ASSIGNMENT # 3

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#1-3)

1. After observing the **F_1** parental flies (F_1 x F_1) 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

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

To get full marks, please record your data in the file available online through the modules tab in Canvas (Lab # 3)

PREDICTIONS USING A MODEL: THE SECOND GENERATION (F_2)

You already proposed a genetics model of inheritance for the yellow, white, miniature, and sepia mutations (pages 29-31). Using this information, please answer the following questions.

2. Please provide the genotype and phenotype of the F_1 flies.

F_1 genotype(s): _____

F_1 phenotypes(s): _____

3. Please use the following template to draw a Forked-lined method to estimate the expected **phenotypic** frequencies of the F_2 offspring.

Important information: **1)** Please do not consider the sex of the flies, only the phenotypes. **2)** When both, white and sepia mutations are present (w/w ; se/se), the resulting flies will show white eyes. This is due to an epistatic interaction that will be studied in further labs.

Body color (yellow – wt)	Eye color (white – wt)	Wing size (miniature – wt)	Eye color (sepia – wt)	Proportion (As a fraction: Ex. ¼)

GENETICS VIRTUAL LAB

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

**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, 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.

4. Eye 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 "analysis" tab of each corresponding vial.

Scoring Table. Vial #:______

Eye color	Body color	F	M	Total
Sepia	Wild type			
Sepia	Yellow			
Wild type	Wild type			
Wild type	Yellow			
Phenotypic Ratio				
Wild Type:		**Sepia:**		

Scoring Table. Vial #:______

Eye color	Body color	F	M	Total
Sepia	Wild type			
Sepia	Yellow			
Wild type	Wild type			
Wild type	Yellow			
Phenotypic Ratio				
Wild Type:		**Sepia:**		

Scoring Table. Vial #:______

Eye color	Body color	F	M	Total
Sepia	Wild type			
Sepia	Yellow			
Wild type	Wild type			
Wild type	Yellow			
Phenotypic Ratio				
Wild Type:		**Sepia:**		

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

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

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

Scoring Table. Vial #:______

Eye color	Body color	F	M	Total
Sepia	Wild type			
Sepia	Yellow			
Wild type	Wild type			
Wild type	Yellow			
Phenotypic Ratio				
Wild Type:	**Sepia:**			

Scoring Table. Vial #:______

Eye color	Body color	F	M	Total
Sepia	Wild type			
Sepia	Yellow			
Wild type	Wild type			
Wild type	Yellow			
Phenotypic Ratio				
Wild Type:	**Sepia:**			

Scoring Table. Vial #:______

Eye color	Body color	F	M	Total
Sepia	Wild type			
Sepia	Yellow			
Wild type	Wild type			
Wild type	Yellow			
Phenotypic Ratio				
Wild Type:	**Sepia:**			

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

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

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

Scoring Table. Vial #:______

Eye color	Body color	F	M	Total
Sepia	Wild type			
Sepia	Yellow			
Wild type	Wild type			
Wild type	Yellow			
Phenotypic Ratio				
Wild Type:	**Sepia:**			

Scoring Table. Vial #:______

Eye color	Body color	F	M	Total
Sepia	Wild type			
Sepia	Yellow			
Wild type	Wild type			
Wild type	Yellow			
Phenotypic Ratio				
Wild Type:	**Sepia:**			

Scoring Table. Vial #:______

Eye color	Body color	F	M	Total
Sepia	Wild type			
Sepia	Yellow			
Wild type	Wild type			
Wild type	Yellow			
Phenotypic Ratio				
Wild Type:	**Sepia:**			

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

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

7. Eye color: perform **three** independent crosses between a **sepia-eyed female** and a **sepia-eyed male**. Record the data in the scoring tables. Make sure that you use different parental flies each time you perform a cross.

Scoring Table. Vial #:______

Eye color	Body color	F	M	Total
Sepia	Wild type			
Sepia	Yellow			
Wild type	Wild type			
Wild type	Yellow			
Phenotypic Ratio				
Wild Type:	**Sepia:**			

Scoring Table. Vial #:______

Eye color	Body color	F	M	Total
Sepia	Wild type			
Sepia	Yellow			
Wild type	Wild type			
Wild type	Yellow			
Phenotypic Ratio				
Wild Type:	**Sepia:**			

Scoring Table. Vial #:______

Eye color	Body color	F	M	Total
Sepia	Wild type			
Sepia	Yellow			
Wild type	Wild type			
Wild type	Yellow			
Phenotypic Ratio				
Wild Type:	**Sepia:**			

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

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

8. Based on your analysis of the previous nine crosses, propose a **genetics mode of inheritance** for the **eye 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 eye coloration is: **Dominant**: ________ **Recessive**: __________

Sepia eye coloration is: **Dominant**: ________ **Recessive**: __________

The eye-color trait is: **Autosomal**: ________ **Sex-linked**: __________

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

9. 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 “analysis” tab of each corresponding vial.

