AP Biology Summer Assignment 2018/2019

You MUST pick up your AP TEXTBOOK BEFORE the end of the school year in ROOM 90. You will NEED it for this assignment.

Due Dates and Assessment:
Task 1 will be due on the first day that we have AP Biology depending on the rotating schedule for the 2018/2019 school year. This will count as 50 points worth of your total summer assignment primary grade.

Task 2 will be due September 6 or 7, 2018 (depending on the rotating schedule). There will be a short quiz on September 6 or 7, 2018 (depending on the rotating schedule) to assess your understanding of the important chemistry topics covered in the chemistry review.

Task 3 will be due September 10 or 11, 2018 (depending on the rotating schedule). Your understanding is essential for the Macromolecules Unit. There will be a short pre-quiz on September 11 or 12, 2018 (depending on the rotating schedule) to assess your understanding of macromolecules.

The two quizzes (about 25 questions each) will be combined for 50 points worth of your total summer assignment primary grade.

Task 1: Analysis of Scientific Data and Graphs

You will be given a line graph, a bar graph, and a map to critically analyze with the intent of understanding data analysis, as well as, use a model for yourself (what to do and what not to do) with laboratory activity data and results. (Graphs and background information are provided on the following pages.) For each graph or map, answer the following questions:

1. Is there anything wrong with or missing from this graph/map? Explain. If not are there improvements that you would make to make the data easier to analyze?

2. A) What is the independent variable in the data set?
   B) What is the dependent variable in the data set?

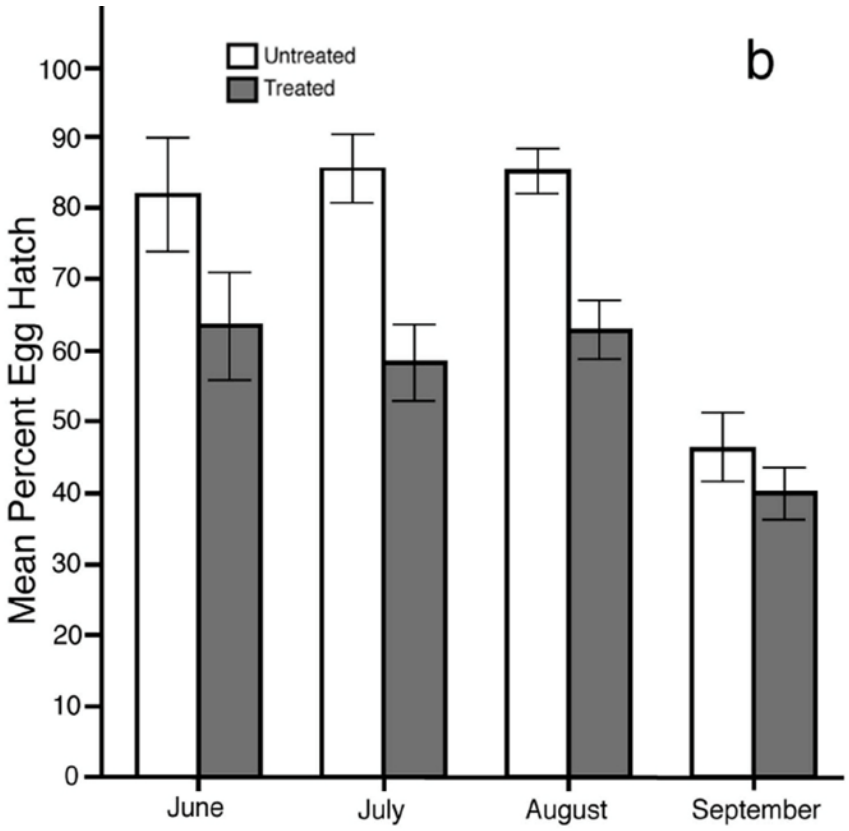
3. Does your graph have consistent and equal intervals on each axis? What is the importance of having consistent and equal intervals on both axes of a graph?

