WELCOME TO ADVANCED PLACEMENT BIOLOGY

The two main goals of AP Biology are to help you develop a conceptual framework for modern biology and to gain a deeper appreciation of science as a process (as opposed to an accumulation of facts). Because of the rapid pace of learning in the life sciences our primary emphasis is on developing an understanding of unifying concepts that connect the major topics of biology. The AP Biology Curriculum centers around the four Big Ideas and you will need to not only know these but also understand how they all relate to every aspect of biology:

- Big Idea 1: The process of evolution drives the diversity and unity of life.
- Big Idea 2: Biological systems utilize free energy and molecular building blocks to grow, to reproduce and to maintain dynamic homeostasis.
- Big Idea 3: Living systems store, retrieve, transmit and respond to information essential to life processes.
- Big Idea 4: Biological systems interact, and these systems and their interactions possess complex properties.

What to do before the first day of school:

- AP Biology was designed by a select group of college professors and high school science teachers to be equivalent to an introductory college biology course. Visit the College Board site (below) to explore what an AP Biology course is like:
  https://apstudent.collegeboard.org/exploreap?affiliateId=apcentral&bannerId=exploreap1

- Take a good look through our class website and explore the units and helpful links!
  www.gwg-apbiology.weebly.com

- Finish the assignments listed below.
  o *Assignment No 1* – Copy the notes from Unit 8 ECOLOGY from our class website into your binder and complete the HHMI Biointeractive Click & Learn on Biomes. Watch the Videos to support your understanding!
  o *Assignment No 2* – The Language of Science.
  o *Assignment No 3* – Science Skills Review.
  o *Assignment No 4* – Graphing Review.
  o *Assignment No 5* – Analyzing Scientific Articles.

ALL WORK DUE ON THE FIRST DAY OF CLASS. Expect a test on Ecology within the first week back.

Assignment No. 2 – The Language of Science

Because vocabulary in this course can be a stumbling block, you need to take some time to review the Latin/Greek roots that form many of our scientific terms. It will make life in AP Biology much easier if you KNOW these prefixes and suffixes.

Please complete the following chart using the reference document on the website titled Scientific Root Words Prefixes and Suffixes.

Word	Meaning	Word	Meaning
a / an		-lysis	
aero		macro	
anti		meso	
amphi		-meter	
aqua / hydro		micro	
arthro		mono	
auto		morph	
bi / di		multi / poly	
bio		neuro	
cephal		ov	
chloro		-path / -pathy	
chromo		phago	
-cide		-philia	
cyto		-phobia	
derm		photo	
ecto / exo		-phyll	
endo		-pod	
epi		primi / archea	
gastro		proto	
-genesis		pseudo	
haplo		saccharo	
hemo		soma	
herba		-stasis	
hetero		sub	
homo		sym /syn	
hyper		-synthesis	
hypo		-taxis	
intra		therm	
-itis		tri	
kary		-troph	
-lateral		-tropism	
leuco / leuko		zoo / zoa	
-logy		-zyg/ -zygous	

Once you have completed the previous table, use it to develop a definition, in your own words, for each of the following terms.

1. Hydrology _____

2. Cytolysis _____

3. Protozoa _____

4. Epidermis _____

5. Spermatogenesis _____

6. Exoskeleton _____

7. Abiotic _____

8. Pathogen _____

9. Pseudopod _____

10. Hemophilia _____

11. Endocytosis _____

12. Herbicide _____

13. Anaerobic _____

14. Bilateral _____

15. Autotroph _____

16. Monosaccharide _____

17. Arthropod _____

18. Polymorphic _____

19. Hypothermia _____

20. Biogenesis _____

This is a review of foundational science concepts and skills – we will not spend mush class time on all these concepts, as they should have been learned already. Please make sure that you know them and if not, be sure to study through them. *Please hand write in pencil or pen.*

Chemistry Review:

