdivided.
Which of the kingdoms contain only multicellular organisms? ________________
Which of the kingdoms contain only single-celled organisms? ________________
Which of the kingdoms contain both single-celled and multicellular organisms? ________________

Practice: Decide whether each of the following is unicellular or multicellular, prokaryotic or eukaryotic; and state the kingdom to which belongs.

2. Cat ________________ 7. Mushroom ________________ 12. Cyanobacteria ________________
5. Gold Fish ________________

Homeostasis
- Maintaining a ____________ and ____________ environment inside of an organism
- Examples
  - Breathe in oxygen
  - Breathe out carbon dioxide
  - Eat Food
    - Energy
    - Building Blocks
  - Eliminate Waste
  - Maintain Temperature
  - Blood pH
  - Blood sugar
- How does each of the following organs, systems, or responses function in maintaining homeostasis?
  - Kidneys
  - Cardiovascular System
  - Shivering
  - Sweating
  - Sunning
  - Buffers in our blood
  - Roots on a plant
  - Leaves on a plant
  - Digestive System
  - Mitochondria
  - Lysosome
  - Stomach
Cellular Transport

Materials Transported into a cell:
- _________
- _________
- _________
- _________
- _________
- _________
- _________

Materials Transported out of a cell
- _________
- _________
- _________
- _________
- _________
- _________
- _________

Methods of Transport Across a Cell Membrane

Active Transport
- Requires _________ (ATP)
- Uses Transport Protein

Passive Transport
- Does _________ require energy
- Particles move from _________ concentration to _________ concentration.
- Works to reach equilibrium

- Diffusion
  - Movement of _________ through the membrane down a concentration gradient

- Osmosis
  - Movement of _________ through a semi-permeable membrane from an area of low solute concentration to an area of high solute concentration.

- Facilitated Diffusion
  - Movement of particles through a cell membrane by means of a transport protein.
  - Down the concentration gradient
  - Does NOT require energy.

Osmosis
- Movement of water
- Water makes up about 70% of the cell and is required for transport of food, nutrients, and waste throughout the body.
- Water moves from a _________ solution to a _________ solution.
- Hypotonic Solution: Lower solute concentration
- Hypertonic Solution: Greater solute concentration
- Isotonic Solution: equal solute concentration

These are relative terms used to compare two solutions

- Animal Cells need to be surrounded by an _________ solution
  - Animal cells in a hypotonic solution gain water and will _________ and _________
  - Animal cells in a hypertonic solution lose water and will _________

- Plant Cells need to be surrounded by a hypotonic solution.
  - Plant cells in an isotonic solution become _________
  - Plant cells in a hypertonic solution lose water undergo _________

Hypotonic solution | Isotonic solution | Hypertonic solution
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>H₂O</td>
<td>H₂O</td>
<td>H₂O</td>
</tr>
<tr>
<td>Lysed</td>
<td>Normal</td>
<td>Shriveled</td>
</tr>
</tbody>
</table>
Endocytosis
- “Cell ________”
- A cell takes in macromolecules or other substances when regions of the plasma membrane surround the substance, pinch off, and form a vesicle within the cell.

Exocytosis
- A cell secretes macromolecules –waste, hormones, neurotransmitters, etc.

Practice:
1. An animal cell is placed in a hypertonic solution; what will happen to the cell?

2. A plant cell contains a solute concentration of 0.5M; in what direction will water move if the cell is placed in a 0.2M solution?

3. What term best describes the process by which a drop of food coloring over time spreads out uniformly through a beaker of water?