4. What do the brackets at the top of each bar/data point represent? (This question does not pertain to the map.)

5. Make an inference using the data on the graph/map.

6. A) Can you give a short explanation that describes what the data displayed on the graph/map is illustrating?
   B) What is a possible experimental hypothesis for this data set?
   C) What would be the corresponding null hypothesis?

Bar Graph



Caption: Percentage of Aedes albopictus mosquito eggs that hatched at sites where male mosquitoes infected with Wolbachia bacteria were released (gray bars) and at sites where the mosquito population was left untreated (white bars). The error bars represent 95% confidence intervals (CI).

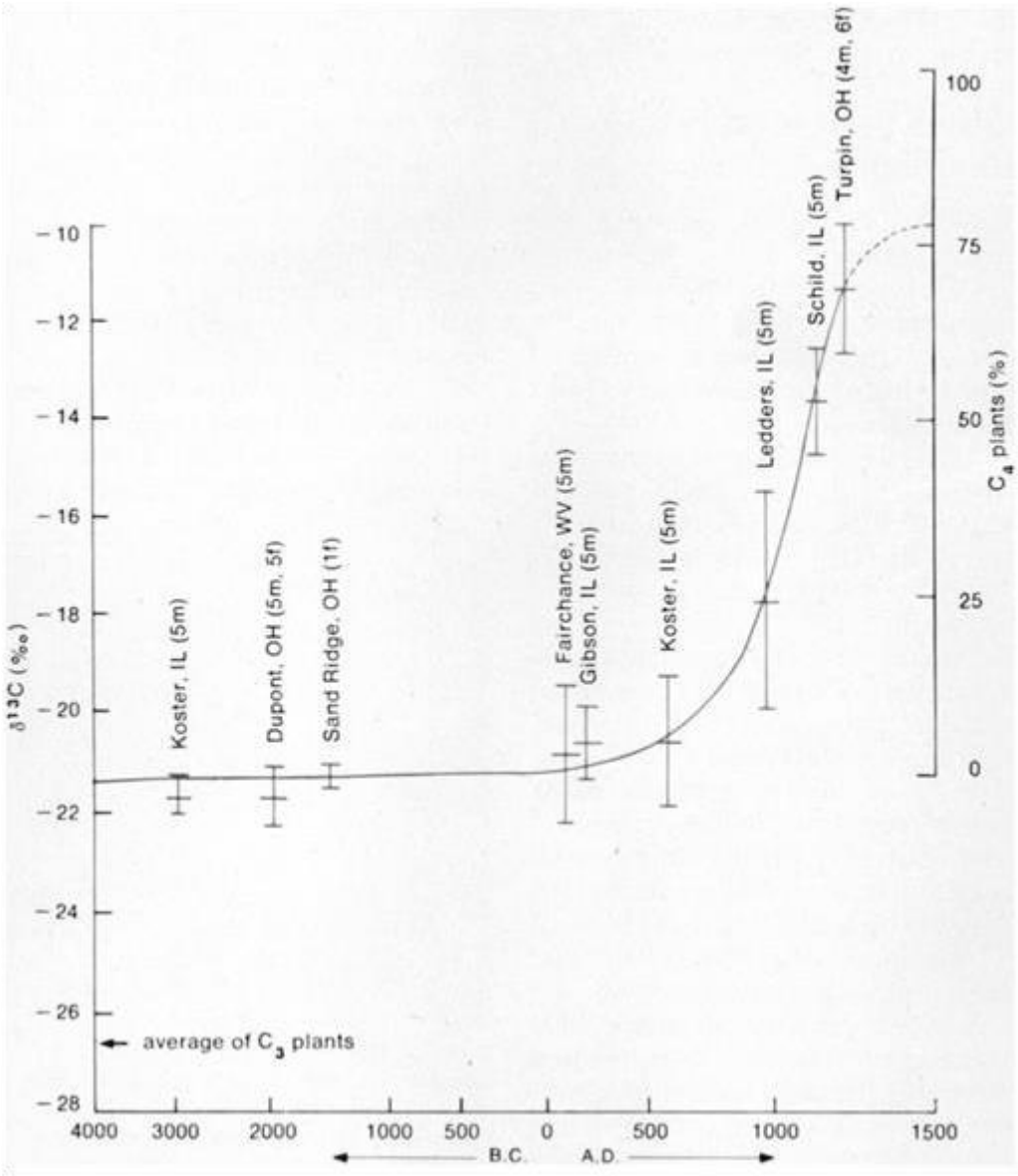
BACKGROUND INFORMATION

Some mosquito-borne pathogens, like the dengue, chikungunya, and Zika viruses, cause diseases for which there are not yet effective treatments or vaccines. Zika virus in particular has spread to more than 80 countries to date, making it a global concern. Zika can cause a debilitating illness of the nervous system called Guillain-Barré syndrome and, when a pregnant woman is infected, severe birth defects including microcephaly. An increasingly common approach to preventing the spread of these diseases is to target mosquito fertility rather than use insecticides, which can have negative environmental effects. One of these techniques involves using the naturally occurring *Wolbachia* bacteria that infect mosquitoes, making them, in some