1. Contrast the term element with compound.

2. Know the symbols of the following elements and their charge (combining capacity):

    a. Carbon:

    b. Hydrogen:

    c. Oxygen:

    d. Nitrogen:

    e. Phosphorus:

    f. Sulfur:

1. Label the diagram below and define the terms that you label.
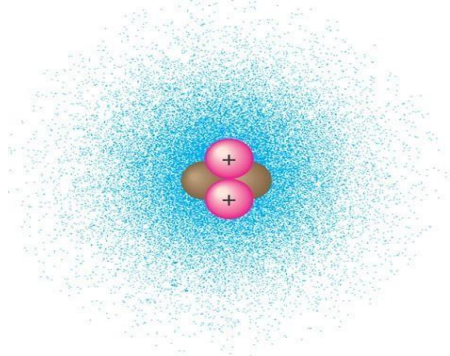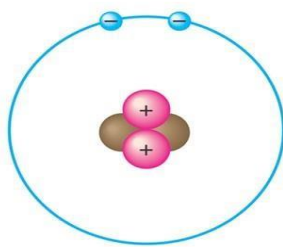
(a)   (b)

2. Contrast the terms atomic mass and atomic number.

3. What determines interactions between atoms? Why are valence electrons important?

4. Define the following terms:

   a. Chemical bond

   b. Covalent bond

   c. Nonpolar covalent bond

   d. Polar covalent bond

5. Write the molecular formula for the following compounds.

Oxygen gas	
Carbon dioxide	
Glucose	
Nitrogen gas	
Ammonia	
Water	

6. How do ionic bonds compare with covalent bonds?

7. What are hydrogen bonds?

8. Define the following terms:

   a. Solute

   b. Solvent

   c. Aqueous solution

   d. Hydrophilic

   e. Hydrophobic

   f. Molarity

9. Define the terms acid and base? How might you recognize their chemical formulae?

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

Biology Review:

11. Define the following terms:

   a. Biology:

   b. Hypothesis:

   c. Observation:

   d. Homeostasis:

12. What are the 6 main characteristics of life?

13. Scientists are testing a new pain reducing drug in a trial with 50 patients. Group A gets the drug while group B gets a placebo pill. Level of pain is being recorded for each patient.

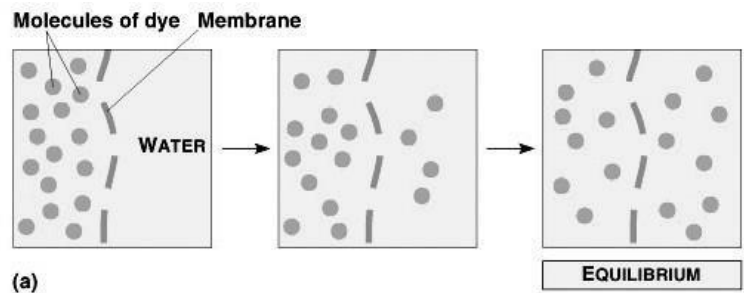   a. What is the control group:

   b. Experimental group:

   c. Independent variable:

   d. Dependent variable:
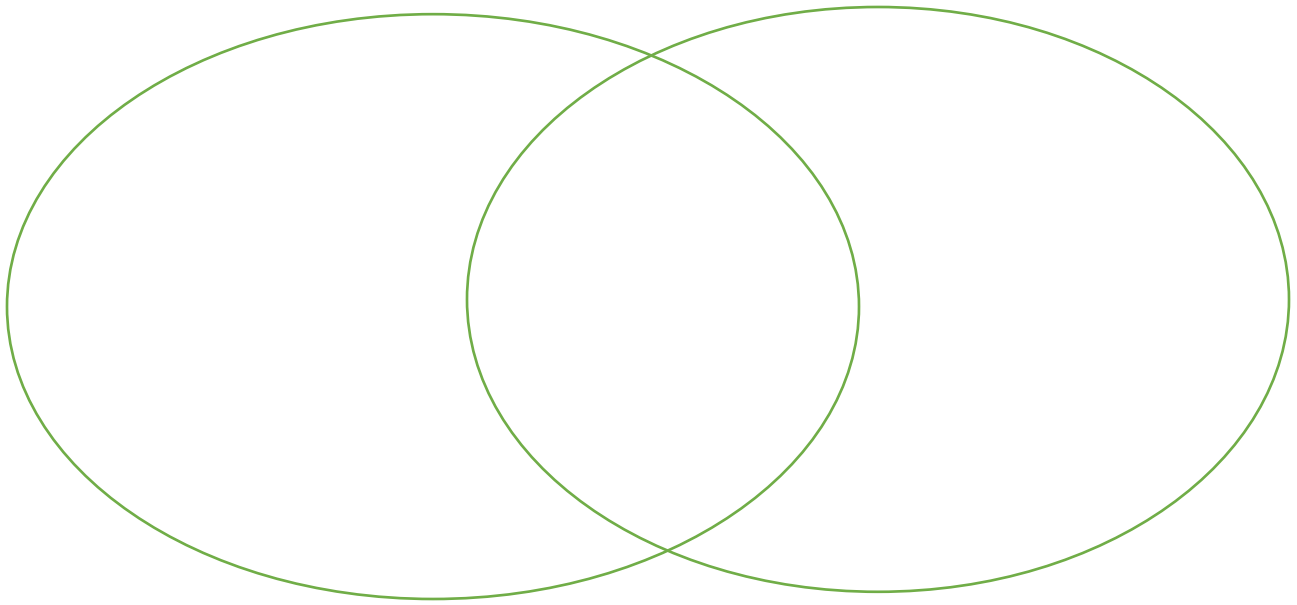
14. Using the picture to the right:

   a. Explain *equilibrium*:

   b. Label the most concentrated side of the membrane in the first picture.

Molecules of dye   Membrane
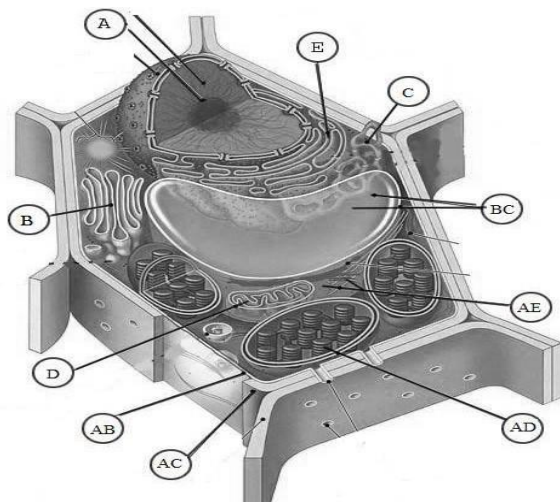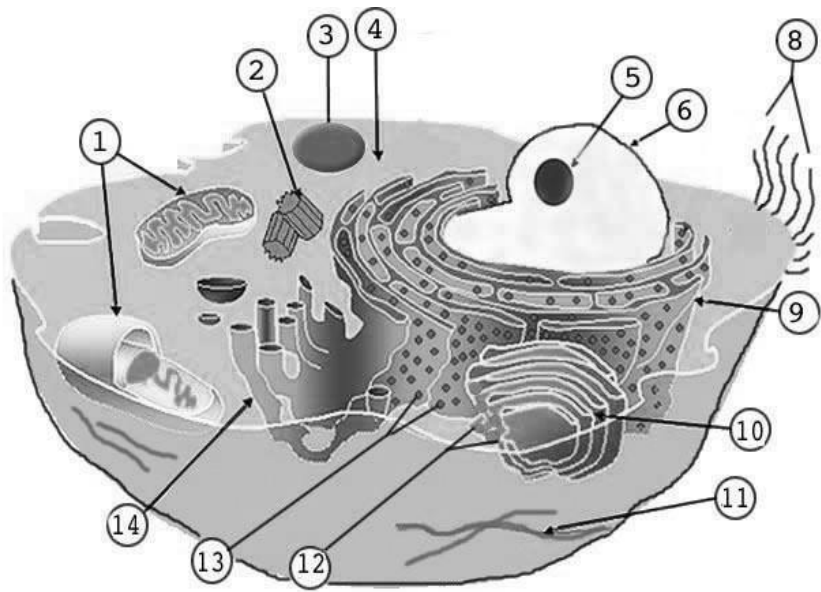
WATER

