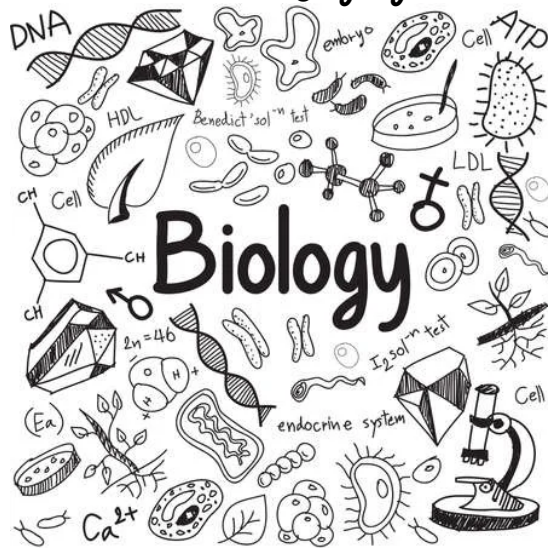


# AP Biology Summer Assignment

Miss. Quigley



The purpose of this three part summer assignment is to prepare you for the excitement and rigors of AP Biology. Advanced Placement Biology is designed to be the equivalent of a college introductory course usually taken by biology majors during their first year of study. Therefore, I require that students possess a level of maturity and sophistication found in the typical university undergraduate student. If you have any questions, you can come see me in room 129 through June or email me at [marissa.quigley@eischschools.org](mailto:marissa.quigley@eischschools.org). I will be sporadically available via email throughout the summer. Please allow 48 hours for a response should you have any questions.

Part 1 of the summer assignment is due by AUGUST 1st. You will need to purchase a small journal/marble notebook for the other two parts of the summer assignment. You will turn in your journal to me no later than September 8th. *Any assignments turned in late will automatically receive ½ credit for that part of the assignment.*

My goal with assigning summer assignments is to encourage you to interact with the biological world around you, expand your vocabulary, introduce you to major concepts we will be covering in depth, and to get you to keep your mind sharp during these summer months. If you have any questions please do not hesitate to email me or use the messages in Parent/Student Square.

Enjoy your summer - I am looking forward to seeing you all in September ready to dive into the wonderful world of AP Biology!

Sincerely,

Miss Quigley

AP Biology

Chemistry

## Forensics

East Islip High School

[marissa.quigley@eichools.org](mailto:marissa.quigley@eichools.org)

The AP Biology curriculum is built around 4 'Big Ideas', with Essential Knowledge and Science Practice that support each Learning Objective:

- **Big Idea 1: Evolution (EVO)** – The process of evolution drives the diversity and unity of life.
- **Big Idea 2: Energetics (ENE)** – Biological systems utilize free energy and molecular building blocks to grow, to reproduce, and to maintain dynamic homeostasis.
- **Big Idea 3: Information Storage and Transmission (IST)** – Living systems store, retrieve, transmit, and respond to information essential to life processes.
- **Big Idea 4: Systems Interactions (SYI)** – Biological systems interact, and these systems and their interactions possess complex properties.

Assignment #1: Meet Your Teacher **25 points** (DUE **August 1st**)

1. Send an email to [marissa.quigley@eischools.org](mailto:marissa.quigley@eischools.org) **using your school email** only and type "AP Bio: Introduction to (your name)" in the subject. This is a professional form of communication. Use clearly written sentences. Do not abbreviate words like you are texting with a friend. Include the following information in your email:
  1. Introduce yourself: What is your name? Do you have a nickname that you go by? What grade are you in?
  2. Courses:
    - a. What science classes have you taken so far and who was your teacher for each? What was your final grade in each class?
    - b. How many AP classes have you taken before this year? How many have you scored a 3 or higher on?
    - c. What subject area(s) are you most interested in continuing in college?
    - d. Is there anything you specifically liked or disliked about your earlier biology class?
  3. Yourself:
    - a. What do you like to do? (hobbies, sports, music, interests, etc)
    - b. Tell me about your family (siblings? Who do you live with? How would you describe them?)
    - c. Do you have a job or plan on getting one for this year? What kind?
  4. Learning
    - a. What are your strengths when it comes to learning new material?
    - b. What causes you to struggle in a course? What do you do to address that struggle?
    - c. What is the most effective way you've found to study for a test?
    - d. How would you describe yourself as a learner?
  5. AP Biology
    - a. What are you looking forward to the most in AP Biology?
    - b. Do you have any concerns coming into AP Biology this year?
    - c. Why are you taking AP Biology? What do you hope to accomplish/gain from this course?
  6. Attach a picture of yourself with your face clearly visible- doing something you love, I hope!
  7. Close with your name.