cases, infertile. When male mosquitoes are infected with *Wolbachia*, they must mate with an infected female to produce viable embryos. If they mate with an uninfected female, their sperm are unable to go through mitosis after embryo formation. Consequently, in the field, after mating with a *Wolbachia*-infected male, an uninfected wild female will lay eggs that never hatch. This is called cytoplasmic incompatibility.

In this study, researchers tested whether releasing *Wolbachia*-infected male *Aedes albopictus* (Asian tiger mosquitoes) would suppress populations of this mosquito species in their study area. First, they

infected male mosquitoes bred in the lab with a strain of *Wolbachia* known to cause this type of infertility. They worked with homeowners in the neighborhood (a suburban area of Lexington, Kentucky) and the Environmental Protection Agency (EPA) to carefully select the study area where they could release the infected mosquitoes. Each week for 17 weeks, they released 10,000 *Wolbachia*-infected male mosquitoes. The number of released mosquitoes outnumbered the native male population 10 to 1, a ratio expected to allow the released males to outcompete the native males for mating opportunities. The researchers collected adult mosquitoes and eggs at 15 sites where infected mosquitoes were released as well as at 11 sites nearby that were not treated with infected mosquitoes. The hatch rates of the eggs were then observed to assess the impact of the treatment on mosquito fertility.