4. In the diagram to the right, what will be the direction of net water movement across the semi-permeable membrane?

Cell Division
Mitosis
- _______ and _______ (body) cells
- Daughter cells:
  - _______ produced
  - _______ to the parent

Label each step of the cell cycle on the line below each picture.
• Steps of Mitosis:
  o __________
    ▪ Chromatin coiled to form discrete chromosomes
    ▪ Nucleoli disappear
    ▪ Form mitotic spindle, lengthen microtubules
    ▪ Nuclear membrane breaks down
    ▪ Microtubules attach to chromosomes at kinetochore
  o __________
    ▪ Chromosomes lined up at __________ of cell
  o __________
    ▪ Microtubules shorten
    ▪ Chromatids __________, pulled toward opposite sides of the cell
  o __________
    ▪ Daughter nuclei form at either side
    ▪ Chromatin becomes less tightly coiled
    ▪ Cytokinesis (division of cytoplasm) occurs during telophase.

Meiosis
• __________reproduction (why is meiosis required for sexual reproduction)
• Form __________ (sperm and egg)
• Daughter cells
  o __________produced (two nuclear divisions)
  o __________ (cuts the number of chromosomes in half)
  o Different from parent and unique from each other
• Steps
  o Prophase I
  o Metaphase I
  o Anaphase I
  o Telophase I
    ▪ Prophase II
    ▪ Metaphase II
    ▪ Anaphase II
    ▪ Telophase II

Comparing Mitosis and Meiosis:

<table>
<thead>
<tr>
<th></th>
<th>Mitosis</th>
<th>Meiosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Two identical daughter cells</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Four daughter cells</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Chromosome number halved</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Chromosome number maintained</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Two rounds of cell division</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>One round of cell division</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Associated with sexual reproduction</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Associated with asexual reproduction</td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>Genetic variation more likely</td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>Daughter cells identical to parent</td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>Daughter cells not identical to parent</td>
<td></td>
</tr>
<tr>
<td>12.</td>
<td>Duplication of chromosomes occurs</td>
<td></td>
</tr>
<tr>
<td>13.</td>
<td>Necessary for growth and maintenance</td>
<td></td>
</tr>
<tr>
<td>14.</td>
<td>Produces gametes</td>
<td></td>
</tr>
</tbody>
</table>

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**Energy/ Matter Transformations**

*Macromolecules*

Carbohydrates, Proteins, Lipids, and Nucleic acids are all organic macromolecules. Organic Molecules are composed primarily of carbon and are the building blocks of all living organisms.

<table>
<thead>
<tr>
<th>AKA</th>
<th>Carbohydrates</th>
<th>Proteins</th>
<th>Lipids</th>
<th>Nucleic Acids</th>
</tr>
</thead>
<tbody>
<tr>
<td>Components</td>
<td>Monosaccharide</td>
<td>Amino Acids</td>
<td>1 glycerol + 3 Fatty Acids</td>
<td>Nucleotide (Sugar + Phosphate + Nitrogenous Base)</td>
</tr>
<tr>
<td>Polymer</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Function</td>
<td>Short Term</td>
<td>Structure</td>
<td>Long Term</td>
<td>Store</td>
</tr>
<tr>
<td></td>
<td>Storage</td>
<td></td>
<td>Storage</td>
<td>Information</td>
</tr>
<tr>
<td></td>
<td>Structure</td>
<td></td>
<td>Padding</td>
<td>Ribosomes</td>
</tr>
<tr>
<td></td>
<td>Identification of cells</td>
<td></td>
<td>Insulation</td>
<td>Protein Synthesis</td>
</tr>
<tr>
<td>Examples</td>
<td>Glucose, sucrose, lactose, glycogen, cellulose</td>
<td>Hemoglobin, Hair, Nails, Lactase, Muscles</td>
<td>Body Fat, Oils, Wax, Phospholipids in cell membrane</td>
<td>DNA, RNA, tRNA, ribosomes</td>
</tr>
<tr>
<td>Food Source</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Energy Contained</td>
<td>kcal/g</td>
<td>kcal/g</td>
<td>kcal/g</td>
<td></td>
</tr>
</tbody>
</table>