(a)

EQUILIBRIUM

15. Complete the diagram comparing DNA and RNA:

16. Draw a generalized nucleotide

17. Write a sentence to describe all of the features of DNA. (You can use one you've heard before!)

18. Label each of the pinned strutures:

1	9	C
2	10	D
3	11	E
4	12	AB
5	13	AC
6	14	AD
7	A	AE
8	B	BC

19. The tall allele, *T, is dominant to the short* allele, *t,* in Mendel's pea plants. You examine a pea plant that has a *phenotype* of *short*. What is its *genotype*?

20. If two plants that are heterozygous for height are crossed what are the possible genotypes of the offspring? What is the genotypic ratio? What is the phenotypic ratio? Create a Punnett square to support your answer.

Assignment No. 4 – Graphing Skills Review

Graphing is an important procedure used by scientists to display the data that is collected during a controlled experiment. **Line graphs** must be constructed correctly to accurately portray the data collected. Many times the wrong construction of a graph detracts from the acceptance of an individual's hypothesis A
graph contains five major parts:
> **a.** Title
> **b.** The independent variable
> **c.** The dependent variable
> **d.** The scales for each variable
> **e.** A legend

- The **TITLE**: depicts what the graph is about. By reading the title, the reader should get an idea about the graph. It should be a concise statement placed above the graph.
- The **INDEPENDENT VARIABLE**: is the variable that can be controlled by the experimenter. It usually includes time (dates, minutes, hours, etc.), depth (feet, meters), and temperature (Celsius). This variable is placed on the X axis (horizontal axis).
- The **DEPENDENT VARIABLE**: is the variable that is directly affected by the independent variable. It is the result of what happens because of the independent variable. Example: How many oxygen bubbles are produced by a plant located five meters below the surface of the water? The oxygen bubbles are dependent on the depth of the water. This variable is placed on the Y-axis or vertical axis.
- The **SCALES** for each Variable: In constructing a graph one needs to know where to plot the points representing the data. In order to do this a scale must be employed to include all the data points. This must also take up a conservative amount of space. It is not suggested to have a run on scale making the graph too hard to manage. The scales should start with 0 and climb based on intervals such as: multiples of 2, 5, 10, 20, 25, 50, or 100. The scale of numbers will be dictated by your data values.
- The **LEGEND**: is a short descriptive narrative concerning the graph's data. It should be short and concise and placed under the graph.
- The **MEAN** for a group of variables: To determine the mean for a group of variables, divide the sum of the variables by the total number of variables to get an average.
- The **MEDIAN** for a group of variables: To determine median or "middle" for an even number of values, put the values in ascending order and take the average of the two middle values. e.g.   2, 3, 4, 5, 9, 10   Add 4+5 (2 middle values) and divide by 2 to get 4.5
- The **MODE** for a group of variables: The mode for a group of values is the number that occurs most frequently.
  > e.g.   2, 5, 8, 2, 6, 11 The number 2 is the mode because it occurred most often (twice)

Rules and Tips for Graphing:
1. Always use a pencil to draw your graph. It's easier to fix mistakes (Or use Excel!).
2. Always draw lines with a ruler. Do not freehand. Use at least half of your paper for the graph.
3. Make sure Independent Variable is on the X-axis and Dependent Variable is on the Yaxis.
4. Include all parts: Title, Axis Labels WITH Units, Legend
5. If you are graphing multiple subjects, use different colored or patterned lines and explain what they are in the legend.
6. Choose an appropriate graph to explain your data. Examples:
   > a. LINE: Measuring a change in something over time
   > b. BAR: Comparing individuals to each other with only one data point.
   > c. PIE: Show percentages that add up to 100%.