Line Graph

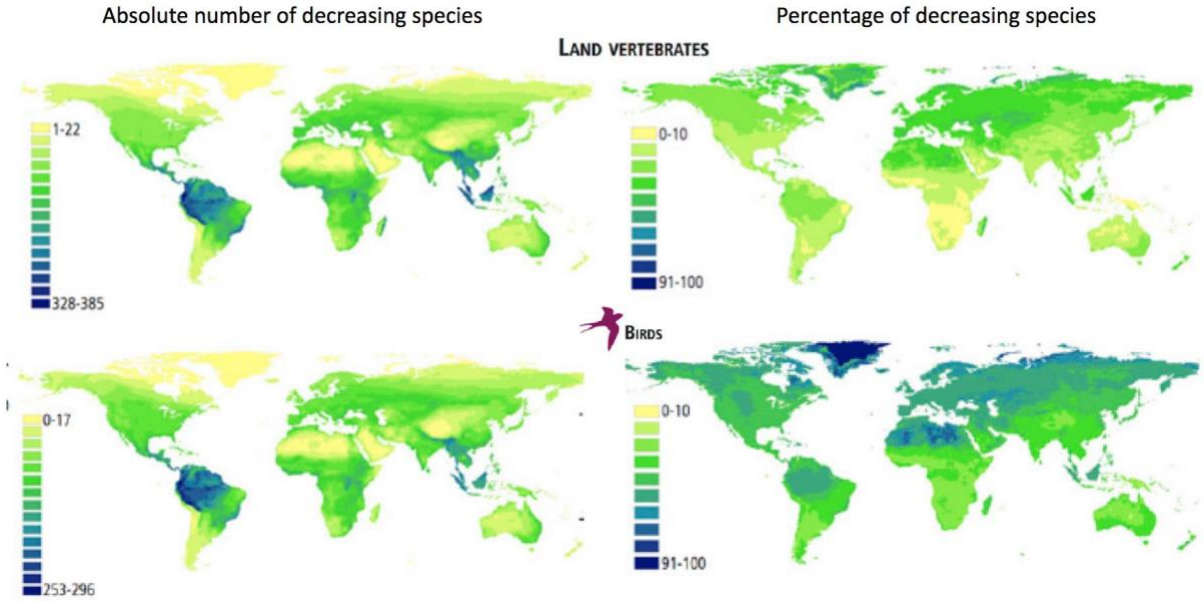


Caption: Carbon isotope ratio data in bone collagen from human skeletons found in Illinois, Ohio, and West Virginia, dated 4,000 B.C. to 1,500 A.D. The number and sex of the individuals found at each location are indicated in parentheses.

BACKGROUND INFORMATION

To study the change in diet as human populations changed lifestyles from hunter-gatherers to agriculturalists, Nikolaas van der Merwe and J. C. Vogel measured carbon isotopes in the collagen tissues of human skeletons from North America dated between 4,000 B.C. and 1,500 A.D. Stable isotopes are different forms of an element with slightly different atomic mass. For example, most carbon (^{12}C) has six protons and six neutrons in the nucleus and an atomic mass of 12, but ^{13}C has six protons and seven neutrons and an atomic mass of 13. Different species of plants contain different ratios of ^{12}C and ^{13}C isotopes depending on the pathway they use for carbon fixation during photosynthesis. Most of the native plants in the Americas are classified as C_3 plants, such as small-seeded cereal crops like rice, wheat, barley, and oats, which convert CO_2 to an initial three-carbon compound during photosynthesis. C_4 plants, such as corn and sugarcane, convert CO_2 to an initial four-carbon compound. C_4 plant tissues have a higher ratio of ^{13}C to ^{12}C isotopes than C_3 plants. When animals eat these plants, the carbon isotope ratios, or "isotopic signatures," are stored in their tissues, such as bone collagen. !s these tissues are formed, fractionation occurs, which means that the carbon isotope ratios change slightly. For humans who consume C_3 plants, the average fractionation when bone collagen is formed is +5.1‰. Prior to the domestication of corn, C_3 plants were the main food sources for prehistoric humans in North America. The graph above illustrates the change in plant consumption before and after the adoption of domesticated corn as a staple agricultural crop in the American Midwest.

Map



Caption: Global distribution of species declines over the past 115 years (1900–2015). Declines are measured as the number and percentage of species that declined per 10,000 km^2 area. The left panels show the absolute number of species whose populations have declined in each region; the right panels show the percentage of species that declined in each region. The top panels include all land vertebrates (amphibians, birds, reptiles, and mammals), whereas the bottom panels represent only bird species.

BACKGROUND INFORMATION

Extinctions are a regular occurrence over the course of geologic time. But catastrophic events in which many species go extinct over brief periods of time are rare. When our planet loses more than 70% of its species within a relatively short geological time interval, scientists refer to these cataclysmic losses as mass extinctions. In the past 540 million years alone, scientists estimate that there have been at least five such mass extinction events. Many experts warn that a sixth mass extinction may be on our doorstep, triggered by human activities and a rapidly growing human population that has destroyed habitats and ecosystems around the world. Today, we are seeing massively accelerated extinction rates that exceed normal extinction rates by a factor of 12. Experts estimate that at the current rate, 75% of our species will disappear in less than 200 years. Species extinctions are nearly always preceded by high regional population declines. In this study, researchers measured species population declines on a global scale that may contribute to the sixth mass extinction. The figure shows the results of a study examining population trends for 27,600 land vertebrate species from 1900 to 2015. The researchers found that 32% of these species, many of which are mammals and birds, are currently in decline. The researchers argue that aggressive species and habitat conservation within the next couple of decades are the only ways to avoid a catastrophic sixth mass extinction.

