

Unit
2Handout
4*Lesson 4: Investigating Larvae Food Preference***Purpose:**

Set up an investigation that finds the food preference of the cabbage white butterfly larvae.

NGSS DCIs

LS1.A (cells/parts), LS1.B (growth/development), LS1.C (energy/matter use), LS2.A (interdependence), LS2.B (flow of matter/energy)

Background and Problem Statement.

When Carolina Biological shipped the butterfly eggs to us they came with an instruction booklet. In the section on feeding in the booklet, we were informed that the Cabbage White larvae are picky eaters. That is, they will only eat certain types of plants. So, we have to make sure the food we buy for them is what they will eat.

Carolina had us make radish plant systems for the larvae as they prefer to eat that. However, we have run out of radish plants for them to eat; they ate all the leaves! So, what will feed them now?

Here is what we do know.

1. Before receiving the eggs, Carolina instructed us to make 9 radish plant systems. We grew these two weeks prior to the eggs arriving. When the eggs arrived, the radish plants had large leaves. About a day or two after placing the eggs on the leaves, small holes appeared and larvae were visible. After about two weeks, the leaves were entirely consumed.
2. Carolina also warned us not to put the larvae with your Fast Plants as they would eat those.
3. The plants we need to buy for the larvae are available in the produce section of the grocery store. These plants will be leafy greens (e.g. lettuce, spinach, brussels sprouts, cabbage, kale, etc.).

Research

Before designing the experiment for this investigation, we need to do some background research. There is a "clue" in the previous section: the larvae will consume radish plants and Fast Plants. What do these organisms have in common? Are there other organisms similar to radishes and Fast Plants?

An easy way to find this out is to look at the biological classification of the radish and the Fast Plant. On the next page is a graphic organizer for the scientific name of the radish and the Fast Plant. Use Wikipedia to help you complete the missing information on the table.

In Wikipedia search for "Wisconsin Fast Plant" and "Radish." The scientific names of the organisms can be found on the right side of the page.

Taxon*	Fast Plant	Radish
Domain	Eukarya	Eukarya
Kingdom		
Order		
Family		
Genus		
Species		

*I have excluded the taxa phylum and class from this list.

1. What did you learn from the scientific name of the Fast Plant and radish?

Now that we know how the Fast Plant and Radish are related, we need to figure out if other leafy greens are related. In our investigation, we have available: lettuce, spinach, cabbage, and brussels sprouts. Which of these are closely related to the Fast Plant and radish? Look up their scientific classifications and enter them into the table below.

Taxon*	Lettuce	Spinach	Cabbage**	Brussels Sprouts
Domain	Eukarya	Eukarya		
Kingdom				
Order				
Family				
Genus				
Species				

** After the page for cabbage page loads, click on the species name *Brassica oleracea* for the scientific name.

Prediction

In science a prediction is a statement of what you believe is going to happen.

2. Write a statement that predicts which of the leafy greens the larvae will consume and which they will not.

Hypothesis

In science a hypothesis is a tentative explanation. Statements such as "if...then" are not necessarily hypotheses; rather, if/then statements are predictions. Hypotheses offer a testable statement that explains observations. Consider the following as examples of hypotheses:

- The shape of the cell is dependent on the function of the cell.
- Listening to music while studying distracts the student.
- Woodland fires recycle nutrients into the soil.

Each of the statements offers a possible explanation that can be tested by scientists.

3. Think a possible explanation as to why the larvae prefer one type of plant over another. What possible explanation is there for this?

Experimental Design

Our investigation should test our hypothesis. However, the hypotheses we generate are typically too complex for us to test. However, we are still going to carry out an investigation to determine if our predictions are true.

We need to design an investigation that will help us figure out which food to give the larvae as they have completely consumed the radish plants. Since we have a list of possible food sources (lettuce, spinach, cabbage, and brussels sprouts) we can brainstorm ideas of how we will fairly test this.

Last year the students design this investigation as follows. They took two pieces of leafy greens and placed them at opposite ends of a petri dish. They placed one larvae between them and waited to see what the larvae consumed.

Each group did this but there was limited data as the larvae were not particularly hungry. Some groups concluded incorrect information from their experiments based on their observation of their worm.

4. While this method produced mixed results, there is a glaring limitation with it. What is the (or some) major limitation(s) of doing the experiment in this way?

Side note: It is not a "bad" thing that last year's design was flawed. In fact, it's incredibly helpful to us because it helps us from producing the same mistake they made last year.

Having identified the limitation with last year's experiment, let's design our own. We need to make sure it improves upon last year's so our data will be valid.

Here is the equipment/materials we will have available to us:

- Containers with unspecified masses of each of the leafy greens.
- About 70 larvae (decreasing each day as they go through metamorphosis)

We want to make sure what we do in the investigation is fair. This means no one container will have "better" results than another (e.g. the larvae had more food so it looks like they preferred that one over a container that simply had less food in it). To help us with this we need to think about the following.

5. What and how are we going to measure to show the larvae's preference for a leafy green? (This is known as your dependent variable.)

6. What and how will we keep the investigation the same between each container? What are some possible variables (things that could be different) between the containers that we need to make sure are not?

7. What is the one variable we want between the containers? (This is known as your independent variable.)

8. In the space below, make a diagram of how the investigation would be setup.

Data and Analysis

Use the data table below to record data from the investigation.

Container (I.V.)	Data Collected: _____ (D.V.)
Lettuce	
Spinach	
Cabbage	
Brussels Sprouts	

9. Which of the leafy greens did the larvae prefer? Cite specific data to support your response.

10. How does this finding compare to your prediction?

11. What are some limitations of the design of our investigation?

12. What could we do next to continue investigating this topic? For example, now that we know what the larvae prefer, what could we do to expand our understanding through further investigations? What questions do you have remaining?