ASSIGNMENT # 2

DEADLINE: RETURN AT THE END OF THE LABORATORY SESSION

OPTION 1: Deposit a physical copy in the cart (front of the lab)

OPTION 2: Submit an electronic copy (i.e., PDF file) through the LMS platform (Canvas)

NAME: _____ **STUDENT #:** _____ **DATE:** _____

IN PERSON LABORATORY WORK AND IDENTIFICATION OF PHENOTYPES
WORTH 30% OF ASSIGNMENT GRADE (Q#1-2)

1. After observing the **F1** flies under the dissecting scope, please summarize the obtained data in the table below. **Please double check the phenotypes with your TA**. y=yellow, w=white, m=miniature, se=sepia, WT= wild-type. **NOTE**: To get full marks, please record your observed results in the electronic file available in the link in the Canvas modules (Lab # 2).

	Males			Females			Total
	y-w-m	se	WT	y-w-m	se	WT	
Total							

Is there any **major difference (i.e., bias)** between the phenotype of male vs. female flies?
For example: All males are mutants (none are wild-type); All females are wild-type (none are mutants)
This may be considered evidence of the presence of sex-linkage

YES: ____ **NO**: ____

2. Based on your analysis of the obtained **F_1 data**, please propose the mode of inheritance of the different mutations. **HINT**: Consider the phenotype of the **P_1** and **P_2** flies. Then, carefully analyze the segregation of the traits in the **F_1** flies.

P1 Female: yellow body, white eyes, miniature wing

X

P2 Male: Sepia eyes (wild type for the other traits)

F1 males phenotype: _____

F1 females phenotype: _____

-Based on your analysis, please propose the **most probable** genetics model of inheritance for the traits (fill with an "X"):

Body color:

The gene is:	Autosomal:	____	Sex-linked:	____
The wild-type allele (trait) is:	Dominant:	____	Recessive:	____
The yellow allele (trait) is:	Dominant:	____	Recessive:	____

Eye color (white vs. wild-type):

The gene is:	Autosomal:	____	Sex-linked:	____
The wild-type allele (trait) is:	Dominant:	____	Recessive:	____
The white allele (trait) is:	Dominant:	____	Recessive:	____

Wing shape color:

The gene is:	Autosomal:	____	Sex-linked:	____
The wild-type allele (trait) is:	Dominant:	____	Recessive:	____
The miniature allele (trait) is:	Dominant:	____	Recessive:	____

Eye color (sepia vs. wild-type) HINT: The sepia locus is located on an autosome.

The gene is:	Autosomal:	__**X**_	Sex-linked:	____
The wild-type allele (trait) is:	Dominant:	____	Recessive:	____
The sepia allele (trait) is:	Dominant:	____	Recessive:	____

RAPID TEST: MAKE PREDICTIONS USING A PROPOSED MODEL

3. Assume that the yellow body, white eyes and miniature wings are recessive and sex-linked mutations. The sepia eye color mutation is an autosomal and recessive mutation. Please provide the **genotype** of the **P_1** yellow body, white eyes, miniature wing females and **P_2** sepia-eyed males (both are homozygous). Use the notation for *Drosophila* research (pages 11-12).

P_1 yellow, white, mini females: _____

P_2 sepia-eyed males: _____

4. Please provide the **expected** phenotype and genotype of the **F_1** flies. Show your work.

P_1: y-w-m females: _____ X **P_2**: sepia males: _____

Gametes		

F_1 genotype(s): _____

F_1 phenotypes(s): _____

5. Do these **expected** results (question # 4) correspond with the **observed** data (question # 1)?

YES: ____ **NO**: ____

Please provide a brief explanation:

GENETICS PROBLEM: IMPROVE YOUR SOLVING SKILLS

In *Drosophila melanogaster*, **Curly** is **dominant** over **normal** wings (wild type) and **brownish** body color (wild type) is **dominant** over **ebony** body color (black). **Assume** that both genes are located on **different autosomes**. The following cross between two pure lines (i.e., **homozygous**) is performed:

P_1: females, Curly wings x **P_2:** males, ebony body color

Answer the following questions:

6. Based on the **genetics** **notation used in *Drosophila*,** please provide the genotypes of $\mathbf{P_1}$ Curly-wing females and $\mathbf{P_2}$ ebony body males.