Task 2: Chemistry Review

This task will help you review or become familiar with important chemistry concepts that are essential to understand for this course. This should be a review from freshman year biology and sophomore year chemistry.
You need to complete the Chemistry Concepts and Skills Review(on the next page).

You can use the following resources to help you:

AP Biology Textbook Chapter 2: Basic Chemistry and Chapter 3: The Chemistry of Organic Molecules.

Khan Academy Videos:
Dehydration Synthesis
Hydrolysis
Chemical Bonding
Water and Hydrogen Bonding
Carbon as a Building Block for Life

Bozeman Science Videos:
Properties of Water
The Molecules of Life

Essential Chemistry Skills Review

1. Create a concept map that shows the relationships (including but not limited to similarities and differences) between the following terms. For each type of bond, give one example of a substance that bonds that way.
    a. Chemical Bond
    b. Ionic
    c. Covalent Bond
    d. Nonpolar Covalent Bond
    e. Polar Covalent Bond
    f. Hydrogen Bond

2. Identify the formula for the following compounds and list one reason why it is important to know in the field of biology:
    a. H_2O
    b. CO_2
    c. $C_6H_{12}O_6$
    d. O_2

3. What properties does carbon have that makes it the central atom in the chemistry of life?

4. Illustrate the process of hydrolysis and dehydration synthesis. (Hint: Use two monomers of a macromolecule to help you do this.) Compare and contrast the general characteristics of the reactants, products, and overall process of hydrolysis and dehydration synthesis.

5. Make a concept map showing the properties of water that make it so unique and essential to life and its processes. Include any information from the chemistry review to support and give more detail.

Task 3: Macromolecule Review

This task will help you review the information about macromolecules (protein, carbohydrate, nucleic acid, and lipid) that you should have learned in freshman biology. It is essential that you have a basic understanding of the macromolecules because we will be adding significantly more detail to your knowledge at a relatively rapid pace. This task will be directly aligned with your textbook. Navigating the textbook and critical reading skills are necessary for success in this course. Make sure you are using both the text and figures in the chapter to help you answer the questions.

Use Chapter 3: The Chemistry of Organic Molecules, in your textbook to complete the Macromolecules Review.

Macromolecules Review

Chapter 3: The Chemistry of Organic Molecules
2018/2019 AP Biology Summer Assignment

As you read the chapter and take notes, answer the following questions. The questions focus on the important content that you should know.

3.1 Organic Molecules (Should be a review of the chemistry review.)
1. What is the significance of the pairing of the carbon skeleton and functional groups for organic macromolecules?
2. In a short narrative, explain dehydration synthesis and hydrolysis in terms of monomers and polymers. (Hint: Use Figure 3.3 to help you.)
3. Answer the "Check Your Progress" questions on page 38.

3.2 Carbohydrates
1. What are the differences (structurally and functionally) between monosaccharides, disaccharides, and polysaccharides?
2. Compare and contrast the difference between the plant and animal methods of storage for polysaccharides.
3. Answer the "Check Your Progress" questions on page 42.

3.3 Lipids
1. BEFORE reading this section, look at Figure 3.10 on page 43. What are the structural similarities and differences between saturated fatty acids and unsaturated fatty acids?
2. Describe the interaction between lipids and water in which a membrane is formed. (Hint: Use Figure 3.11 to help.)
3. Answer the "Check Your Progress" questions on page 46.

(See next page)

3.4 Proteins

1. Describe the importance of an R group in an amino acid.
2. Draw and annotate a diagram depicting how a protein starts as a single amino acid and becomes a combination of polypeptides in its quaternary structure.
3. Answer the "Check Your Progress" questions on page 50.

3.5 Nucleic Acids

1. Draw and label the molecular structure of one side of a DNA double helix.
2. Compare and contrast DNA and RNA.
3. Answer the "Check Your Progress" questions on page 52.