**Carbohydrates**
- **Glucose**
  - Required to produce ATP through cellular _________________
- **Glycogen**
  - Polymer of _________________
  - Short term energy storage for _________________
  - Stored in the liver and muscles
- **Starch**
  - Polymer of _________________
  - Short term energy storage for _________________(example: potato)
  - Stored in the roots
- **Cellulose**
  - Polymer of _________________
  - Structural
  - Cell walls in _________________

**Lipids**
- _________________ storage
- Fats—animals
- Oils—plants
- Padding and Insulation
Nucleic Acids

DNA
- Structure
  - Helix (Looks like a ________________)
  - ________________ strands of nucleotides joined down the middle by hydrogen bonds
  - Four bases – ________________, ________________, ________________, ________________
  - A pairs with T
  - G pairs with C

- DNA Replication
  - ________________-conservative
  - Double Helix unwinds, and each strand separates
  - Each strand used as template to construct new complementary strand
  - Occurs before Mitosis and Meiosis

- DNA Determines structure of proteins
  - Each group of three bases codes for a single ________________
  - Proteins assembled through process of ________________ and ________________

RNA
- ________________ stranded

- Ribonucleic Acid (contains ribose rather than deoxyribose).
- Four bases—Adenine, Uracil, Guanine, Cytosine (Uracil replaces Thymine)
- Three types
  - rRNA—forms the ribosomes
  - tRNA—transports amino acids from cytoplasm to ribosomes
  - mRNA—carries information for protein structure from DNA to a ribosome

Proteins
- Composed of amino acids

Uses
- Enzymes
- Muscle
- Hair
- Nails
- Microtubules

Protein Synthesis
- Transcription
  - ________________ information from DNA to mRNA
  - mRNA then transported from DNA to a ________________
    - Eukaryotes—mRNA leaves nucleus to find ribosome
    - Prokaryotes—no nucleus, transcription and translation can occur simultaneously
  - mRNA attaches to ribosome

- Translation
  - Information in mRNA used to construct specific sequence of amino acids
  - Information is translated from language of nucleotides to the language of amino acids
  - ________________carries amino acids to ribosomes where they are linked together.
Practice:
The substances in your body that are needed in order to grow and maintain life come from the nutrients in food. There are 6 classes of nutrients in food - carbohydrates, proteins, lipids, water, vitamins, and minerals. Of these, carbohydrates, proteins, and fats are the major sources of energy for the body. Analyze and evaluate the sample daily diet of a 16 year old male. Be sure to include the following in your evaluation:
- Total calories ingested
- Percent of calories contributed by each of the nutrients
- Compliance with the RDI standards set by the USDA.

<table>
<thead>
<tr>
<th>Dietary Reference Intake for Food Areas</th>
<th>Males 14-18 years old</th>
<th>Females 14-18 years old</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbohydrates</td>
<td>130</td>
<td>130</td>
</tr>
<tr>
<td>Total Fat</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Protein</td>
<td>52</td>
<td>46</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Food</th>
<th>Caloric Value</th>
<th>Grams of Fat</th>
<th>Grams of Protein</th>
<th>Grams of Carbohydrates</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 bowl of Honey Nut Cheerios</td>
<td>120</td>
<td>1.5</td>
<td>3</td>
<td>24</td>
</tr>
<tr>
<td>8 oz. 2% milk</td>
<td>121</td>
<td>4.7</td>
<td>8</td>
<td>12</td>
</tr>
<tr>
<td>8 oz. orange juice</td>
<td>112</td>
<td>.5</td>
<td>2</td>
<td>26</td>
</tr>
<tr>
<td>Deluxe chicken sandwich (lettuce, tomato, mayo)</td>
<td>390</td>
<td>24.5</td>
<td>24</td>
<td>30</td>
</tr>
<tr>
<td>French fries</td>
<td>152</td>
<td>11</td>
<td>8</td>
<td>13</td>
</tr>
<tr>
<td>Ketchup</td>
<td>15</td>
<td>0</td>
<td>.2</td>
<td>4</td>
</tr>
<tr>
<td>8 oz. Mountain Dew</td>
<td>129</td>
<td>0</td>
<td>0</td>
<td>32</td>
</tr>
<tr>
<td>2 chocolate chip cookies</td>
<td>79</td>
<td>4</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>Slice of pizza</td>
<td>110</td>
<td>2</td>
<td>3</td>
<td>16</td>
</tr>
<tr>
<td>8 oz. Pepsi</td>
<td>136</td>
<td>0</td>
<td>0</td>
<td>37</td>
</tr>
<tr>
<td>Grilled cheese</td>
<td>320</td>
<td>19</td>
<td>20</td>
<td>30</td>
</tr>
<tr>
<td>2 burritos (fully loaded)</td>
<td>660</td>
<td>9</td>
<td>12</td>
<td>48</td>
</tr>
<tr>
<td>2 scoops ice cream</td>
<td>300</td>
<td>16</td>
<td>5</td>
<td>34</td>
</tr>
<tr>
<td>TOTALS</td>
<td>2644</td>
<td>86.2</td>
<td>86.2</td>
<td>316</td>
</tr>
</tbody>
</table>
Respiration and Photosynthesis

