TRANSGENIC FLY VIRTUAL LAB WORKSHEET

INTRODUCTION

Go to http://www.hhmi.org/biointeractive/transgenic-fly-virtual-lab. Start the Virtual Lab and maximize the screen if you wish. Answer the following questions in the spaces provided.

TRANSGENIC FLY LAB INTRODUCTION

Read the Transgenic Fly Lab Introduction. Answer the following questions in the spaces provided.

1. What is the purpose of this virtual lab? What are transgenic organisms used for in research?

_____

_____

2. Click on "more on experimental design." What gene will you be studying as a graduate student in this lab? _____
3. What is the role of a promoter (regulatory region) of a gene?

_____

_____

4. What occurs when the appropriate signals turn on the promoter?

_____

_____

5. What is the role of a reporter gene?

_____

_____

6. Why is the luciferase gene such a popularly used reporter gene in experiments?

_____

_____

7. Won't it be interesting to turn an ordinary fruit fly into a fly that glows? However, the light produced has no practical function for your fly. What does the light from this transgenic organism demonstrate to you?

_____

_____

8. In summary, transgenic _____ flies will produce light in a pattern that reflects the _____ activity of the _____ gene.

9. List the basic steps and substeps of the lab procedure:

_____

_____

_____

_____

_____

_____

10. What does the *period* gene normally control for the fly?

_____

_____

11. What can a mutation in the *period* gene alter?

_____

_____

12. In this lab, the *period* gene is linked to the luciferase gene. Why? What does this elegant model allow us to do?

_____

_____

Click to Enter the Lab. (Click the window on the left-hand side of the screen to enter the lab.) Follow the instructions in the lab (left-hand window) and answer the following questions pertaining to each part from the information Notebook window on the right.

PART 1: PREPARE DNA THAT WILL BE INCORPORATED INTO THE FLY GENOME

1. What is "construct DNA"?

_____

_____

Click on "learn more about the technical details of DNA preparation."

2. Where is the promoter of the *period* gene?

_____

_____

3. If the construct DNA's promoter is activated, what will occur and what will be produced?

_____

_____

4. How are DNA sequences "put together" in the laboratory?

_____

_____

5. The construct DNA contains a gene that confers the red eye trait. What is the significance of this "clever device" built into the construct DNA? What does it enable us to check for?

_____

_____

6. The embryos normally develop white eyes. If the embryos incorporate the new DNA, they will pass the gene on to their progeny. What color eyes will the progeny have?

_____

_____

At this point, if you wish to perform a BLAST sequence analysis of the construct DNA, click on the appropriate link. (This is not a required portion of the virtual lab.)

Move through the steps in the virtual lab window on the left. Be sure to watch the virtual lab animation and follow the instructions.

7. After being filled, what does the glass needle contain?

_____

_____

8. What is the purpose of the pump to which the glass needle is attached?

_____

_____

Be sure to answer all virtual quiz questions as they appear on your screen. Submit them for grading. Look over your results, and review the questions that were answered incorrectly.

PART 2: PREPARE EMBRYOS FOR INJECTION

1. Why is it important to use embryos that are less than 30 minutes old?

_____

_____

2. What is a germ cell? Where are germ cells found in fly embryos?

_____

_____

_____

_____

3. If the DNA integrates properly into the germ cells, the adult fly will contain _____

   that contain _____. After mating, these flies can then produce

   progeny that will contain _____.

Click and review the lab equipment used in this experiment. Be sure to proceed through the virtual lab in the window on the left.

Answer all virtual quiz questions as they appear on your screen. Submit them for grading. Look over your results, and review the questions that were answered incorrectly.

PART 3: INJECT FLY EMBRYOS WITH DNA

1. The DNA is injected into which end of the embryo? _____

2. Explain why embryo survival rates are so low in this type of experiment. (Include all reasons.)

_____

_____

_____

_____

3. What are "transformant progeny"?

_____

_____

_____

_____

Be sure to proceed through the virtual lab in the window on the left.

4. How much time does it take for the embryos to reach adulthood?

_____

_____

Be sure to answer all virtual quiz questions as they appear on your screen. Submit them for grading. Look over your results, and review the questions that were answered incorrectly.

PART 4: BREED FLIES

1. The adult flies are white eyed. Does this mean there are no transgenic flies?

_____

_____

2. Your task now is to mate these adults with noninjected white-eyed flies. What do you expect from this mating?

_____

_____

3. What do you expect all of their cells to contain? What color will their eyes be?

_____

_____

Be sure to proceed through the virtual lab in the window on the left.

4. What occurs in the vial during the first two to three days?

_____

_____

Be sure to answer all virtual quiz questions as they appear on your screen. Submit them for grading. Look over your results, and review the questions that were answered incorrectly.

PART 5: SELECT TRANSGENIC PROGENY

1. When looking at the progeny, what is the visible marker?

_____

_____

Be sure to proceed through the virtual lab in the window on the left.