PROCEDURE 1: Using the following data, answer the questions below and then construct a line graph.

Depth in meters	Number of Bubbles / minute Plant A	Number of Bubbles / minute Plant B
2	29	21
5	36	27
10	45	40
16	32	50
25	20	34
30	10	20

1. What is the dependent variable and why?

2. What is the independent variable and why?

3. What is the mean, median, and mode of all 3 columns of data?
   i. Depth: Mean_____Median_____Mode_____
   ii. Bubbles - Plant A: Mean _____Median_____Mode_____
   iii. Bubbles - Plant B: Mean _____Median_____Mode_____

4. Come up with an explanation for the data in this graph, including the varying rates in plant A and B.

5. Graph the data on the following page and label it appropriately. Include a title, legend and labelled axes.
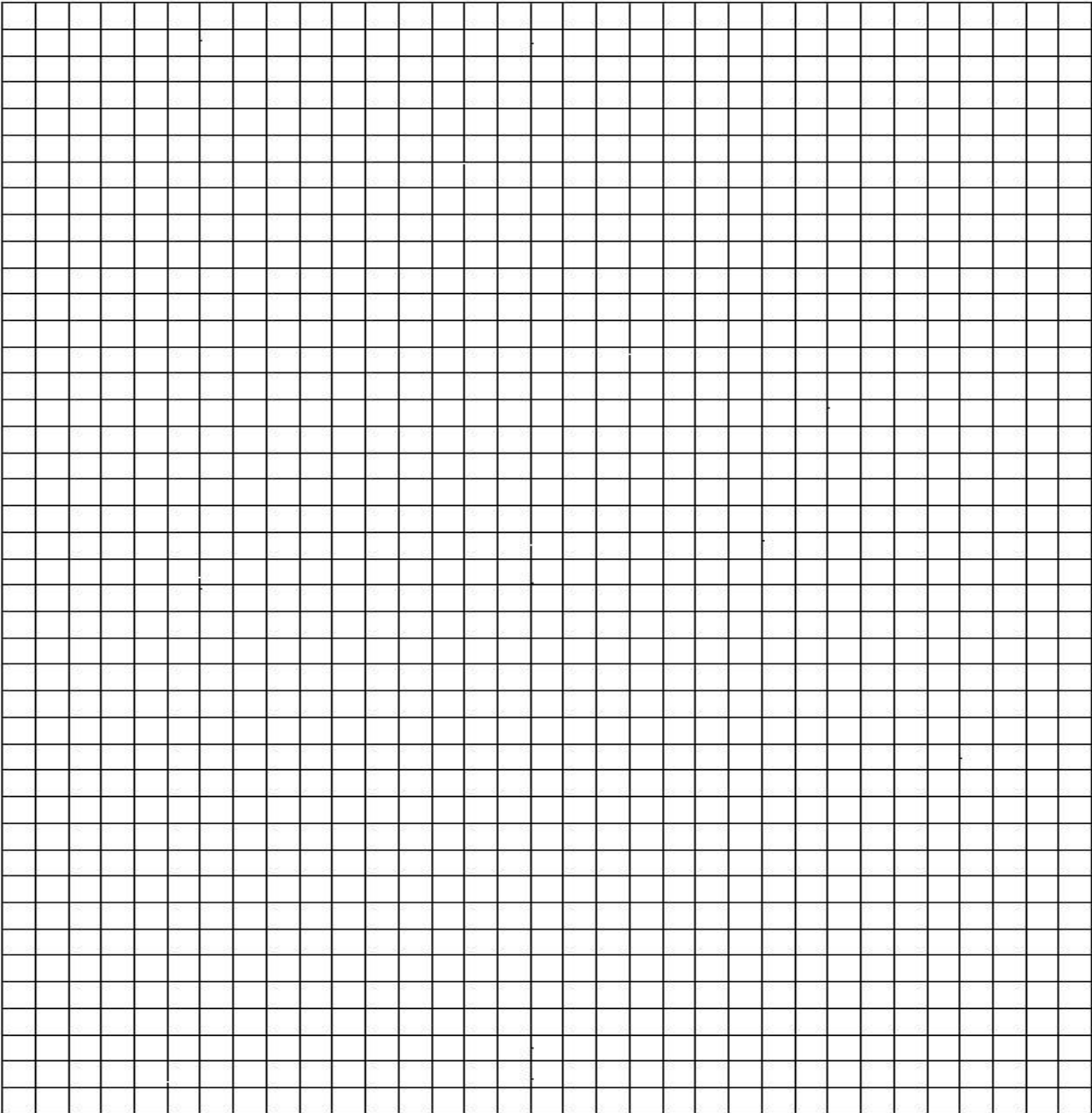
PROCEDURE 2:

Diabetes is a disease affecting the insulin producing glands of the pancreas. If there is not enough insulin being produced by these cells, the amount of glucose in the blood will remain high. A blood glucose level above 140 mL/L for an extended period of time is not considered normal. This disease, if not brought under control, can lead to severe complications and even death.

Answer the following questions concerning the data below and then graph it.

Time After Eating hours	Glucose ml / Liter of Blood Person A	Glucose ml / Liter of Blood Person B
0.5	170	180
1	155	195
1.5	140	230
2	135	245
2.5	140	235
3	135	225
4	130	200

1. What is the dependent variable and why?

2. What is the independent variable and why?

3. Which, if any, of the above individuals (A or B) has diabetes?

4. What data do you have to support your hypothesis?

5. If the time period were extended to 6 hours, what would the expected blood glucose level for person B?

6. What conclusions can be drawn from the data in graph 2?

PROCEDURE 3: The chart to the right is the raw data of the mL of water expelled by the contractile vacuole of a bacteria in different types of solutions.

This data was then summarized using averages in the table below.

Solution	Baseline	Saline	Deionized
Average (in mL)	16.4	7.30	25.87
Standard deviation (error)	6.10	3.43	5.23

Group	Baseline	Saline	Deionized
1	11.67	6.33	24.33
2	12.14	7.55	22.12
3	15.23	4.56	27.89
4	16.89	3.49	30.17
5	21.72	8.43	34.44
6	11.38	9.12	22.49
7	8.49	3.46	21.16
8	25.29	4.21	30.26
9	24.41	7.56	28.16
10	13.66	11.16	24.59
11	24.88	15.19	29.62
12	11.1	6.49	15.19

1. Construct a bar graph of the amount of water expelled for each solution type.

2. Each group has an error value or "standard deviation". Show this on your graph using lines above and below each bar. Use the example to the right of "Experiment 1" as a guide. **We will do this together in September.**

Experiment 1

Mean ± SEM, N=5
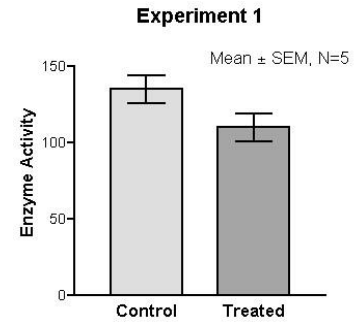
1. Why are averages used to construct graphs?

2. What does "standard deviation" mean?

We cannot emphasize enough how important it is that you carefully read these passages. We have included the questions below to ensure that you actually read the article and also to highlight some of the more crucial concepts, but the primary purpose of the assignment is for you to encounter important biological ideas in a palatable and even entertaining medium. Zimmer and Sapolsky are renowned for their ability to articulate scientific information in an engaging and clear manner and we sincerely hope that you find the reading enjoyable. We recommend reading each selection straight through in its entirety before going back and answering the questions. Please type or handwrite the answers on a separate piece of paper. *Articles are linked on the website under summer assignment.*

"E. Coli and the Elephant"

1. What does the "E" stand for in E. Coli? Why?

2. Explain what Kluyver meant by his exclamation in 1926: "From the elephant to butyric acid bacterium—it is all the same!"