- **Respiration**
  - Process of using energy from sugar (glucose) to produce ________________
  - $\text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2 \rightarrow 6\text{CO}_2 + 6\text{H}_2\text{O} + 38\text{ATP}$
  - Occurs in ________________
  - ATP provides energy to do work in the cell
  - When ATP is used, it is converted to ________________: respiration then uses energy in sugars to convert ADP back to ATP by adding a phosphate.
  - Occurs in both ________________ and ________________
  - Occurs in both ________________ and ________________

- **Photosynthesis**
  - Process of using energy from the sun to produce ________________ (glucose)
  - $6\text{CO}_2 + 6\text{H}_2\text{O} + \text{Light Energy} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$
  - Occurs in ________________ of plants and some algae

- How are photosynthesis and respiration related?

- Where and how are excess sugars stored in plants?

- Where and how are excess sugars stored in animals?

- Construct a food chain that traces the flow of energy from the sun, to your lunch, through you, and to the muscles that make your arm move.

Genetics/ DNA

**Heredity and Mendelian Genetics**

Genetics: The study of _______________ (the passing of traits from parents to offspring)

Gregor Mendel: The father of genetics.

DNA: Consists of many ________________

Gene: Stretch of DNA that codes for a given ________________.

Allele: Alternate ________________ of a gene

**Dominant and Recessive Traits**

**Dominant Allele**
- Gene that is fully expressed.
- ________________ / “speaks louder than” a recessive allele.

**Recessive Allele**
- Masked/not expressed if dominant allele is present.
- Only expressed if dominant allele is ________________.
Genotype
- The __________________ makeup of an organism
  - Homozygous: having two of the ______________ allele
  - Heterozygous: having two __________________ alleles.
  - Homozygous Dominant: having two ______________ alleles
  - Homozygous Recessive: having two ______________ alleles
  - Heterozygous: having one of each allele

Phenotype
- The physical and physiological traits of an organism
- How the genes are ______________
- What you would see in a photograph

Example:
In peas, Y is a dominant allele that instructs for yellow seeds; y is a recessive allele that produces green seeds. Given the following genotypes, fill in the term that best describes each, and then indicate what the phenotype of the organism will be.

<table>
<thead>
<tr>
<th>Genotype</th>
<th>Description of Genotype</th>
<th>Phenotype</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yy</td>
<td>Homozygous Dominant</td>
<td>Green</td>
</tr>
</tbody>
</table>

A Punnett Square can be used to predict the genotypes and phenotypes of the offspring produced by a given genetic cross.

