AP Biology Summer Assignment 2016-17

Hello and welcome to AP Biology! This course is designed to be the equivalent of a two-semester introductory biology course usually taken as a prerequisite to upper level college biology courses. Over the course of this year, you will become familiar with major recurring themes that persist throughout all topics and material in the study of biology. The major themes (also known as "Big Ideas") are:

BIG IDEA 1: The process of evolution drives the diversity and unity of life.
BIG IDEA 2: Biological systems utilize energy and molecular building blocks to grow, to reproduce, and to maintain 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 interactions possess complex properties.

To successfully complete the course and meet all of the required objectives, you will occasionally be expected to do independent work both during the summer and throughout the school year. The several of the major themes from above will be introduced in this summer assignment as well as some data analysis skills and techniques that will be crucial to your success in AP Biology this year.

The first topic we will cover this year is Biochemistry because it will serve as a review of what you should know from having already taken Chemistry, and will allow us to get right into Biological Processes. We will be using a new textbook this fall, *Principles of Life, 2nd edition*. For this summer assignment, resources (hyperlinks) are provided.

It is necessary for each student to have access to the Internet and a personal or school e-mail address. I will periodically post notes and the calendar of assignments and topics we cover each class period on the class website, so internet access is critical.

If you have any questions regarding any part of the summer assignment, do not hesitate to e-mail me.
My e-mail is pedgerton@gsgis.k12.va.us

There are two parts to this assignment:

Part 1.
Fill out the second page of this packet (Student Information Sheet) and turn it into me on the first day of Early AP week (or the first day of school if you are unable to attend Early AP Week). This is a general survey for me to learn a little about you and your schedule. You need to hand this to me, in person, so that I can give you a textbook.

Part 2.
Answers to the questions will be due the first day of class for the school year (***NOT Early AP Week***)

Student Information Sheet

Name: _____

Grade Level (for the 2016-17 school year): _____

E-mail: _____

1. Why did you sign up to take AP Biology?

2. What are your personal strengths when it comes to learning new material?

3. What causes you to struggle in a course?

4. What is the most effective way for you to prepare for a test?

5. What do you plan to major in when you get to college?

6. How many AP and dual enrollment courses are you enrolled in for this school year? (Please list).

   AP Courses - _____

   Dual Enrollment Courses - _____

Part 2. Use the resources below to answer the questions in the space provided.

Lecture notes – Emergence of Organic Molecules
Biology Concepts Flexbook-Introduction to Biology, sections 1.1-1.8

A. Introduction: Themes in the Study of Life

A Case Study in Scientific Inquiry. Read the information below and answer the questions that follow. We will do a follow up to this in class during the first week of class.

Beluga Whales in the St. Lawrence River
Passage #1 - The Arctic beluga whales are, at maturity, pure white and highly intelligent organisms. They have lived in the St. Lawrence Seaway for millennia. As a resource, beluga whales provided traders, fisheries, and settlers with a livelihood for centuries. But, times change. Scientists estimate that the population of belugas must have been 5,000 to 10,000 near the turn of the 20th century and about 500 in the second half of the century. As the demand for whale products decreased, the beluga were increasingly ignored and almost forgotten. One would assume that the populations would increase. However, by the 1970s the population still was estimated at 500. In 1979 the Canadian government provided the whales complete protection from hunting. Despite this twenty-year protection, the population has not increased.

1. Why do you think the number of whales has not increased? **EXPLAIN** your answer choice.
   A) Small populations of organisms tend to have low reproductive rates.
   B) The St. Lawrence Seaway has become increasingly polluted.
   C) The whales' habitat has become degraded and modified due to industry and human settlements.
   D) Other (please describe)

2. What is the question that would best guide a scientific investigation about why the population of whales does not increase? **EXPLAIN** your answer choice.
   A) Where do belugas live and reproduce?
   B) What is the cause of death for belugas?
   C) How have the habitats along the St. Lawrence changed?
   D) Other (please describe)

Passage #2 - A team of marine biologists headed by Pierre Béland began a series of investigations with one dead beluga beached on the St. Lawrence. Laboratory work showed that the whale died from renal failure. Tissue samples revealed that the whale was heavily contaminated with mercury, lead, PCBs, DDT, MIREX, and other pesticides. Investigations of two other dead belugas revealed similar results.

Still curious about why the population remained low, the biologists continued their investigations. During a 15-year period the team recorded 179 deaths and examined 73 carcasses. The entire sample was highly contaminated with an array of chemicals. Results of the study included the following.

- 40% of the organisms bore tumors, 14 of which were cancerous.
- The whales had a high incidence of stomach ulcers, including three perforated ulcers.
- 45% of females produced smaller than normal amounts of milk due to infections or tumors in their mammary glands.
- Lesions of the thyroid and adrenal glands were common.
- Some whales had compromised immune systems.

In comparison, Arctic beluga in other locations did not display any of these conditions, nor did other species of whales or seals living in the St. Lawrence. Both of the latter groups contained the same toxic substances as the belugas, but in lesser amounts. Finally the scientists also found that the toxins were not confined to the fat in blubber. Small amounts were found in other tissues, which might have contributed more readily to the injury of vital organs. In answering the original questions the scientists proposed that the whales were victims of pollution.

When the scientists presented their evidence and explanation suggesting that pollution was the cause of the low numbers and lack of increase in the beluga population, other marine biologists maintained that toxins were not at fault. The skeptical scientists argued that although the diseases and lesions observed in belugas matched the known effects of toxic chemicals, the original investigations had not demonstrated a cause-and-effect relationship.