Scoring Table. Vial #:_______				
Eye color	**Body color**	**F**	**M**	**Total**
Sepia	Wild type			
Sepia	Yellow			
Wild type	Wild type			
Wild type	Yellow			
Phenotypic Ratio				
Wild Type:	**Yellow:**			

Scoring Table. Vial #:_______				
Eye color	**Body color**	**F**	**M**	**Total**
Sepia	Wild type			
Sepia	Yellow			
Wild type	Wild type			
Wild type	Yellow			
Phenotypic Ratio				
Wild Type:	**Yellow:**			

Scoring Table. Vial #:_______				
Eye color	**Body color**	**F**	**M**	**Total**
Sepia	Wild type			
Sepia	Yellow			
Wild type	Wild type			
Wild type	Yellow			
Phenotypic Ratio				
Wild Type:	**Yellow:**			

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

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

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

Scoring Table. Vial #:_______				
Eye color	**Body color**	**F**	**M**	**Total**
Sepia	Wild type			
Sepia	Yellow			
Wild type	Wild type			
Wild type	Yellow			
Phenotypic Ratio				
Wild Type:	**Yellow:**			

Scoring Table. Vial #:_______				
Eye color	**Body color**	**F**	**M**	**Total**
Sepia	Wild type			
Sepia	Yellow			
Wild type	Wild type			
Wild type	Yellow			
Phenotypic Ratio				
Wild Type:	**Yellow:**			

Scoring Table. Vial #:_______				
Eye color	**Body color**	**F**	**M**	**Total**
Sepia	Wild type			
Sepia	Yellow			
Wild type	Wild type			
Wild type	Yellow			
Phenotypic Ratio				
Wild Type:	**Yellow:**			

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

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

11. <u>Body color</u>: perform **<u>three</u>** independent crosses between a **<u>yellow-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.

Scoring Table. Vial #:______				
Eye color	**Body color**	**F**	**M**	**Total**
Sepia	Wild type			
Sepia	Yellow			
Wild type	Wild type			
Wild type	Yellow			
Phenotypic Ratio				
Wild Type:	**Yellow:**			

Scoring Table. Vial #:______				
Eye color	**Body color**	**F**	**M**	**Total**
Sepia	Wild type			
Sepia	Yellow			
Wild type	Wild type			
Wild type	Yellow			
Phenotypic Ratio				
Wild Type:	**Yellow:**			

Scoring Table. Vial #:______				
Eye color	**Body color**	**F**	**M**	**Total**
Sepia	Wild type			
Sepia	Yellow			
Wild type	Wild type			
Wild type	Yellow			
Phenotypic Ratio				
Wild Type:	**Yellow:**			

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

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

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

Scoring Table. Vial #:______				
Eye color	**Body color**	**F**	**M**	**Total**
Sepia	Wild type			
Sepia	Yellow			
Wild type	Wild type			
Wild type	Yellow			
Phenotypic Ratio				
Wild Type:	**Yellow:**			

Scoring Table. Vial #:______				
Eye color	**Body color**	**F**	**M**	**Total**
Sepia	Wild type			
Sepia	Yellow			
Wild type	Wild type			
Wild type	Yellow			
Phenotypic Ratio				
Wild Type:	**Yellow:**			

Scoring Table. Vial #:______				
Eye color	**Body color**	**F**	**M**	**Total**
Sepia	Wild type			
Sepia	Yellow			
Wild type	Wild type			
Wild type	Yellow			
Phenotypic Ratio				
Wild Type:	**Yellow:**			

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

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

13. Based on your analysis of the previous nine crosses, propose a **genetics mode 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**: _____

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

The Body-color trait is: **Autosomal**: _____ **Sex-linked**: _____

GENETICS PROBLEM: IMPROVE YOUR SOLVING SKILLS

Please consider the following information to solve the next genetics problem

A scientist performed a cross between a $\mathbf{P_1}$ **yellow-body and brown-eyed female** and a $\mathbf{P_2}$ **wild-type male**, both were pure lines (i.e. homozygous). Also, it is known that both genes are located on **different chromosomes**.

The cross produced the following offspring:

100% females: Wild type (body and eyes)
100% males: yellow body, wild-type eyes

14. Based on the **F_1 results,** are the alleles for **yellow body** and **brown eyes** dominant or recessive? Are those genes autosomal or sex-linked? Use the table below to fill the right cell with an "**X**".

Mutation	Dominant	Recessive	Autosomal	Sex-linked
Yellow body				
Brown eyes				

15. Based on the notation used in *Drosophila* research, please provide the genotype of the **P_1 yellow body and brown-eyed female** and **P_2 wild-type male** (both are homozygous).

Hint: For the notation, please consider the following information: **females** carry the **yellow body (y)** and the **brown (bw) mutations.** The **males** carry the wild-type allele for both genes (y^+ and bw^+)

P_1 yellow body, brown-eyed females: _____

P_2 wild-type males: _____

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

Gametes		

F_1 genotype(s): _____

F_1 phenotypes(s): _____

17. What are the expected **F_2** phenotypic **proportions** (Ex. ¾ ; ¼) expected by crossing the **F_1** males and females? Please provide the **F_1** genotypes and show your work in the Punnet square template. Reduce the proportions to the lowest terms (Ex. 2/4 should be expressed as ½)

F_1 females: _____ X F_1 males: _____

Gametes				

Proportions:

***IMPORTANT NOTE*:**

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