Generations
- Parental (P): The organisms involved in the ______________ cross
- First Filial (F1): The offspring of the ______________ Generation
- Second Filial (F2): The offspring of the First ____________ Generation

A chicken and a rooster mate. The chicken has white feathers and the rooster has brown feathers. Brown is dominant, and white is recessive. Assuming the rooster is heterozygous, predict the frequency of each genotype and phenotype in their offspring.

<p>| | | |</p>
<table>
<thead>
<tr>
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<tbody>
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</tr>
</tbody>
</table>

What is the cellular process that determines which alleles an offspring will receive from their parents?
Practice
1. A plant that is homozygous dominant for height is crossed with a plant that is homozygous recessive. (T = tall; t = short). Use a Punnett Square to predict the genotypic and phenotypic ratios of the F₁ generation.

   
   

2. Using question number 1, what would be the genotypic and phenotypic ratios of a cross of two F₁ individuals?

   
   

Determining Sex
Human male: XY
Human female: XX

- Which parent determines the sex of a human offspring? __________
- What is the probability of having a boy? A girl? ______________

Sex linked traits
- Carried on the X chromosome
- Example: hemophilia, color blindness.
- Disorders occur more often in males than females. Why?

Mutation
A ______________ in the base sequence of DNA.
A change in DNA can lead to a change in the ______________ coded for by that gene.
A change in the protein structure can lead to certain disorders, for example, sickle cell anemia.

The Six Kingdoms
Bacteria and Archaea
- Celled, prokaryote
- Cell wall
- Live in damp places or in water
- Asexual reproduction—binary fission
- _______________ (breaks down organic material)
- Nitrogen fixation (rhizobium)
- Parasites (tuberculosis, cholera, strep-throat)
- Symbiotic relationships (humans)
Complete the chart comparing bacteria and viruses:

<table>
<thead>
<tr>
<th></th>
<th>Bacteria</th>
<th>Viruses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kingdom(s)</td>
<td>Archaebacteria, Eubacteria</td>
<td>n/a</td>
</tr>
<tr>
<td>Example</td>
<td>Strep throat, Gonorrhea</td>
<td>Cold, Flu, Chicken pox</td>
</tr>
<tr>
<td>Considered living?</td>
<td>______ by most scientists</td>
<td>______</td>
</tr>
<tr>
<td>Structure</td>
<td>______ with peptidoglycan (Eubacteria)</td>
<td>______ core surrounded by protein coat</td>
</tr>
<tr>
<td>Can diseases be successfully treated with antibiotics?</td>
<td>_____</td>
<td>_____</td>
</tr>
</tbody>
</table>

Protista
- ______ (has a nucleus)
- Single Celled
  - Euglena
  - Diatoms
  - Dinoflagellates
  - Ciliates
  - Flagellates
  - Sacrodina (amoeba)
  - Sporozaa (malaria)
- Multi-celled
  - Kelp
  - Seaweed

Plants
- Multicellular, eukaryotic
- Examples:

Animals
- Multicelled, eukaryotic
- Examples:

Fungi
- Multicelled or single celled; eukaryotic
- Examples:

Plants
- Photosynthetic Autotrophs
- How are plant cells different from animal cells?
  - Major parts of a plant
    - Roots
      - absorb water and nutrients from the ____________
      - Store excess sugars (in the form of ____________)
    - Stem
      - connects roots to the rest of the plant
    - Leaves
      - site of ____________
  - Transport in a plant
    - Xylem: transports water and nutrients from the roots to the rest of the plant
    - Phloem: transports products of photosynthesis to the rest of the plant.
  - What environmental factors might affect a plant?
Ecology

Biome
- A major biological community that occurs over a ______________ ______________ of land.
- Determined primarily by precipitation
- Affected by elevation, latitude, soil type, geographical features.

