“Time flies like an arrow, but fruit flies like a banana.”

Overview of Fruit Fly Genetics Project:

Over the course of this semester, roughly eight to ten weeks, we will be examining fruit flies. Fruit flies are used all over the country by high school students and scientists alike. Fruit flies have benefits to use in the laboratory for many reasons. In class, we will use the fruit flies to examine the passing of genetic traits from parents to offspring. With each generation of fruit flies, we will be able to look at probability, principles of DNA, and protein synthesis. At the end of the project, you will be asked to turn in a summary of your work that was done in the laboratory. The formal paper will be written in the form of a scientific journal that real world scientists often submit for publication.

Depending on the success of the lab, or the time needed to rebreed generations, the duration of the project may change. We will devote class time to working in the lab however it will not be exclusively lab work. You will be able to anticipate at least one fruit fly lab work day and one computer lab work day a week during the course of this assignment. You will be responsible for coming in before school, after school or during lunch as your cultures require. If your vials are not cared for properly they will potentially yield poor results. Be careful and thoughtful of your work. Just like in a highly advanced laboratory, details and precautions are of the highest priority!

It is recommended that you take a few moments to research fruit flies when you are able to. Simply search Google for “fruit flies”, “Drosophila”, “genetics”, etc. Within your final lab report you will be able to record and use this information in your paper.

Materials:

You will be supplied with the materials listed below. You are responsible for the proper care of these materials. If they are not returned in the form that they were given to you, you will need to pay for replacements.

- Magnifying lenses
- *Drosophila melanogaster*
- Media
- Yeast
- Anesthetizing Device
  - Lull-A-Fly
  - Alka-Seltzer Utensil
  - Petri Dishes
  - Soft Bristle Brushes
  - Vials
- Netting

You will also be asked to bring the following materials that will not be supplied:

- 3 ring binder (only for Biology)
- A small container
- Painters tape
- Alka-Seltzer Tablets

**Overview of *Drosophila melanogaster***:

*Drosophila* have served as a great experimental organism in the large part because of its short, unique life cycle. The eggs of the *Drosophila* are laid on or near the surface of the food that is placed in their vial. The food is also known as “media”. They hatch about one day later producing minute, white larvae. These larvae burrow into the media and feed on the yeast cells. The larvae attain full size at the end of about seven days. They then climb onto the side of the bottle and pupate. The pupal stage lasts about 2 days, after which the mature flies emerge. The rate at which the flies mature and develop is dependent upon the temperature of the culture. A “culture” of flies is a small selection of flies that are being studied for various traits. At 25 degrees Celsius, the entire life cycle from egg to adult is completed in about ten days. Many of the stages in the fruit fly development can be observed by simply looking at the vials. Fly cultures can be kept at room temperature, which is about 72 degrees Fahrenheit. You should avoid extremely cold and freezing temperatures or temperatures above 100 degrees Fahrenheit.

**How to Handle the Flies:**

To properly handle the flies the vial must be anesthetized, or put to sleep. When asleep the flies can be placed onto a piece of white paper and observed. If they are placed onto the paper, you will be able to see the contrast between the dark bodies of
the flies and the white background. The flies must be gently placed onto the note card. If care is not taken, the flies could be injured or killed in the process. An injured fly will not help create a thriving vial to study. The paper can be divided into two sections. If a line is drawn down the middle of the paper, each side can be designated as a male or female side. The flies can be moved with the paint brush to either side to count and organize your specimen. There are many ways to put a fly to sleep in order to manipulate them as listed above. However, we will primarily use Alka-Seltzer tablets. This method is easy to use and is non-toxic. To properly use the device, follow the instructions below:

**Step 1:** Cool the apparatus.

**Step 2:** Assemble the apparatus with the test tube approximately one fourth full of water. If too much water is used, when Alka-Seltzer is added in the next step, the water will bubble up into the test tube. To prevent this, use less water or Alka-Seltzer tablets. Practice to make sure you have this as efficient at possible.

**Step 3:** When ready drop one fourth to one half of an Alka-Seltzer tablet into the test tube. Carbon dioxide will immediately be generated.

**Step 4:** Quickly insert the pipet tip between the wall of the vial and the foam stopper. Make sure the culture vial is on its side. If the vial is not on its side, the flies could fly out! You don’t want to lose all your work!