3. Based on your understanding, were the original investigations adequate? Why or why not?

4. Did the scientists use appropriate tools and techniques to gather, analyze, and interpret data? **Support** your answer.

5. What evidence did the scientists use to develop an explanation that the whales died because of pollutants?

6. What would be the best approach to design and conduct a scientific investigation that would demonstrate a cause-and-effect relationship? (Think about the components of experimental design.)

Introduction to Biology

7. Briefly **explain** the biochemical experiment performed by Miller-Urey and its significance to the origin of living organisms.

8. The Earth is believed to be 4.5 billion years old. What **evidence** do scientists use to make this statement?

9. You are probably most familiar with the name Hubble from the Hubble telescope launched by NASA in 1990. What **evidence** did Edwin Hubble use to help support the Big Bang theory?

10. Where do scientist believe all the natural elements that make up the Earth originally came from?

11. Scientists have come up with the acronym "LUCA." What do the letters stand for? Briefly **describe** the basis for this hypothesis.

B. Spreadsheet Data Analysis Tutorials #1-3 from HHMI BioInteractive

Spreadsheets programs such as Excel are powerful tools to analyze data; if used properly these programs can assist you to **organize data**, use formulae and functions to **calculate statistical values** including mean, standard deviation, standard error of the mean, 95% confidence intervals, and **plot graphs with error bars**. All of these data analysis techniques are critical in evaluating and analyzing data. The more proficient you become in using Excel or another spreadsheet program, the more successful you will be in Advanced Placement Biology. Later in the year we will learn how to perform t-tests, and plot the data as histograms as well.

Each of the tutorials will introduce specific data analysis techniques and provide practice opportunities with data within an Excel spreadsheet. You are expected to complete each tutorial and the exercise included with the tutorial.

Instructions:

1. Go to the Spreadsheet Data Analysis Tutorials page on the HHMI BioInteractive website.
2. Scroll down the page and click on "Tutorial 1-Formulae, Functions, and Averages"
3. Click on the "Access the Google Sheets version here" link.
4. Proceed through the tutorial from the "Read this First" tab at the bottom of the spreadsheet through to the "Exercise" tab. Save the file and share it with me on Google Docs. (1pedgerton@gsgis.k12.va.us)
5. Complete "Tutorial 2-Autofill Data, Cell References, and Standard Deviation", and "Tutorial 3-Column Graphs, Error Bars, and Standard Error of the Mean", using the **Google Sheets version** so that you can share it with me.

I DO NOT WANT, NOR WILL I ACCEPT, A HARDCOPY OF THESE TUTORIALS.

C. Data/Quantitative Analysis Practice

AFTER you have completed Part I of this assignment, use your new spreadsheet skills and the multiple resources provided below to assist you in answering the following questions.

Introduction to Statistics for AP Biology
Mean, SD, SEM, and Graphing Student Guide
Quantitative Skills Series #1 - Graphing

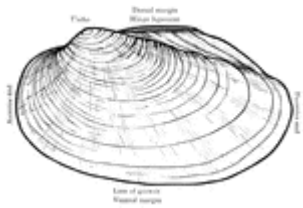
1. In determining normal proportions in human bodies, doctors look at the relationships between the lengths of various body parts. Artists are also interested in these relationships. Knowing such relationships helps them draw human figures that appear appropriately proportioned. On a less serious note, this activity was inspired by a piece of trivia from Julia Roberts' character in the 1990 movie Pretty Woman, in which she states – "your forearm length is the same as your foot length." To check the validity of this assertion, we collected data on forearm and foot lengths of 26 college students enrolled in an introductory statistics course. These data appear in Table 1 below.

Table 1. - The Relationship of Forearm Length to Foot Length

Forearm Length (inches), *x*	Foot Length (inches), *y*	Forearm Length (inches), *x*	Foot Length (inches), *y*
10.00	9.50	8.75	9.00
9.00	9.00	9.00	10.50
10.00	9.50	8.50	11.00
10.00	10.00	10.25	11.50
11.50	12.50	10.25	11.25
9.00	11.50	8.50	9.00
8.50	9.00	9.25	10.50
6.75	9.25	10.50	10.50
10.00	10.00	8.25	8.50
8.25	8.25	9.00	10.00
8.25	9.50	7.00	8.75
9.00	9.50	9.50	8.75
8.00	9.50	9.75	10.00

A. **Examine** the data in Table 1 – **determine** the type of graph that would be appropriate to represent this data.
B. Using Excel, **create** a spreadsheet table for this data and graph it. Include **both** the table and graph when you turn in this assignment.

2. A student investigated the variation in the length of mussel shells at two locations on a rocky shore in New Hampshire. Her data are below. Use an Excel spreadsheet to analyze the data.



A. Null Hypothesis:

B. Research Hypothesis:

C. **Calculate** the Standard Deviation for both groups of mussel shells.

D. **Calculat**e the standard error for both groups of mussel shells.

E. **Calculate** the confidence limits for both groups. Confidence limits = ± (SE X 2)

F. **Graph** the data, including SEM bars.

Table - Mussel Shell Length

Group A (mm)	Group B (mm)
46	23
50	28
45	41
45	31
63	26
57	33
65	35
73	21
55	38
79	30
62	36
59	38
71	45
68	28
77	42
Mean ($\bar{x}$) =	Mean ($\bar{x}$) =

G. Make a conclusion (is the data significant, what **EVIDENCE** can you use?)

F. What does the data indicate about the two populations of mussels and their environment? Which hypothesis is supported by the data?