3. What did Thomas Morgan demonstrate using Drosophila melanogaster

4. What did Beadle and Tatum discover in 1941 by studying Neurospora crassa?

5. The section on pages 7-12 is titled "The Unity of Life." What unifies life?

6. What did Delbruck learn from sick E. coli? What was making the bacteria sick?

7. What was Avery (and his colleagues) primary confribution to the field of genetics?

8. Alfred Hershey and Martha Chase conducted one of the most famous experiments of all time. Describe the experiment and what they concluded.

9. Matthew Meselson and Frank Stahl "conducted what came to be known as the beautiful eXperiment in biology." Explain.

10. "What is true for E.coli is true for the elephant." Explain.

11. Describe three ways in which E. coli is much more complex than scientists like Monod initially believed.

12. "The first species whose metabolism scientists mapped in fine detail was E.coli. What does it mean to map a metabolism?

13. "As E. coli juggles iron, captures energy, and transforms sugar into complex molecules, it seems to defy the universe." What does Zimmer mean by this statement, i.e. what is being defied? How is the universe actually not being defied?

14. In what sense is E. coli a microcosm of life as a whole, and therefore microcosm a good title for a book about E. coli?

15. What are two amazing characteristics of E. coli 's propulsion system?

16. What "few elegant rules" allow E. coli to navigate its world successfully?

17. What is the "The Myth of the Tangled Spaghetti?" Why is it mythical?

18. Bacteria like E.coli can multiply at an incredible exponential rate. Why hasn't E. coli taken over and covered the planet?

"Boltzmann's Explanation of the Second Law of Thermodynamics"

1. What is the second law of thermodynamics?

2. How did Boltanann explain (i.e. provide theoretical foundation) the second law?

3. What is the cosmological question Susskind and other cosmology are still unable to answer?

"Genes, Claustrum, and Consciousness"

1. What is V. S. Ramachandran's favorite elegant idea?

2. Ravichandran believes that strategy that led to cracking the genetic code, might fruitfully be applied to what other question?

3. Briefly summarize the chain of events that led up to elucidating the structure of DNA.

4. "Watson and Crick didn't just describe DNA's structure, they explained its significance." What is the significance of DNA's structure recognized by Watson and Crick?

5. What is a claustrum?

6. What is histology?

7. What does the claustrum have to do with consciousness?

"A Gene for Nothing"

1. How have people known for a long time that cloning a human to produce two or more people with identical genomes wouldn't resulted in "one multibodied consciousness among the clones, a mind meld, an army of photocopies of the same soul?"

2. "For many, genes and the DNA that comprises genes represent the holy grail of biology, the code of codes...The worship at the altar of the gene rests on two assumptions." What are those two assumptions?

3. How is the first assumption mentioned in #2 mistaken?

4. How is the second assumption mentioned in #2 mistaken?

5. What, specifically, does a gene 'do?'

6. Sections of DNA that code for a protein (exons) are usually broken up by sections of non-protein-coding DNA (introns). What is one the roles of this non-coding DNA?

7. Use a specific example to describe the biochemical mechanism by which the expression Of a particular gene by be regulated by factors in the environment.

8. Using your new knowledge of major histocompatibility proteins, provide a biochemical mechanism to actually answer the question, "How do rodents use smell to distinguish friends from strangers?"

9. What percentage of DNA is non-coding?

10. According to Sapolsky, what does the phrase 'survival of the fittest' really mean?

11. Instead utilizing the language of the misinformed, what would be a more accurate way Of stating the idea behind 'genes determine behavior?'

12. Instead of claiming "evolution is mostly about natural selection for different assemblages of genes," what is a more accurate way of expressing what evolution really does?