Terrestrial Biomes
1. Tropical Rain Forest
   - Rain: 200-450 cm (80-180 in) per year (A ______________of rain)
   - Rich in number of species (many different types of organisms)
   - Central America, South America, Africa, Asia
   - Examples of Animals and Plants:

2. Desert
   - Rain: fewer than 25 cm (10 in) per year (Very ______________rain)
   - Sparse vegetation
   - May be ______________or ______________
   - Examples of Animals and Plants:

3. Savanna
   - Rain: 90-150 cm (35-60 in) per year
   - Prevalent in Africa.
   - Dry ______________
   - Widely spaced trees; animals active during rainy season
   - Examples of Animals and Plants:

4. Temperate Deciduous Forest
   - Rain: 75-250 cm (30-100 in)
   - Mild Climate, plentiful rain
   - Deciduous trees ______________
   - Warm summer, cold winter
   - Mammals hibernate in winter, birds migrate
   - Eastern US, Southeastern Canada, Europe, Asia
   - Examples of Animals and Plants:

5. Temperate Grasslands
   - Halfway between equator and poles
   - ______________ of North America, Eurasia, South America
   - Fertile soil, used for agriculture
   - Examples of Animals and Plants:

6. Coniferous Forest
   - ______________ ______________ trees: ______________
   - Pacific Northwest (temperate rain forests)
   - Northern Coniferous Forest (Taiga)
     - Cold and wet
     - Winters long and cold; precipitation in summer
     - Coniferous forests (spruce and fir)
     - Large mammals: ______________
7. Tundra
   • Between taiga and poles
   • 20% of Earth’s surface
   • Rain: less than 25 cm (10 in)
   • ______________________ 1m deep (3ft)
   • Examples of animals:
   • Alpine Tundra
     • found at high latitudes
     • high winds and cold temperatures

Aquatic Biomes
1. __________________ Communities
   • Standing bodies of water
     o lakes, ponds
   • Moving bodies of water
     o streams, rivers
   • Wetlands
     o Swamp, marsh, bog
   • ~2% of Earth’s surface
   • Plants, fishes, arthropods, mollusks, microscopic organisms

2. __________________ Communities (salt water)
   • 75% Earth’s surface covered by ocean
   • Average depth 3km (1.9mi)
   • Mostly dark, cold
   • Photosynthetic organisms mostly towards surface
   • Heterotrophic organisms throughout
   • Fish, plankton (algae, diatoms, bacteria).

Flow of Energy Through an Ecosystem
In order to live, organisms must obtain energy and nutrients
   o Heterotrophs
     ▪ Obtain energy and nutrients from the ____________ they ____________
   o Autotrophs
     ▪ Obtain energy from the __________________
     ▪ Obtain nutrients from the soil.

   • Producer
     o Uses energy from the sun and carbon from the environment to _____ its ________ food.
     o “bottom of the food chain”
     o Why are producers necessary in any ecosystem?

   • Consumer
     o Obtains energy through __________________ _______________ ________________
       ▪ Herbivore: eats only ________________
       ▪ Carnivore: eats only ________________
       ▪ Omnivore: eats both ________________ and ________________
     o Primary consumer: eats producers
Secondary consumer: eats the consumers that eat the producers
Means of obtaining nutrition
  - Predation
    - Ecological interaction in which one organism (predator) feeds on another living organism (prey).
    - Predator may or may not kill the prey.
  - Scavenging
    - An animal ingests dead plants, animals, or both.
    - Vultures, termites, beetles
  - Decomposer (______________)
    - Breakdown (absorb nutrients from) non-living organic material—corpses, plants, waste of living organisms—and convert them to inorganic forms.
    - Bacteria, fungi
    - Why are decomposers necessary in any ecosystem?

Food Chain
  - ________________pathway of energy transport through an ecosystem
  - algae→krill→cod→seal→killer whale→bacteria
  - Producers always come first in the food chain.
  - Decomposers always come last in the food chain; they will break down dead organisms and allow nutrients to be recycled.
  - Arrows indicate the ________________in which ________________flows through the ecosystem.