Assignment #2: General Biology, Chemistry and Statistics Review Questions 75 pts (Due September 6th) - your responses should be all handwritten in your journal/marble notebook  
***\*\*\* The Gen Chem information is a chunk of Unit 1. When we cover this in class, it will be expected that you already learned this information and we will simply review it.***

**General Biology Questions**- you can answer these using some simple research. You can also utilize the Crash Course Biology Videos to help.

<https://www.youtube.com/playlist?list=PL3EED4C1D684D3ADF>

1. How does natural selection result in adaptation to the environment?
2. Give an example of a controlled study. Name the independent variable and the dependent variable in your example.
3. Explain why water is a polar molecule. What does the polarity and shape of water have to do with its ability to form hydrogen bonds?
4. How do eukaryotic and prokaryotic cells differ? How are they the same?
5. Describe the structure and function of the mitochondria and the chloroplast.
6. Tell how phospholipids are arranged in the plasma membrane. What other lipid is present in the membrane, and what function does it serve?
7. Why is less energy needed for a reaction to occur when an enzyme is present?
8. Describe the cell cycle, including its different stages.
9. What accounts for (a) the genetic similarity between daughter cells and the parent cell following mitosis, and (b) the genetic dissimilarity between daughter cells and the parent cell following meiosis?
10. Describe the Watson and Crick model of DNA structure. How did it fit the data provided by Chargraff and the X-ray diffraction patterns of Franklin?
11. Explain how the fossil record develops and how fossils are dated relatively and absolutely.
12. Contrast viruses with cells in terms of the characteristics of life.
13. Describe three examples of limiting factors that can impact a population's growth and keep it within the carrying capacity of an ecosystem.
14. Give an example of how humans impact (a) the water cycle, (b) the carbon cycle and (c) the nitrogen cycle.
15. Compare and contrast characteristics of Kingdom Protista, Kingdom Fungi, Kingdom Plantae and Kingdom Animalia.

**General Chemistry Questions:** You can use the following videos to help you answer the chemistry review questions.

Water: Liquid Awesome

[https://www.youtube.com/watch?v=HVT3Y3\\_gHGg&list=PL6C159EF1A62143A2&index=12](https://www.youtube.com/watch?v=HVT3Y3_gHGg&list=PL6C159EF1A62143A2&index=12)

Carbon..SO SIMPLE

[https://www.youtube.com/watch?v=OnQe0xW\\_JY4&list=PL6C159EF1A62143A2&index=8](https://www.youtube.com/watch?v=OnQe0xW_JY4&list=PL6C159EF1A62143A2&index=8)

1. Contrast the term element with compound.
2. Know the symbols of the following elements and their charge:
  - a. Carbon
  - b. Hydrogen
  - c. Oxygen
  - d. Nitrogen
  - e. Phosphorus
  - f. Sulfur
3. Contrast the terms atomic mass and atomic number
4. What is an isotope and what is “special” about radioactive isotopes?
5. What determines interactions between atoms? Why are valence electrons important?
6. Define the following terms:
  - a. Chemical bond
  - b. Covalent bond
  - c. Single bond
  - d. Double bond
  - e. Electronegativity
  - f. Nonpolar covalent bond
  - g. Polar covalent bond
7. Know the molecular formulas for the following compounds:
  - a. Oxygen gas
  - b. Carbon dioxide
  - c. Glucose
  - d. Phosphate
  - e. Ammonia
  - f. Water
8. How do ionic bonds compare with covalent bonds?
9. Compare and contrast hydrogen bonds and Van der Waals forces.
10. Why is water considered a polar molecule?
11. For each of the below listed properties of water - briefly define the property and then explain how water’s polar nature and polar covalent bonds contribute to the property.
  - a. Cohesion
  - b. Adhesion
  - c. Surface tension