Hint: For the notation, please consider the following information: **females** carry the **Curly mutation (Cy)** and the wild type allele for body color (**b^+**). The **males** carry the **ebony mutation (b)** and the wild type allele for wing shape (**Cy^+**)

$\mathbf{P_1}$ Curly-wing females: _____ $\mathbf{P_1}$ Gametes: _____

$\mathbf{P_2}$ ebony body males: _____ $\mathbf{P_2}$ Gametes: _____

7. Based on your answer to the previous question, please provide the expected **phenotype** and **genotype** of the $\mathbf{F_1}$ flies.

Make a Punnet square if you need it:

Gametes		

Phenotype: _____

Genotype: _____

8. What are the **F_2 phenotypic proportions** (Ex. 9/16) expected by crossing the **F_1** males and females? Show your work using the Punnet square template.

F_1 genotype: _____ X **F_1** genotype: _____

Gametes				

Phenotypic proportions:

9. In *Drosophila melanogaster,* **Bar-shaped** eyes are **dominant** to **normal** eyes (the most common phenotype is normal). Assume that this is an **autosomal** gene and use the *Drosophila* **genetics notation**.

- How would you designate the genotype of a **homozygous** Bar-eyed fly? _____

- How would you designate the genotype of a **normal**-eye fly? _____

- What is the phenotype of a **heterozygous** fly? _____

- What is the result of a cross between a **heterozygous** Bar-eyed fly to a **normal**-eyed fly?. Show your work using a Punnet square.

GENETICS VIRTUAL LAB

For the next set of questions, you will use the **"Dihybrid Inheritance Analyzer"** tool available online (www.ampossot.com/dihybrid).

Note: *All crosses performed at the Virtual Lab correspond to hypothetical simulated and randomized data. The actual genetics basis of the genes/traits in nature may be different*.

To describe the phenotypes, **reduce the ratio to its lowest terms** (Ex., 3.1:1)

Based on the simulation of several crosses (dihybrid), you need to determine the **genetics model** of **two traits** (I.e., Dominant vs. Recessive; Autosomal vs. Sex-linked). Perform the following crosses using the virtual tool and fill the tables with the required information.

Hint: When you are studying a cross that includes several traits, start your analysis with **one trait at a time**. For example, start by crossing two flies with the same wing shape **without** considering the body color.

10. Wing shape: perform **three** independent crosses between a **wild-type female** and a **wild-type male**. Record the data in the scoring tables. The number of obtained flies is available in the "show details" tab of each corresponding vial.

Vial #:_______

Wing Shape	Body Color	F	M	Total
Curly	Ebony			
Curly	Wild type			
Wild type	Ebony			
Wild type	Wild type			
Phenotypic Ratio				
Wild Type:		**Curly:**		

Vial #:_______

Wing Shape	Body Color	F	M	Total
Curly	Ebony			
Curly	Wild type			
Wild type	Ebony			
Wild type	Wild type			
Phenotypic Ratio				
Wild Type:		**Curly:**		

Vial #:_______

Wing Shape	Body Color	F	M	Total
Curly	Ebony			
Curly	Wild type			
Wild type	Ebony			
Wild type	Wild type			
Phenotypic Ratio				
Wild Type:		**Curly:**		

Is there any **major difference (i.e. bias)** between the phenotype numbers of male vs. female flies? ____

For example: All males Curly (none wild-type); All females wild-type (none Curly).
This may be considered evidence of the presence of sex-linkage

11. <u>Wing shape</u>: perform **<u>three</u>** independent crosses between a **<u>wild-type female</u>** and a **<u>Curly-winged male</u>**. Record the data in the scoring tables. Make sure that you use different parental flies each time you perform a cross.

Vial #:_______

Wing Shape	Body Color	F	M	Total
Curly	Ebony			
Curly	Wild type			
Wild type	Ebony			
Wild type	Wild type			
Phenotypic Ratio				
Wild Type:		**Curly:**		

Vial #:_______

Wing Shape	Body Color	F	M	Total
Curly	Ebony			
Curly	Wild type			
Wild type	Ebony			
Wild type	Wild type			
Phenotypic Ratio				
Wild Type:		**Curly:**		

Vial #:_______

Wing Shape	Body Color	F	M	Total
Curly	Ebony			
Curly	Wild type			
Wild type	Ebony			
Wild type	Wild type			
Phenotypic Ratio				
Wild Type:		**Curly:**		

Is there any **<u>major difference (i.e. bias)</u>** between the phenotype numbers of male vs. female flies? ____

For example: All males Curly (none wild-type); All females wild-type (none Curly).
This may be considered evidence of the presence of sex-linkage

12. <u>Wing shape</u>: perform **<u>three</u>** independent crosses between a **<u>Curly-winged female</u>** and a **<u>wild-type male</u>**. Record the data in the scoring tables. Make sure that you use different parental flies each time you perform a cross.