**Step 5:** If bubbles enter into the tubing, immediately remove the pipet from your vial. Water may rush in and flood your vial. Remember, flies can’t swim.

**Step 6:** When the flies are put to sleep, transfer them to a cold plate for observation. Flies will remain asleep for about two minutes. You can place the note card under the cold plate so that you can still see the flies easily. The cold device helps slow the fly’s metabolism of the carbon dioxide down. If they awake before you are able to finish, place them quickly underneath a petri dish. Here, you will be able to slide your pipet under the dish and re-anesthetize them. **Do not** place them back into the vial if they are asleep. They will fall into the media and get stuck. They will not be able to remove themselves and die.

If the Alka-Seltzer tablet method does not prove to be successful, we will attempt another method to put the flies to sleep. The solution, known as Lull-A-Fly, will put the flies to sleep safely for up to 45 minutes at a time. If this method is chosen, you will be given a larger
portion of time to work with the flies, but remember not to place the flies into the vial asleep or they will die. In order to use the Lull-A-Fly, you must get Mr. Barth for help.

**Step 1:** Dip the tip of the wand into the Lull-A-Fly solution.

**Step 2:** Follow the standard Drosophila transfer techniques to knock the flies to be anesthetized to the bottom of the vial. (Remember, do not lodge them into the food! Tap gently.)

**Step 3:** Replace the cap on the Lull-A-Fly bottle. (Please be careful with this solution.)

**Step 4:** Quickly place the end of the wand into the vial just below the vial plug. Do not get any Lull-A-Fly on the foam stopper.

**Step 5:** Watch the flies as they become anesthetized. When the last fly has been anesthetized, remove the wand.

**Step 6:** Remove the plug from the vial and dump the flies onto a white piece of paper.

**Step 7:** Replace the plug in the vial, to ensure that no contamination is made. Return the wand to its original location.

**Sex Identification:**

It is imperative that we identify the sex of a fruit fly before we create a genetic cross. If we do not know the sex of the fruit fly then we will not be able to create any offspring. We will use microscopes and hand held magnifying glasses to look at the physical features to tell us what the specimen is. Look for the pictures in the packet. The following are characteristics of flies:

**Size:** Females are usually larger than males.

**Shape:** The caudal extremity of the male is round and blunt, whereas the female is sharp and protruding. The caudal extremity is the portion of the fly that is farthest away from the head. The abdomen of the male is relatively narrow and cylindrical, whereas the female is distended
and appears spherical. Adults newly emerge from the pupa case are relatively long and slender. The sexual difference described here are not so readily noted.

*Color:* Black pigment is more extensive on the caudal extremity of the male than on that of the female. On the male, the markings extend completely around the abdomen and meet on ventral side. The ventral side of the organism is the side of the mouth. On the female the pigment occurs only in the dorsal region. The dorsal region of a fly is the wing side of the fly.

*Sex Combs:* Only the males have sex combs. Sex combs are small tufts of black bristles that are on the front of each leg. Magnification is needed to see the sex combs.

**Medium:**

The medium (media), or otherwise known as food, will be supplied to you at the beginning of the lab. Once you have been shown how to create a vial and prepare it for future crosses, the media will be available for you to use at your discretion. The media is an instant *Drosophila* food that can be easily prepared when equal amounts of water and solid are mixed. These materials are not known to be dangerous but after handling the food it is recommended that you wash your hands. This food is blue in color and can stain hands or clothing. Once you have a consistent color in the media after the water has been added you know that you have made a proper vial. If the media is too runny, not enough solid has been added. If the media is not dark enough in color, not enough water was added. In either case the vials will need to be redone. Please be prudent with these materials.

In moist environments, there is a tendency for mold to grow. Because the media is mixed with water, it creates an environment that provides the right conditions for mold to grow. To prevent the growth of mold in the media and also help supplement the diet of the flies, it is important to include a few grains of yeast into each vial. Six to ten grains per culture is
sufficient. Take care to not take use more yeast than specified as this can cause sterilization or
death of the flies in your culture. Flies are also known to grow and live upon other natural
products. Such natural products include: fruit, vegetables and other organic materials.