- d. High specific heat
- e. Heat of vaporization
- f. Evaporative cooling

12. What is special about water and density?

13. Explain how these properties of water are related to the phenomena described in the statements below. More than one property may be used to explain a given phenomenon.
- a. During the winter, air temperatures in the northern United States can remain below 0 degrees for months, however the fish and other animals living in the lakes survive.
  - b. Many substances, for example, salt (NaCl) and sucrose, dissolve quickly in water.
  - c. When you pour water into a 25mL graduated cylinder, a meniscus forms at the top of the water column.
  - d. Sweating and the evaporation of sweat from the body surface help reduce a human's body temperature.
  - e. Water drops that fall on a surface tend to form rounded drops or beads.
  - f. Water drops that fall on your car tend to bead or round up more after you polish (or wax) the car than before you polished it.
  - g. If you touch the edge of a paper towel to a drop off colored water, the water will move up into the towel.

14. Define the following terms:

- a. Solute
- b. Solvent
- c. Aqueous solution
- d. Hydrophilic
- e. Hydrophobic
- f. Molarity

15. What defines an acid and a base?

16. Why are small changes in pH so important in biology?

17. Why is organic chemistry so important in the study of biology?

18. What is special about carbon that makes it the central atom in the chemistry of life?

19. Be familiar with the following functional groups - know its chemical compound and the functional properties

- a. Hydroxyl
- b. Carbonyl
- c. Carboxyl
- d. Amino
- e. Sulfhydryl
- f. Phosphate

## **Statistics Review:**

You may be thinking, “Stats??? I thought this was AP Biology!” You’re totally right, it is! There will be many opportunities this year to analyze authentic data; having a strong understanding of what graph to use to display information and the skills needed to interpret those results will help you become an even stronger scientist as we’re learning content.

1. Beginner’s Guide to Graphing Data: (<http://www.bozemanscience.com/statistics-graphing>)
  - a. What type of a graph uses a “best fit” line?
  - b. Explain the difference between a bar graph and a histogram.
  - c. Which type of graph shows a change over time?
  - d. Which type of graph displays a correlation of variables?

Distinguish between the independent/dependent variable in an experiment, and where their axes are on a graph.

- e. Which type of graph is best for comparing 2 or more different groups?
  - f. Which type of graph is better for showing distribution of data?
  - g. Explain when a pie chart/graph should be used and give (draw, label) any example.
  - h. State at least 5 elements that any graph should always display.
2. Bozeman- Statistics for Science <https://www.bozemanscience.com/statistics-for-science>
  - a. What is  $n$ ?
  - b. What is  $\bar{x}$  (bar)?
  - c. What is  $M$ ?
  - d. What was the range of the sample he gave?
  - e. Explain ‘Degrees of Freedom’ (with any example) and why the formula is  $n-1$
3. Bozeman-Standard Deviation <http://www.bozemanscience.com/standard-deviation>
  - a. What is meant by normal distribution?
  - b. What does standard deviation (SD) measure?
  - c. Can 2 sets of data have the same mean but a different SD? Explain.
  - d. 1 SD means % of the population falls within this range; while 2 SD means % falls in this range.
  - e. Pause the video and calculate the SD from the 2nd set of data given BY HAND. Show your work.
4. Bozeman- Standard Error <https://www.bozemanscience.com/statistics-for-science> & Kevin Piers Standard Deviation & Standard Error of Mean  
<https://www.youtube.com/watch?v=3UPYpOLeRJg>  
From Bozeman:
  - a. Explain the significance of standard error among 2 different sets of data with different sample sizes that have the same Mean (in terms of precision).

From Piers:

- What do SEM bars that have overlapping Means on a graph indicate?
- Explain the significance if SEM bars overlap, but the Means do not overlap.
- Explain the significance if there is no overlap between SEM bars.