Vial #:_______

Wing Shape	Body Color	F	M	Total
Curly	Ebony			
Curly	Wild type			
Wild type	Ebony			
Wild type	Wild type			
Phenotypic Ratio				
Wild Type:		**Curly:**		

Vial #:_______

Wing Shape	Body Color	F	M	Total
Curly	Ebony			
Curly	Wild type			
Wild type	Ebony			
Wild type	Wild type			
Phenotypic Ratio				
Wild Type:		**Curly:**		

Vial #:_______

Wing Shape	Body Color	F	M	Total
Curly	Ebony			
Curly	Wild type			
Wild type	Ebony			
Wild type	Wild type			
Phenotypic Ratio				
Wild Type:		**Curly:**		

Is there any **<u>major difference (i.e. bias)</u>** between the phenotype numbers of male vs. female flies? ____

For example: All males Curly (none wild-type); All females wild-type (none Curly).
*This may be considered evidence of the presence of sex-linkage**

13. **Wing shape**: perform **three** independent crosses between a **Curly-winged female** and a **Curly-winged male**. Record the data in the scoring tables. Make sure that you use different parental flies each time you perform a cross.

Vial #:______

Wing Shape	Body Color	F	M	Total
Curly	Ebony			
Curly	Wild type			
Wild type	Ebony			
Wild type	Wild type			
Phenotypic Ratio				
Wild Type:		**Curly:**		

Vial #:______

Wing Shape	Body Color	F	M	Total
Curly	Ebony			
Curly	Wild type			
Wild type	Ebony			
Wild type	Wild type			
Phenotypic Ratio				
Wild Type:		**Curly:**		

Vial #:______

Wing Shape	Body Color	F	M	Total
Curly	Ebony			
Curly	Wild type			
Wild type	Ebony			
Wild type	Wild type			
Phenotypic Ratio				
Wild Type:		**Curly:**		

Is there any **major difference (i.e. bias)** between the phenotype numbers of male vs. female flies? ____

For example: All males Curly (none wild-type); All females wild-type (none Curly).
This may be considered evidence of the presence of sex-linkage

14. Based on your analysis of the previous twelve crosses, propose a **genetics model of inheritance** for the **wing shape trait**:

Can you **determined** the mode of inheritance using the collected data: **YES**: _____ **NO**:______

If your answer is "**NO**", try re-running the virtual tool until you have data that supports your conclusions.

Wild-type wing is: **Dominant**: ________ **Recessive**: __________

Curly wing shape is: **Dominant**: ________ **Recessive**: __________

The wing shape gene (trait) is: **Autosomal**: ________ **Sex-linked**: __________

Does the genetics model of the **simulation** correspond to that of question # 6?. Please explain

In the following section, you will focus on the analysis of the **second trait (body color)**.

15. Body color: perform **three** independent crosses between a **wild-type female** and a **wild-type male**. Record the data in the scoring tables. The number of obtained flies is available in the "show details" tab of each corresponding vial.

Vial #:_______

Wing Shape	Body Color	F	M	Total
Curly	Ebony			
Curly	Wild type			
Wild type	Ebony			
Wild type	Wild type			
Phenotypic Ratio				
Wild Type:		**Ebony:**		

Vial #:_______

Wing Shape	Body Color	F	M	Total
Curly	Ebony			
Curly	Wild type			
Wild type	Ebony			
Wild type	Wild type			
Phenotypic Ratio				
Wild Type:		**Ebony:**		

Vial #:_______

Wing Shape	Body Color	F	M	Total
Curly	Ebony			
Curly	Wild type			
Wild type	Ebony			
Wild type	Wild type			
Phenotypic Ratio				
Wild Type:		**Ebony:**		

Is there any **major difference (i.e. bias)** between the phenotype numbers of male vs. female flies? _____

For example: All males ebony (none wild-type); All females wild-type (none ebony).
This may be considered evidence of the presence of sex-linkage

16. Body color: perform **three** independent crosses between a **wild-type female** and an **ebony body male**. Record the data in the scoring tables. Make sure that you use different parental flies each time you perform a cross.