Food Web
  - A ________________of interconnected food chains in an ecosystem
  - Producers are at the beginning.
  - Decomposers are at the end.
  - Arrows indicate the ________________in which energy flows through the ecosystem.

Practice:
1. Draw a food chain with at least five organisms. Label all organisms as being a producer, a consumer, or a decomposer. Make sure arrows are drawn to show how the energy is transferred.

2. How does a food chain prove the Law of Conservation of Matter and Energy?
**Symbiosis**

- "Ecological interaction in which two or more species live together in a close, long-term association.

1. **Mutualism**
   - Mycorrhizae (fungus) and plant roots
   - Ants and aphids
     - Aphids supply sugars to ants; ants protect aphids from insect predators

2. **Commensalism**
   - One species ________________, the other is ________________ harmed or helped
   - Birds and bison
     - birds feed on insects flushed out of grass by grazing bison
   - Barnacles and whales

3. **Parasitism**
   - One species (the parasite) ________________; the other (the host) is ________________.
   - One organism feeds on and usually lives on or in another.
   - Bacterial infection of animals
   - Fungus infects trees
   - Malaria

**Practice:**
Match the type of relationship with the correct term

1. ___ Both species benefit from each other.   a. mutualism
2. ___ One species benefits; the other is unaffected.  b. parasitism
3. ___ One species benefits; the other is harmed.     c. commensalism

**Cycles of Matter**

**Carbon Cycle**
- Carbon is the key ingredient in all living organisms
- Processes involved: ________________ (example: photosynthesis), ________________ (example: release of CO₂ by volcanoes), ________________ (example: burning of fossil fuels)

**Nitrogen Cycle**
- All organisms require nitrogen to build ________________
- Forms of nitrogen: N₂ in ________________; NH₃, NO₃⁻, NO₂⁻ in ________________; nitrate from fertilizers
- Some bacteria convert N₂ into NH₃ during ________________
- Some bacteria convert nitrates into N₂ during ________________.

**Water Cycle**
- All organisms require water to survive.
- Processes: evaporation, transpiration, condensation, precipitation, seepage, runoff
**Important Ecological Terms**

**Abiotic factors**
- _______________ chemical or physical factors in the environment.
- Examples: _________________________________________________

**Biotic factors**
- _______________ organisms in the environment.
- Examples: _________________________________________________

**Ecosystem**
- _______________ living and nonliving things in a given area

**Community**
- _______________ that inhabit a given area.
- A group of populations

**Population**
- A group of individuals belonging to the _________ _________ that live together in the same area

**Competition**
- Two or more organisms require the same resource that is in limited supply.
- Food, shelter, light, water, mates
- The strongest organism will win the competition and will be more likely to live and pass its genes on to the next generation (_________________ ________________).

**Habitat**
- Place or environment in which populations live

**Niche**
- _______________ of a species in an ecosystem
- Relationships, activities, resources used

**Succession**
- The series of _________ changes that occurs in a community over time
- _________ succession occurs on a surface where no soil exists. Example: ______ _____, areas covered by _________ ash
- _________ succession occurs in an area where a disturbances changes an existing community without destroying the soil. Example: ______ _____, area ________ by wildfire
Adaptation and Natural Selection

Natural Selection
- Idea first stated by ___________________ __________________
- “Survival of the ___________________”
- Organisms that are best ___________________ to their environment are more likely to live long enough to produce offspring and pass their traits on to the next generation.
- In terms of evolution and natural selection, the number one goal of any organism is to pass its ___________________ on to the next generation through the production of ___________________.