5. Solve the following problems in pencil. You must show all work.

Below are 2 samples of data that were collected:

- Sample A: 12, 13, 14, 15, 16, 17, 18  
Calculate the mean for Sample A
- Sample B: 10, 15, 20  
Calculate the mean for Sample B
- Are the calculated means sufficient in explaining the data? Why or why not? (give specific evidence for your reasoning!)
- Calculate SD for Sample A
- Calculate SD for Sample B  
Explain the significance of the results.
- Calculate SEM for Sample A
- Calculate SEM for Sample B

Assignment #3: Scavenger Hunt (DUE - September 6th) – You will be familiarizing yourself with commonly used science terms by “collecting” assigned items by taking a photograph (with your phone or camera). You will use a marble notebook or some small journal for the data (pictures) you “collect”. **See attached word list AND directions!!!**

- Original photos only! NO internet images allowed!! The best way to prove you are the photographer is to place a personal item (name tag, pen, coin, etc.) in all of your photographs that only you could have added each time. Print out pictures to glue into your journal.
- Natural items!! All items should be from something that you have found in nature or outside (your neighborhood, yard, vacation spot, etc.). I will also accept unique or well-thought out ideas (remember you can always email me or use Parent Square).
- Research what each term means and where it can be found, enter it in your journal, then go snap a picture, and add it to the appropriate term. SEE WORD LIST BELOW FOR DETAILED INSTRUCTIONS!!!

**100+ words to know before starting AP Biology:**

It is extremely important for all students to start with basic vocabulary used in the first year biology course. Your summer assignment is to know the following terms with definitions as given below and choose 10 words to use for your Scavenger Hunt.

-Choose 10 of the following 100+ items to “collect”. You must use different examples for each item. Each item is worth **4 points** for a **total of 100 possible points**.

Directions: In your journal (same as the journal from assignment 2 - you can do one or two terms per page) you will:

1. List term.
2. Define term in your **own** words - Look up other definitions if you need help
3. Give an example of where you might find the word - think biology!
4. Take picture of something in nature OR something clever that reminds you of the word. NO INTERNET IMAGES. To prove the photo is yours, you can place a "proof" item in the images. See description of Assignment #3 above for details. Print out the picture (black and white is fine, I know ink is \$\$\$) and glue/tape it into your journal.
5. Explain why you chose that item to use and how it relates to the term.

**Abiotic:** Non-living chemical and physical parts of the environment that affect living organisms and the functioning of ecosystems.

**Active site:** The part of the enzyme where the substrate will bind.

**Active transport:** The movement of molecules across the cell membrane with the use of ATP.

**Aerobic:** Of, pertaining to, having, or requiring the presence of air or free oxygen. (ex. cellular respiration)

**Adhesion:** The force of attraction between unlike molecules, or the attraction between the surfaces of contacting bodies.

**Allele:** One of the possible forms of a gene. Most genes have two alleles, a dominant allele and a recessive allele.

**Allopatric speciation:** A fancy name for speciation by geographic isolation, discussed earlier. In this mode of speciation, something extrinsic to the organisms prevents two or more groups from mating with each other regularly, eventually causing that lineage to speciate. (Compare sympatric speciation)

**Amino Acids:** The 20 molecules that are held together by peptide bonds to make up proteins.

**Anabolic reaction:** The process involving a sequence of chemical reactions that constructs or synthesizes molecules from smaller units, usually requiring input of energy (ATP) in the process. (Compare catabolism.)

**Anaerobic:** Not requiring, or capable of occurring, in the absence of air or free oxygen. (ex. fermentation)

**Antibodies:** Proteins made by the B cells that immobilize antigens.

**Anticodon:** The three nucleotide combination on the transfer RNA that matches up with the three letter combination on the messenger RNA.

**Antigen:** The foreign particles or substances that trigger an immune response.

**Apoptosis:** In multicellular organisms, cells that are no longer needed or are a threat to the organism are destroyed by a tightly regulated cell suicide process known as programmed cell death.

**ATP:** A high energy molecule that can be split apart to release energy for many different processes in living things.

**Autotroph:** An organism that makes its own food.

**Bacteria:** Microscopic living organisms, usually one-celled, that can be found everywhere. They can be dangerous, such as when they cause infection, or beneficial, as in the process of fermentation (such as in wine) and that of decomposition.