2. What does the CO_2 do to the flies?

_____

_____

_____

_____

3. Did your experiment work? _____ If you answered "No," answer question #4 and 5 and then proceed to Part 6.

4. What are four reasons why the experiment might have failed?

   a. _____

   b. _____

   c. _____

   d. _____

5. None of your flies had red eyes. The ability to troubleshoot an experiment is a vital skill in research. What are a few possible explanations of what went wrong?

_____
_____
_____

_____

PART 6: EXAMINE LIGHT OUTPUT FROM TRANSGENIC ADULTS

1. What was your original hypothesis at the beginning of the experiment?

_____
_____

2. What is luciferin? What is its function?

_____
_____

3. How often are light emissions measured in this experiment?

_____
_____

Be sure to proceed through the virtual lab in the window on the left.

4. Analyze the graph before clicking on it. What initial conclusions can be drawn from it?

_____
_____
_____
_____

Be sure to answer all virtual quiz questions as they appear on your screen. Submit them for grading. Look over your results, and review the questions that were answered incorrectly.

5. Conclusions: During what time of day did light emissions peak? And trough?

_____

_____

USE TRANSGENIC FLIES

You should now be in to the next section, Use Transgenic Flies. To redirect there yourself, choose the bottom right tab. Note that there are three experiments in this section.

Experiment Selection

- In the virtual lab window to the left, select Experiment 1 to begin this portion of the virtual lab. Once you have selected an experiment, click to select the hypothesis that you think is the correct one for that experiment.
- Proceed through the following questions pertaining to the experiment that you are completing.
- You must complete all three experiments in order, along with the accompanying questions that follow.

Experiment 1: Measure *per-luc* Gene Expression While Keeping Lights Off

1. What is your hypothesis?

_____

_____

2. According to the Methods, what is the variable you are manipulating in this experiment?

_____

_____

Be sure to proceed through the virtual lab in the window on the left.

3. Look at the graph before clicking on it. What initial conclusions can be drawn from it?

_____

_____

4. What is the purpose of days 1-5?

_____

_____

Click on the graph and complete the Graph Analysis for Experiment 1. Print the data window if you wish.

Be sure to answer all virtual quiz questions as they appear on your screen. Submit them for grading. Look over your results, and review the questions that were answered incorrectly.

5. Is your hypothesis correct or incorrect?

_____

_____

6. Explain the conclusion of Experiment 1 in your own words. (Scroll to bottom of screen.)

_____

_____

_____

_____

Experiment 2: Measure *per-luc* Gene Expression While Changing Light On/Off Times

1. What is your hypothesis?

_____

_____

2. According to the Methods, what is the variable you are manipulating in this experiment?

_____

_____

Be sure to proceed through the virtual lab in the window on the left.

3. Look at the graph before clicking on it. What initial conclusions can be drawn from it?

_____

_____

_____

_____

Click on the graph and complete the Graph Analysis for Experiment 2. Print the data window if you wish.

Be sure to answer all virtual quiz questions as they appear on your screen. Submit them for grading. Look over your results, and review the questions that were answered incorrectly.

4. Is your hypothesis correct or incorrect? _____

5. Explain the conclusion of Experiment 2 in your own words. (Scroll to bottom of screen.)

_____
_____
_____
_____

Experiment 3: Examine Different Fly Body Parts for *per-luc* Gene Expression

1. What is your hypothesis?

_____
_____

Be sure to proceed through the virtual lab in the window on the left.

2. Analyze the graphs before clicking on them. What initial conclusions can be drawn from each?

   a. Head:_____

   _____

   b. Leg:_____

   _____

   c. Wing:_____

   _____

3. What is the purpose of the following:

   a. Days 1-2:_____

   _____

   b. Days 3-7:_____

   _____

   c. Days 8-10:_____

   _____

Click on the wing graph and complete the Graph Analysis for Experiment 3. Print the data window if you wish.

Be sure to answer all virtual quiz questions as they appear on your screen. Submit them for grading. Look over your results, and review the questions that were answered incorrectly.

4. Is your hypothesis correct or incorrect? _____

5. Explain the conclusion of Experiment 3 in your own words. (Scroll to bottom of screen.)

After completing all three experiments, proceed to the next section.

TRANSGENIC FLY VIRTUAL LAB: CONCLUSION

1. What are the three main conclusions that can be drawn from the three different experiments?

Experiment 1:

Experiment 2:

Experiment 3:

Click on "View lab status and quiz summaries." Print the "Lab Status and Quiz Summaries," write your name on it, and turn it in to your instructor. (Staple the data analysis sheets to this packet if you printed them as you completed the three experiments.)

AUTHOR

Prepared by Ann Brokaw, Rocky River High School.
Edited by Susan Dodge and Laura Bonetta, HHMI; Copyedited by Linda Felaco.