Vial #:_______

Wing Shape	Body Color	F	M	Total
Curly	Ebony			
Curly	Wild type			
Wild type	Ebony			
Wild type	Wild type			
Phenotypic Ratio				
Wild Type:		**Ebony:**		

Vial #:_______

Wing Shape	Body Color	F	M	Total
Curly	Ebony			
Curly	Wild type			
Wild type	Ebony			
Wild type	Wild type			
Phenotypic Ratio				
Wild Type:		**Ebony:**		

Vial #:_______

Wing Shape	Body Color	F	M	Total
Curly	Ebony			
Curly	Wild type			
Wild type	Ebony			
Wild type	Wild type			
Phenotypic Ratio				
Wild Type:		**Ebony:**		

Is there any **major difference (i.e. bias)** between the phenotype numbers of male vs. female flies? _____

For example: All males ebony (none wild-type); All females wild-type (none ebony).
This may be considered evidence of the presence of sex-linkage

17. <u>Body color</u>: perform **<u>three</u>** independent crosses between an **<u>ebony body female</u>** and a **<u>wild-type male</u>**. Record the data in the scoring tables. Make sure that you use different parental flies each time you perform a cross.

Vial #:_______

Wing Shape	Body Color	F	M	Total
Curly	Ebony			
Curly	Wild type			
Wild type	Ebony			
Wild type	Wild type			
Phenotypic Ratio				
Wild Type:		**Ebony:**		

Vial #:_______

Wing Shape	Body Color	F	M	Total
Curly	Ebony			
Curly	Wild type			
Wild type	Ebony			
Wild type	Wild type			
Phenotypic Ratio				
Wild Type:		**Ebony:**		

Vial #:_______

Wing Shape	Body Color	F	M	Total
Curly	Ebony			
Curly	Wild type			
Wild type	Ebony			
Wild type	Wild type			
Phenotypic Ratio				
Wild Type:		**Ebony:**		

Is there any **<u>major difference (i.e. bias)</u>** between the phenotype numbers of male vs. female flies? ____

For example: All males ebony (none wild-type); All females wild-type (none ebony).
This may be considered evidence of the presence of sex-linkage

18. <u>Body color</u>: perform **<u>three</u>** independent crosses between an **<u>ebony body female</u>** and an **<u>ebony body male</u>**. Record the data in the scoring tables. Make sure that you use different parental flies each time you perform a cross.

Vial #:_______

Wing Shape	Body Color	F	M	Total
Curly	Ebony			
Curly	Wild type			
Wild type	Ebony			
Wild type	Wild type			
Phenotypic Ratio				
Wild Type:		**Ebony:**		

Vial #:_______

Wing Shape	Body Color	F	M	Total
Curly	Ebony			
Curly	Wild type			
Wild type	Ebony			
Wild type	Wild type			
Phenotypic Ratio				
Wild Type:		**Ebony:**		

Vial #:_______

Wing Shape	Body Color	F	M	Total
Curly	Ebony			
Curly	Wild type			
Wild type	Ebony			
Wild type	Wild type			
Phenotypic Ratio				
Wild Type:		**Ebony:**		

Is there any **<u>major difference (i.e. bias)</u>** between the phenotype numbers of male vs. female flies? ____

For example: All males ebony (none wild-type); All females wild-type (none ebony).
This may be considered evidence of the presence of sex-linkage

19. Based on your analysis of the previous twelve crosses, propose a **genetics model of inheritance** for the **body color trait**:

Can you **determine** the mode of inheritance using the collected data: **YES**: _____ **NO**:_____

If your answer is "**NO**", try re-running the virtual tool until you have data that supports your conclusions.

Wild-type body color is: **Dominant**: _____ **Recessive**: _____

Ebony body color is: **Dominant**: _____ **Recessive**: _____

The body color gene (trait) is: **Autosomal**: _____ **Sex-linked**: _____

Does the genetics model of the **simulation** correspond to that of question # 6?. Please explain

***IMPORTANT NOTE*:**

Return your assignment at the END of the lab session or submit an electronic copy (i.e., scanned PDF file) through CANVAS.

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