**Binary fission:** The asexual reproduction in bacteria.

**Biomass:** The total mass of all living material in a specific area, habitat, or region.

**Biome:** A major ecological community of organisms adapted to a particular climatic or environmental condition on a large geographic area in which they occur.

**Biotic:** Of, pertaining to, or produced by life or living organisms.

**Capillary:** the smallest blood vessels that connect veins to the arteries and are the site of all exchange with the environment.

**Carbohydrate:** Any of the group of organic compounds consisting of carbon, hydrogen, and oxygen, usually in the ratio of 1:2:1, hence the general formula:  $C_n(H_2O)_n$ . Examples include sugar, starch, cellulose and gums.

**Carbon:** All living things contain carbon in some form. Carbon is the primary component of macromolecules, including proteins, lipids, nucleic acids, and carbohydrates. Carbon's molecular structure allows it to bond in many different ways and with many different elements.

**Carrying capacity:** A biological species in an environment is the maximum population size of the species that the environment can sustain indefinitely, given the food, habitat, water, and other necessities available in the environment. (Represented by the letter K)



**Catabolic reaction:** The process involving a series of degradative chemical reactions that break down complex molecules into smaller units, usually releasing energy in the process. (Compare anabolic)

**Catalyst:** A molecule that speeds up a chemical reaction by lowering the activation energy.

**Cell Cycle:** The continuous series of events that all somatic cells go through that includes mitosis, cytokinesis, and interphase.

**Cell signaling:** Part of any communication process that governs basic activities of cells and coordinates all cell actions.

**Cell Wall:** Structural part of some cells that can be made of cellulose, peptidoglycan, or chitin depending on what kingdom the organism belongs to.

**Cellular respiration:** The process of breaking down glucose to make ATP. (Look up glycolysis, Krebs cycle, ETC)

**Central Dogma of Biology:** Provides the basic framework for how genetic information flows from a DNA sequence to a protein product inside cells. This process of genetic information flowing from DNA to RNA to protein is called gene expression.

**Cholesterol:** The steroid embedded in the cell membrane that keeps the membrane fluid and strong.

**Chloroplast:** The cell part responsible for photosynthesis in eukaryotic cells.

**Chromatin:** The unwound form of DNA that is accessible for making RNA.

**Chromosomes:** The DNA when it is wrapped up tightly around proteins during metaphase.

**Clade:** A group of organisms believed to have evolved from a common ancestor, according to the principles of cladistics.

**Classification:** The process by which scientists group living organisms. (cladogram, taxonomy, evolutionary tree, phylogeny) also (Domain, Kingdom, Phylum, Class, Order, Family, Genus, Species)

**Codominance:** A form of dominance in which the alleles of a gene pair in a heterozygote are fully expressed thereby resulting in offspring with a phenotype that is neither dominant nor recessive.

**Codon:** The three nucleotide combination on the messenger RNA that matches up with the three letter combination on the transfer RNA and has the information to code for one amino acid

**Cohesion:** The attractive force between polar molecules of the same substance.

**Controlled variables:** The many characteristics of the experimental group and control group which are held constant.

**Covalent bond:** An intramolecular bond where atoms are sharing electrons equally.

**CRISPR:** Stands for Clustered Regularly Interspaced Short Palindromic Repeats, which are the hallmark of a bacterial defense system that forms the basis for CRISPR-Cas9 genome editing technology.

**Cytokinesis:** After mitosis or meiosis it is the “splitting” of the cytoplasm to form two or four new cells each with its own nucleus.

**Dehydration synthesis reaction:** The type of reaction that links together monomers to make polymers and release water in the process. (opposite hydrolysis reaction)

**Dependent variable:** The variable being tested and measured in a scientific experiment.(y-axis)

**Diploid:** Cells that have two copies of each kind of chromosome.

**Diffusion:** Net passive movement of particles (atoms, ions or molecules) from a region in which they are in higher concentration to regions of lower concentration. (passive transport)

**DNA ligase:** The enzyme that splices DNA together in genetic engineering and the Okazaki fragments of replication.

**Dominant:** An allele or a gene that is expressed in an organism’s phenotype, masking the effect of the recessive allele or gene when present. (ex. BB)

**Ecosystem:** A system that includes all living organisms (biotic factors) in an area as well as its physical environment (abiotic factors) functioning together as a unit.

