**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 ( $F_1 \times F_1$ ) 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): \_\_\_\_\_

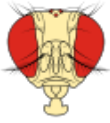
$F_1$  phenotypes(s): \_\_\_\_\_

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. $\frac{1}{4}$ )



## GENETICS VIRTUAL LAB

For the next set of questions, you will use the "**Sex-Linked Inheritance Analyzer**" tool available online ([www.ampossot.com/sex](http://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			
<b>Phenotypic Ratio</b>				
<b>Wild Type:</b>		<b>Sepia:</b>		

Scoring Table. Vial #: \_\_\_\_\_

Eye color	Body color	F	M	Total
Sepia	Wild type			
Sepia	Yellow			
Wild type	Wild type			
Wild type	Yellow			
<b>Phenotypic Ratio</b>				
<b>Wild Type:</b>		<b>Sepia:</b>		

Scoring Table. Vial #: \_\_\_\_\_

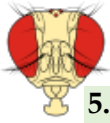
Eye color	Body color	F	M	Total
Sepia	Wild type			
Sepia	Yellow			
Wild type	Wild type			
Wild type	Yellow			
<b>Phenotypic Ratio</b>				
<b>Wild Type:</b>		<b>Sepia:</b>		

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. Eye color:** 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. Eye color:** 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:

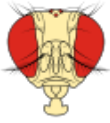
**Dominant:** \_\_\_\_\_

**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:		

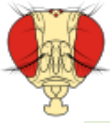
Scoring Table. Vial #: _____				
Eye color	Body color	F	M	Total
Sepia	Wild type			
Sepia	Yellow			
Wild type	Wild type			
Wild type	Yellow			
Phenotypic Ratio				
Wild Type:		Yellow:		

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. Body color:** perform **three** independent crosses between a **yellow-body 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:		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\*

**12. Body color:** perform **three** independent crosses between a **yellow-body 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:		

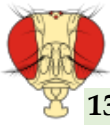
Scoring Table. Vial #: _____				
Eye color	Body color	F	M	Total
Sepia	Wild type			
Sepia	Yellow			
Wild type	Wild type			
Wild type	Yellow			
Phenotypic Ratio				
Wild Type:		Yellow:		

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\*



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

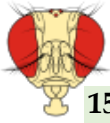
A scientist performed a cross between a P<sub>1</sub> **yellow-body and brown-eyed female** and a P<sub>2</sub> **wild-type male**, both were pure lines (i.e. homozygous). Also, it is known that both genes are located on **different chromosomes**.

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<sub>1</sub> 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<sub>1</sub> **yellow body and brown-eyed female** and P<sub>2</sub> **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<sup>+</sup> and bw<sup>+</sup>)

P<sub>1</sub> yellow body, brown-eyed females: \_\_\_\_\_

P<sub>2</sub> wild-type males: \_\_\_\_\_

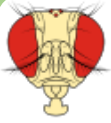
16. Please provide the **expected** phenotype and genotype of the F<sub>1</sub> flies. Show your work.

Gametes		

F<sub>1</sub> genotype(s): \_\_\_\_\_

F<sub>1</sub> phenotypes(s): \_\_\_\_\_

17. What are the expected F<sub>2</sub> phenotypic **proportions** (Ex.  $\frac{3}{4}$  ;  $\frac{1}{4}$  ) expected by crossing the F<sub>1</sub> males and females? Please provide the F<sub>1</sub> genotypes and show your work in the Punnet square template. Reduce the proportions to the lowest terms (Ex.  $\frac{2}{4}$  should be expressed as  $\frac{1}{2}$ )



F<sub>1</sub> females: \_\_\_\_\_ X F<sub>1</sub> males: \_\_\_\_\_

**Gametes**


**Proportions:**

University of Saskatchewan

**\*IMPORTANT NOTE\*:**

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