Creating Your Experiment:

There are a variety of crosses that can be made throughout this experiment. You and
your lab partner must decide what one trait you will examine. Remember a trait is a code that is
held within the DNA of a fruit fly that ultimately affects how the fly appears to the naked eye.
Through roughly 3 genetic crosses, you will see how certain dominant and other recessive
features are displayed. You can cross flies to examine eye color, body color, wing shape, and
the absence of wings. “Wild” fruit flies are flies that will express the dominant trait over all other
traits. Wild fruit flies have red eyes, long straight wings, and a tan body color. Consider
crossing wild flies with white eyes, vestigial flies, apterous flies, or ebony flies.

Requirements:

For this activity, we will have various assignments along the way. The following are the
parts to this laboratory exercise which must be completed for full credit.

- For each time you work with the flies a journal entry must be written describing the
  steps you took at that specific time.
  o Journal Checks
- Passing of a lab practical comprehension quiz.
- Successful fruit fly crossing.
- Rough draft of lab report (turned in for credit)
- A formal draft of your lab report (turned in for credit)
- Proper use of class room tools
- Daily participation
- Multimedia Project

Make sure you keep track of all the activities as to not overlook any aspects to the project.

Completion the Lab and BYOT Multimedia Components:

To complete your lab, you will need to submit a formal summary of the work that was
completed. As discussed in class, each scientific paper should follow the outline that is listed
below. Your scientific formal report will elaborate on what fruit flies are, how they are used in
science today, your lab and procedure, your results, and an analysis of the events that took
place. Use the following titles as your headings for the final paper: “Introduction”, “Materials and
Methods", “Results”, and “Conclusion”. Under each heading describe in great detail any pertinent information. Copies of past papers that met the project expectations are available for reference. When writing your final paper, do not use first person language.

- Introduction:
  o Use this as a way to discuss what fruit flies are, why they are important, what is their genetic make-up, why they are used in science today, modern advances that scientists have done with fruit flies in recent years, etc. Information that is used from other sources must be accounted for on a bibliography.

- Materials and Methods:
  o In great detail, this section must include two parts: every tool you used in this lab and how you ultimately used each one. Do not include information about the success of these steps. “Success” is an opinion and should be included only in your “Conclusion.”

- Results:
  o In this section you should describe the data that you compiled over the course of the experiment. The punnett squares included in this section can be no larger than 2 inches by 2 inches when printed. No other pictures or graphics will be allowed. If you were not able to successfully complete the lab and get valid results, you will need to report on the data you did receive. (You will need to compare your results to the correct results in the “Conclusion”.)

- Conclusion:
  o Conclude your paper with a final summary of the project. Consider discussing successes, struggles, error analysis, suggestions for future fruit fly testing.

The paper must be properly formatted and contain all the needed information for full credit. I am asking that you turn in a rough draft before you turn in a final draft so I can help guide you in the right direction. Papers are to be typed in Open Office or Microsoft Word. Traditional format rules apply, such as Times New Roman or Arial font, 12 pt. font (no exceptions), and double-spaced. Your paper must reach a length of 4 pages which does not include your bibliography or title page. Accurate results, appropriate content, and correct format are the most important pieces to this project!

The final component to this project will be the completion of a multimedia project. This can include the creation of:

- WordPress Blog
- Twitter Feed

Blog Requirements:

[o] Must include a weekly post containing at least 400 characters for 15 weeks.
Include images to help elaborate on your project.

Connect with other blogs or websites to enhance your project by adding links to reputable sources.

Twitter Feed Requirements:

- Must include at least four (4) weekly updates to your profile/feed totaling to at least 400 words per week over the 15 week project. Re-Tweets or non-original content does not count toward your point total.
- Include Vines, “Twit-pics”, pictures, .gif animations, etc. to help draw your readers in. Challenge your classes to see who can get the most followers!
- Follow other scientists and class members to share ideas and suggestions.
- With each tweet, use the hashtag “#RBHSFruitFly” to create our own class feed.
- Please follow Mr. Barth, @biologybarth to stay connected throughout the project.

Internet Safety:

- Never post your full name, school, locations, addresses, or personal information.
- Use appropriate language, “hashtags”, etc. Inappropriate behavior done through the blog or Twitter feed will result in discipline outlined in our classroom syllabus and school handbook.
- All content posted online is permanent. Be cognizant of the information you submit!