**Endocrine system:** Chemically controls the various functions of cells, tissues, and organs through the secretion of hormones.

**Endoplasmic reticulum:** the series of membranes inside the cell that allow for passage of materials through the cytoplasm and the synthesis of lipids.

**Endosymbiosis:** The theory that eukaryotic cells arose from prokaryotic cells that lived closely together to the point that we now call these former cells “mitochondria” and “chloroplasts”.

**Enzyme:** An organic catalyst that lowers the activation energy of chemical reactions in organisms thus increasing the rate of reaction.

**Eukaryotic cell:** A cell with a nucleus and membrane bound organelles.

**Evolution:** The process through which the characteristics of organisms change over successive generations, by means of genetic variation and natural selection. It is most commonly defined as "changes in gene frequencies in populations.

**Exons:** A coding region of a gene that contains the information required to encode a protein. (gene expression – introns)

**Facilitated transport:** The movement of molecules across the cell membrane without the use of ATP, but with the help of a protein.

**Fruit:** The ripened ovary of a plant.

**Gametes:** The haploid cells produced by meiosis.

**Gene:** The section of DNA that is responsible for the production of one polypeptide.

**Genetics:** The study of heredity, or how the characteristics of living things are transmitted from one generation to the next.

**Genetic engineering:** The process of combining the DNA of two different organisms.

**Genome:** The entire complement of chromosomes in an individual.

**Genotype:** A set of alleles that determines the expression of a particular characteristic or trait (phenotype)

**Global Warming:** The increase in carbon dioxide and other gases causes heat to be trapped and thus raises the temperature of the Earth and possibly could lead to flooding and climate change.

**Glycerol:** The three carbon backbone molecule of the triglycerides.

**Glycogen:** The polysaccharide that is how animals store glucose in their liver.

**Gonads:** The site of meiosis in humans that includes the ovaries and testes.

**Haploid:** Cells that have one copy of each kind of chromosome.

**Hardy-Weinberg:** A model, theorem, or law, states that allele and genotype frequencies in a population will remain constant from generation to generation in the absence of other evolutionary influences. (5 conditions)

**Heterozygous:** An organism has two different alleles of a gene. (ex. Bb)

**Homeostasis:** The condition in animals where they keep their internal environment constant for a specific characteristic often as a result of negative feedback.

**Homology:** (1) A degree of similarity, as in position or structure, and that may indicate a common origin; a correspondence of structure (2) (evolutionary biology) A state of similarity in structure and anatomical position but not necessarily in function between different organisms indicating a common ancestry or evolutionary origin (3) (genetics) A condition denoting to the pair of chromosomes having corresponding genes for a particular trait or characteristic

**Homozygous:** The description of an individual who has the same allele for a trait on both homologous chromosomes. (ex. BB or bb)

**Hydrogen bond:** The weak intermolecular bond that forms between water molecules that causes them to "stick" to each other.

**Hydrolysis reaction:** Breaks polymers into monomers using a water molecule (opposite dehydration synthesis).

**Hydrophilic:** Molecules typically have polar groups enabling them to readily absorb or dissolve in water as well as in other polar solvents.

**Hydrophobic:** Literally means "the fear of water". Hydrophobic molecules and surfaces repel water. Hydrophobic liquids, such as oil, will separate from water.(nonpolar)

**Hypertonic:** Have a higher solution concentration (more solute) than another, more diluted solution.

**Hypothesis:** A testable explanation for a question that is often written in if... then... form.

**Hypotonic:** A solution that has a lower concentration of solutes than other solutions, made of the same solutes.

**Immune system:** Complex network of interacting cells, cell products, and cell-forming tissues that protects the body from pathogens and other foreign substances, destroys infected and malignant cells, and removes cellular debris: the system includes the thymus, spleen, lymph nodes and lymph tissue, stem cells, white blood cells, antibodies, and lymphokines.

**Incomplete dominance:** The type of inheritance where the heterozygous individual has a blend of the dominant and recessive trait.

