

LABORATORY # 2: *Drosophila* BREEDING EXPERIMENT (F₁ GENERATION) AND DIHYBRID CROSSES

LEARNING OUTCOMES

When students complete this lab, they should be able to:

- Outline the basic theoretical framework to perform a *Drosophila* cross (dihybrid cross)
- Obtain and analyze F₁ and F₂ data that illustrate the Mendelian principles of segregation and assortment.
- Propose a genetic model of inheritance for two traits (genes) based on the analysis of simulated *Drosophila* crosses.

INTRODUCTION

Mendel's studies on contrasting morphological traits in garden peas clearly established the basic laws of inheritance. First, **the law of segregation** of alleles describes that parental alleles are separated to the gametes (each containing only one) and therefore, offspring inherit **one allele from each parent** when gametes merge in fertilization. Then, in this first hybrid generation (F₁), alleles separate again from each other during the formation of gametes with equal frequency.

Secondly, **the principle of independent assortment** states that alleles from different genes are sorted independently from one another and hence, inheritance of one trait is not dependent on the inheritance of another. For example, in a **dihybrid** individual, the alleles of different genes segregate first and then, they assort independently with equal frequency into gametes. Thus, the expected F₂ phenotypic ratio in a monohybrid cross (Aa x Aa) is **3:1**; while in

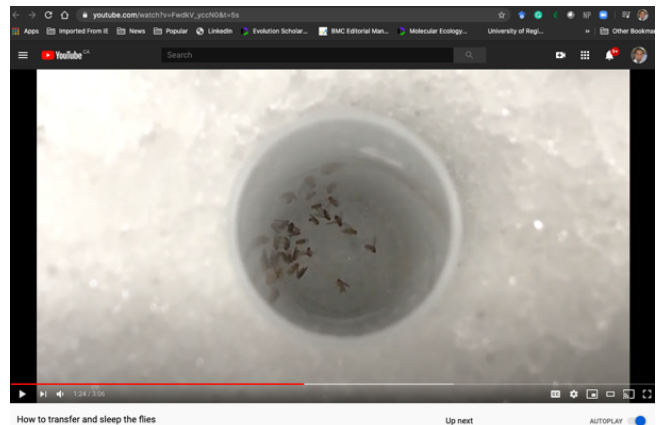
a dihybrid cross (AaBb X AaBb) the expected F₂ ratio is **9:3:3:1**. Please refer to the lecture material or the corresponding chapters on the textbook for further explanation on Mendel's laws.

TECHNIQUE FOR HANDLING FLIES

Please make sure that you remember how to manipulate living *Drosophila* flies for their observation, phenotyping, and scoring. If you need to review this procedure, please watch the following video:

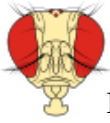
"How to transfer and sleep the flies":

https://youtu.be/FwdkV_yccN0



MAIN MATERIALS

- A dissection microscope
- A frozen cool-pack and a container with ice
- A couple of paint brushes
- Your vial (**main cross**) containing F₁ flies
- A new empty food vial



For the computer simulations you will need:

- Desk or laptop computer. Small devices as cell phones or tablets **are not recommended**.
- Any web browser. The most common choices are Chrome, Mozilla, or Safari.
- Access to the **Virtual Genetics Lab** platform (www.ampossot.com/virtual_lab)
- Notebook and pen (or pencil)
- Calculator

PROCEDURE FOR LABORATORY WORK

1. Work in **pairs** of students. Collect your vial from the previous lab practice. They are located in the cart at the front of the lab room.

Remember the main cross:

P_1 = virgin **females**, **yellow** body, **white** eyes, **miniature** wings \times P_2 = **males**, **sepia** eyes.

2. Check your tube for the presence of F_1 flies.
3. Transfer the flies to a clean vial and use ice to anesthetize the **F_1 generation**. Observe them using the dissecting scope.
4. Using a brush, move the flies around and observe the phenotypes. Identify male and female flies.
5. Score the different phenotypes and sexes. **Keep this information safe, as you need this data to complete your assignment.**
6. Get a **new food vial** available in the cart at the front of the lab. Select 4 males and 4 females to

setup a new cross ($F_1 \times F_1$). If less flies are available, set up the cross with all of them.

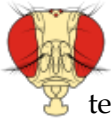
7. Label the new vial with your initials, date, and cross type (i.e., $F_1 \times F_1$).
8. Return the new vial to the rack. You will need the flies that will start emerging in two weeks. These will be the **second generation or F_2 flies**.

PROCEDURE FOR THE VIRTUAL GENETICS LAB

1. **Launch the Virtual Genetics Lab.** For this lab, you will use the “**Dihybrid Inheritance Analyzer**” tool. It is available on Canvas (lab # 2 tab) or here:

www.ampossot.com/dihybrid

2. Click on the “Start” button. Read the information presented and start performing the suggested crosses. This part of the lab is individual, and every student will have a different set of data.
3. **Perform the number of crosses described in your assignment.** Record the number of offspring phenotypes and **ratios** in the provided

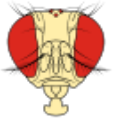


templates. An easy way to obtain phenotypic ratios is dividing the **higher-class number** by the **lowest class number**. Example: If you get 60 wild-type flies and 19 vestigial flies, the ratio will be 60/19 wild-type: 19/19 vestigial flies.

That is 3.15 wild-type: 1 vestigial flies. **If only one phenotypic class is present, the ratio would be 1:0.**

If you need further assistance, please contact your assigned TA or the lab coordinator. Their contact information is available in Canvas

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