Topic 5c: Genetics – Fruit Fly Experiment

Resources:	Campbell et al. *Biology: Exploring Life.* Prentice Hall, Chapters 9 and 10. Campbell et al. *Biology: Concepts and Connections.* Pearson, Chapters 8 and 9. Miller and Levine. *Biology.* Prentice Hall. Chapter 11. http://www.carolina.com/product/living+organisms/animals/animal+food/drosophila,+fruit+fly+culture+kit,+nongenetic+use.do
Building on:	Cell parts and functions Chromosomes Mitosis and meiosis
Links to Chemistry:	DNA chemistry
Links to Math:	Ratios Percentages Probabilty
Stories:	Since the turn of the 19th Century, biology students have used fruit flies (*Drosophila melanogaster*) as a way to study Mendelian genetics relatively quickly and easily. The good news is that we no longer use ether, a vintage World War I anesthesia, that would render the fruit flies and sometimes their handlers unconscious! Rotten bananas have been replaced as a food source for the larvae by much more benign (and starchy) media.

Lab Instructions and Materials for the Teacher:

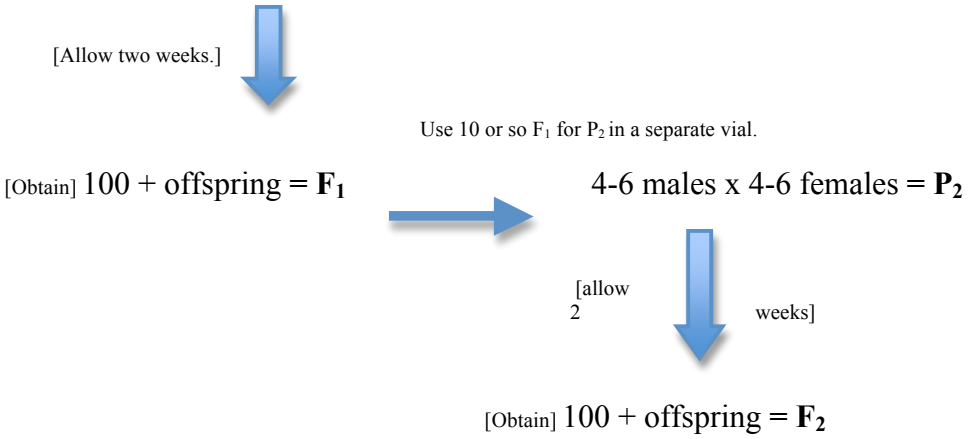
This is a very involved, detail-oriented lab that should be attempted only with higher-level students. If the students try to "cookbook" the lab each day, they will find themselves lost in a labyrinth of procedures and unable to grasp the "big picture." This may not become apparent until they try to write the lab up at the end of four to six weeks of data collection!

You should order flies about one month prior to the experiment so that you can super-culture the flies that you order. Start the project while studying mitosis and meiosis so that F_1 results will start to be obtained as you study Mendelian genetics in the textbook. You can also order pre-crossed F_1 flies and perform a single generation F_2 cross.

When choosing flies, make sure that the traits crossed occur on separate chromosomes (fruit flies have only four pair); otherwise, the results will not turn out "Mendelian," but rather they are "linked." This has been done for you on the sheet below, but you can check the chromosome number when ordering.

The project overview can be seen as follows:

4-6 male fruit flies of one type x 2-4 virgin female fruit flies of a different type = **P_1**
[breed with]



The first vial is called the P_1F_1 vial and the second is a P_2F_2 vial. It takes about two weeks for adult flies to mate and obtain offspring, so the project should take from four to six weeks total. More information is available from Carolina Biological Supply Company. When ordering the stock flies from them, they will send you a *Drosophila* information manual.

How to make an FF vial:

1. Rinse your vial with warm water—NO SOAP! Dry it out with a paper towel, but be careful not to touch the inside of your vial with your finger!
2. Add one level capful of FF Medium (food) to the vial.
3. Gather one capful of cool water, a glass stirring rod and your vial with food.
4. Add the capful of water to the vial with food; POKE AND TAP for **5 SECONDS** (no longer!) with the stirring rod. Tap on tabletop to settle contents.
5. Let vial set up for one minute.
6. Add 10-12 grains of yeast; spread them around on the food.
7. Wipe down the inside of the vial with a paper towel (again do not touch the sides with your finger); be careful not to touch the food.
8. Add a foam cap.
9. Label with:

JC + MJ	5/6	eb x ey	11/20
Your and your partner's initials	Your class period	Your cross male x female	Date started (both male and female added)

Napping and Sorting:

1. Have materials ready: FF vial, wand, FlyNap, textbook, white paper, index cards, stereo microscope, paint brush
2. Slide the foam cap on the FF vial as high as possible so that flies do not escape. (We're trying to minimize the amount of FlyNap that hits the foam cap).
3. Dip wand into FlyNap. Press the wand tip against the side of the bottle to remove the excess. (It should not be "dripping wet.")
4. QUICKLY!!:
   - Tap the FF vial on the counter several times.
   - Press the foam cap in slightly.
   - Insert the FlyNap loaded wand into the vial past the foam cap.
   - Release the foam cap to trap the metal part of the wand against the side of the FF vial.
5. Place the FF vial ON ITS SIDE in an open textbook.
   Do NOT leave the FF vial upright. (The flies will fall into the food and get stuck!!)
6. Observe the vial carefully! When all flies have stopped moving, **wait another 30 second**s**,** then dump them onto plain white paper.
7. Cover your napped flies on the paper with a Petri dish (keeps flies that may wake up contained).
8. Use paint brush (static electricity method) to move flies around.
9. Use an index card to observe flies under a STEREO MICROSCOPE. Sort into desired piles / vials / counts.
10. If flies are F1 or F2 to be counted, push into piles by trait (eb, vg, +. . .) and have your teacher SIGN-OFF on your results. (Put all results in your logs.)
11. DISCARD unwanted flies down the sink with lots of water; please keep flies from waking up and flying around the classroom!

HONORS BIOLOGY: FRUIT FLY CROSS CHOICES

MONOHYBRID CROSSES:

_____	Wild (+)	X	Vestigial (vg) - female vg only
_____	Wild (+)	X	Ebony (eb)
_____	Wild (+)	X	Eyeless (ey)

DIHYBRID CROSSES:

_____	Eyeless	X	Vestigial (female)
_____	Ebony	X	Vestigial (female)
_____	Ebony	X	Eyeless

SEX-LINKED CROSS:

_____	Wild	X	White Eye (male)
_____	Wild	X	White Eye (female)

SEX-LINKED AND DIHYBRID:

_____	Eyeless	X	White Eye (male)
_____	Eyeless	X	White Eye (female)
_____	Ebony	X	White Eye (male)
_____	Ebony	X	White Eye (female)
_____	Vestigial (female)	X	White Eye (male)

Fruit Fly Lab Report
50 points – Due Date_____

1. Title: List a cool title! *Drosophila melanogaster* is the scientific name of FFs.

2. Purpose: State, in your own words, the reason for this study and paper. Make sure and include the cross you have chosen.

3. Procedures: List the basic procedures, in step-by-step fashion, required to perform this lab. Don't get bogged down here; just list simple, shorthand procedures like "nap flies," but include enough so that the entire lab is outlined.

4. Data (Log of P1/F1 and a ***separate*** Log of P2/F2):
   Please turn in the logs from your Fruit Fly Info packet*. I will already have checked these.*

5. Predictions: Please turn in the Predictions page from your Fruit Fly Info packet*. I will already have checked these.*

6. Results/Actuals: This is an organized presentation of your two months of counting and determining the traits for two generations of offspring! Include a well-organized chart of the number of flies you got of each phenotype; give a total of each of these phenotypes at the bottom of this chart. **Again,** *show the data which I signed off on.*

   Following this chart, you should clearly give four ratios:

   Raw Ratio:
   Reduced Ratio:
   Closest Mendelian Ratio (to the reduced):
   Your F_1 Prediction Ratio:

   <u>*Repeat*</u> the chart and the four ratios for your F_2 *actuals.*
   You will be graded on the accuracy of your results and I can tell when you're lying!!

7. Conclusion: THE MOST IMPORTANT PART OF YOUR REPORT!!! This is when you explain to the reader what the "link" is between your predicted and actual ratios—right or wrong!! Start by *summarizing your procedures and results!* If all worked out correctly, then you need to discuss the mechanisms of basic Mendelian genetics that caused these occurrences. If all went wrong (or parts of the lab did), you need to discuss and show with more Punnett squares your analysis of why you got what you got! Don't be alarmed if your actuals are wrong; some of my best and highest scored

papers have had incorrect results, **BUT** the students explained and illustrated the possible explanations for the errors. These have been some of my best papers because students had to research and really "think genetics" to explain who *really* mated with whom; remember, the flies tell the truth!

Fruit Fly Lab Write-up
Grade Sheet

Title
Purpose
Procedures
Logs (already √'d, but include here)
Predictions (already √'d, but include here)

_____
(10 points)

Results
Your own? (You lose 5 points for each set borrowed F_1 / F_2.)
Signed off by teacher?
Accurate ("Good data")?
Four ratios calculated correctly (F_1 and F_2)?

_____
(20 points)

Conclusion
Summarizes procedures and results?
Discusses basic genetics?
Discusses genetics specific to your cross (sex-linked, dihybrid)?
Explains differences between predictions and results?
Reasonable error analysis / best conclusions possible are drawn?
Intelligently handles data and data analysis?

_____
(20 points)

TOTAL = _____
(50 points)