**Independent variable:** The variable that is changed or controlled in a scientific experiment to test the effects on the dependent variable. (x-axis)

**Innate:** Behavior that an organism is not learned and is genetically determined.

**Insulin:** The hormone that lowers blood sugar by having it stored as glycogen in the liver and increasing cellular uptake.

**Introns:** A noncoding, intervening sequence of DNA within a gene that is transcribed into mRNA but is removed from the primary gene transcript and rapidly degraded during maturation of the RNA product. (gene expression - exons)

**Lagging strand:** The DNA strand that is replicated discontinuously from the 5' to the 3' direction. (see Okazaki fragments)

**Leading strand:** The DNA strand that is synthesized continuously during replication in the 5' to 3' direction.

**Lipid:** A substance of biological origin that is soluble in nonpolar solvents. It comprises a group of naturally occurring molecules that include fats, waxes, sterols, steroids, fat-soluble vitamins (such as vitamins A, D, E, and K, monoglycerides, diglycerides, triglycerides, and phospholipids.

**Logistic:** The type of population growth where the population has reached the carrying capacity and stays at a relatively constant level as indicated by a J curve.

**Marker proteins:** Proteins embedded in the cell membrane which allow organisms to differentiate between self and non-self cells.

**Meiosis:** The type of nuclear division that leads to four nuclei with a haploid complement of chromosomes produced from one diploid nucleus.

**Messenger RNA:** RNA made from DNA that carries the nucleotide template to the ribosome for protein synthesis.

**Metabolic pathway:** A series of enzyme-catalyzed reactions so arranged that the product of one reaction is the substrate of the next.

**Mitochondria:** In eukaryotic cells it is the site of the Krebs cycle and electron transport chain of aerobic cellular respiration

**Mitosis:** The type of nuclear division that leads to two nuclei with the entire diploid complement of chromosomes.

**Mutation:** A change in the DNA either by changing a chromosome's structure or the order of nucleotides. (point, insertion, and deletion)

**Natural selection:** The theory that states explains how a population changes over time to reflect the individuals who are most successful.

**Nervous system:** In vertebrates is made up of the brain and spinal cord, nerves, ganglia, and parts of the receptor organs and that receives and interprets stimuli and transmits impulses to the effector organs

**Nucleic acid:** Consist of either one or two long chains of repeating units called nucleotides, which consist of a nitrogen base (a purine or pyrimidine) attached to a sugar phosphate. The two main nucleic acids are DNA and RNA.

**Nucleotides:** The monomer subunit that links together along the sugar phosphate backbone to form nucleic acids (DNA - A,T,C,G & RNA -A,U,G,C).

**Null hypothesis:** In statistics, the premise that any difference observed in an experiment is simply the result of random differences that arise from drawing two finite samples from the same population.

**Okazaki fragments:** Relatively short fragments of DNA synthesized on the lagging strand during DNA replication.

**Oncogene:** A gene that is a mutated (changed) form of a gene involved in normal cell growth. Oncogenes may cause the growth of cancer cells.

**Organelle:** Any of the specialized structures within a cell that perform a specific function (e.g., mitochondria, ribosomes, endoplasmic reticulum, golgi body, nucleus, ribosomes).

**Osmosis:** Movement of a solvent (such as water) through a semipermeable membrane (as of a living cell) into a solution of higher solute concentration that tends to equalize the concentrations of solute on the two sides of the membrane.

**Oxidative phosphorylation:** the process in which ATP is formed as result of the transfer of electrons from NADH or FADH<sub>2</sub> to O<sub>2</sub> by a series of electron carriers. This process, which takes place in mitochondria, is the major source of ATP in aerobic organisms.

**Pathogen:** A bacterium, virus, or other microorganism that can cause disease.

**Passive transport:** The transport of molecules across the cell membrane without the use of energy.

**Phenotype:** The physical appearance or biochemical characteristic of an organism as a result of the interaction of its genotype and the environment.