Selective Breeding
- Organisms with __________ traits are chosen to mate so that their offspring also possess desired traits.
- Examples: ____________________

Adaptation
- Characteristic of an organism that helps it to better survive in a given environment.
- Types of adaptation:
  o Structural: characteristics of an organism’s anatomy. (wings on a bird)
  o Physiological: characteristics relating to internal body processes. (antibiotic resistance)
  o Behavioral: how an organism acts and responds to its environment (bird migration)
- List three additional examples of adaptations and state the type of adaptation:
  o __________________________________________________________________________
  o __________________________________________________________________________
  o __________________________________________________________________________

Evolution
- Change in groups of organisms over a long period of time
- Evidence for evolutionary changes
  o Fossils (The deeper the fossil, the older it is)
  o Comparative anatomy and the study of homologous structures (Example: human arm, dolphin fin, bat wing, dog foreleg)
  o Comparative biochemistry (The fewer the differences in DNA, the closer the organisms are related)
  o Comparative embryology (Example: all vertebrates have gill slits, tail, and notochord in early development)
  o Direct evidence (Example: bacteria can quickly become resistant to antibiotics)

Practice:
Classify the following adaptations as behavioral, structural, or physiological. Discuss the reason(s) for your choices.

1. Bees build a hive
2. Young ducklings follow their mother
3. A woodpecker’s beak is pointed and sharp
4. Flat shape of a leaf
5. Scent given off by a skunk
Human Systems and Basic Life Functions

<table>
<thead>
<tr>
<th>System</th>
<th>Function</th>
<th>Major Components</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circulatory/Cardiovascular</td>
<td>Transport blood to all parts of the body.</td>
<td>Heart, veins, arteries, capillaries</td>
</tr>
<tr>
<td></td>
<td>Blood carries: oxygen, CO₂, nutrients, waste</td>
<td></td>
</tr>
<tr>
<td>Respiratory</td>
<td>Exchange of Oxygen and Carbon Dioxide between the body and the environment.</td>
<td>Lungs</td>
</tr>
<tr>
<td>Immune</td>
<td>Protect the body from disease and foreign substances</td>
<td>T-cells, B-cells, Antibodies, lymphatic system, spleen</td>
</tr>
<tr>
<td>Digestive</td>
<td>Breakdown food; supply nutrients to the body</td>
<td>Stomach, Intestines, Pancreas, Liver</td>
</tr>
<tr>
<td>Excretory</td>
<td>Remove metabolic waste from the blood and dispose (production of urine)</td>
<td>Kidneys (in humans)</td>
</tr>
<tr>
<td>Reproductive</td>
<td>Production of offspring</td>
<td>Male contributes sperm; female contributes egg</td>
</tr>
<tr>
<td>Nervous</td>
<td>Sense/measure conditions within and outside of the body. Respond to these conditions: movement of muscle, release adrenaline, control of heart rate.</td>
<td>Brain, spinal cord, nerves</td>
</tr>
<tr>
<td>Endocrine</td>
<td>Production and release of hormones</td>
<td>Endocrine glands: pituitary, adrenal, ovaries, testes, etc.</td>
</tr>
</tbody>
</table>

Biology Exercises

Answer the following questions in paragraph form. Your answers will not necessarily be essays; they are short practice questions and may require one to three paragraphs. Answer on a separate piece of paper; feel free to give me a copy of your work so I can look over it and give you feedback.

1. Compare and contrast a plant cell and an animal cell.
2. Compare and contrast prokaryotes and eukaryotes.
3. A plant is watered with highly concentrated salt water. Even though the plant is given plenty of water it soon begins to wilt. Explain why the plant is wilting.
4. A plant and an insect are placed in an air-tight container; fresh oxygen is not allowed to enter the container. After about a week the plant died. A day later the insect died. If the insect had a sufficient amount of food and water, explain why the insect died.
5. In terms of the carbon cycle, explain how a carbon atom of one of your cells could have at one time been in George Washington’s body. Draw a food chain or food web to illustrate your point.
6. Explain how a molecule of water in your body could, at one time, have been located in a tree in your back yard. Use scientific terminology to explain the path the water molecule followed from the tree to your body.
7. An animal cell is only capable of cellular respiration; a plant cell is capable of both cellular respiration and photosynthesis. Why do both organisms require cellular respiration? Why does only the plant cell require photosynthesis?