**Photosynthesis:** The chemical reaction that makes glucose and oxygen from water and carbon in the presence of sunlight. (Calvin cycle)

**Phylogenetic tree:** A graphic representation of lines of descent among organisms or their genes. (Compare cladogram, evolutionary tree, taxonomy)

**Plasma membrane:** The outer selectively permeable membrane of ALL cells.

**Polar bond:** A bond where the atoms are sharing electrons unequally creating small negative and positive charges on the atoms.

**Population:** The members of a species within a specific area that has gene flow between its members. A group of organisms of one species that interbreed and live in the same place at the same time and have gene flow between its members. (e.g. deer population)

**Primary productivity:** The amount of photosynthesis in an ecosystem.

**Probability:** The likelihood of an event to occur. It is used in predicting the outcome of a genetic cross or of a random experiment.

**Prokaryotic:** Cells that have no nucleus or membrane bound organelles.

**Protein:** Long chain polymer of amino acids with 20 different common sides. They are coded for by genes and form the basis of living tissues. They also play a central role in biological processes. (Compare enzymes)

**Protista:** The kingdom that has predominantly unicellular eukaryotic organisms including algae, protozoans, and slime molds.

**Recessive:** An allele that produces its characteristic phenotype only when it is paired is identical. (ex. Bb)

**Redox reactions:** A redox reaction is shorthand for an oxidation-reduction reaction and is a chemical reaction in which one molecule loses electrons while another molecule gains electrons.

**Replication:** The duplication of the DNA during the middle "s phase" of interphase during the cell cycle. (poly-A-tail & 5 cap)

**Reproductive barriers/isolation:** Different species may live in the same area, but properties of individuals prevent them from interbreeding. (pre-zygotic and post-zygotic mechanisms)

**Restriction enzymes:** Enzymes that are used to "cut" DNA into pieces that often have "sticky" ends.

**Ribosome:** The part of the cell responsible for dehydration synthesis of proteins using the mRNA template.

**RNA:** The single stranded nucleic acid with uracil instead of the thymine found in DNA.(mRNA, rRNA, and tRNA)

**RNA polymerase:** The enzyme that makes RNA from DNA.

**Selectively permeable:** Cell membrane is one that allows certain molecules or ions to pass through it by means of active or passive transport.

**Sex chromosomes:** The 23rd pair of chromosomes in humans that determine whether the offspring is male or female.

**Speciation:** The process of splitting one biological lineage into two biological lineages that evolve independently from one another.

**Species:** A group of similar looking organisms that can reproduce to make fertile offspring.

**Stem cell:** In animals, an undifferentiated cell that is capable of continuous proliferation.

**Stomata:** The small openings on the underside of leaves that allow for carbon dioxide to come in and oxygen to escape.

**Substrate:** A molecule upon which an enzyme acts. Enzymes catalyze chemical reactions involving the substrate(s).(see enzymes)

**Symbiosis:** A long term relationship between organisms of two different species where at least one of the organisms benefits.

**Sympatric speciation:** An evolutionary process that drives this type of division between species that occupy the same habitat. (Compare allopatric speciation)

**Taxonomy:** The science of defining and naming groups of biological organisms on the basis of shared characteristics. (see cladogram, taxonomy, evolutionary tree, phylogeny)

**Trait:** Characteristics or attributes of an organism that are expressed by genes and/or influenced by the environment.

**Transcription:** The making of RNA from DNA.

**Transfer RNA:** RNA made from DNA that attaches to amino acids and delivers them to the mRNA in the ribosome.

**Translation:** The process of making proteins from the mRNA template.

**Transpiration:** The evaporation of water from the stomata of a leaf that allows water to be pulled up a stem.

**Uterus:** The place where the blastocyst implants and grows in a human female.

**Virus:** A small infectious agent that replicates only inside the living cells of other organisms. Can infect all types of life forms, from animals and plants to microorganisms, including bacteria and archaea.

**Water:** Water is regarded as the universal solvent primarily due to its chemical and physical properties.

**Water potential:** The measure of the relative tendency of water to move from one area to another, and is commonly represented by the Greek letter  $\Psi$  (Psi). Determined by taking into account two factors - osmotic or (solute) potential ( $\Psi_S$ ) and pressure potential ( $\Psi_P$ ).

**Zygote:** The fertilized egg.