

Lesson 8: Measuring Larval Growth and Development

Key Concepts:

- Recording and keeping organized data is an important part of scientific questioning and research.

Skills:

- Record keeping
- Data entry
- Organization
- Observation
- Critical thinking

Materials:

- *Daily Observations* sheets (student handout - 2 pages, 1 per student or student group; data for each larva are kept on a separate sheet)
- Rulers with mm marks clearly visible; clear plastic ones work best
- Balance accurate to the nearest mg is highly desirable; you may be able to borrow one from a high school or other source
- All of the materials required to rear larvae (see lesson 2, *Rearing Monarch Larvae*)
- *Monarch Class Data Sheet* (student handout page: you can keep a single copy for the entire class, and when it is complete, copy it for individual students or groups of students)
- Optional: large wall calendar or calendar drawn onto butcher paper for class monarch calendar

Objective

To expose students to data entry and logging information into organized data tables, and to create questions based upon their findings. While this lesson is written to be done with monarchs, the concepts are applicable to any insects.

Background

Two of the most important scientific skills are making detailed measurements and keeping careful, organized records of these measurements. As your students rear their larvae, they will learn a great deal if they practice these skills. We have developed data sheets and measurement techniques that will help them to do this.

This lesson should be done in conjunction with lesson 2, *Rearing Monarch Larvae*. If you would like your students to keep detailed word descriptions during this process, please see lesson 9, *Keeping a Monarch Journal*.

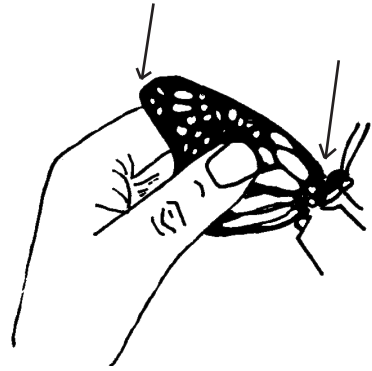
Procedure

1. Tell students they will keep detailed records of the growth and development of their larvae. Hand out *Monarch Daily Observations* charts and monarch eggs or larvae. Do the first observations together. If you do not have an accurate balance for weighing larvae, just record their lengths.
2. Have students fill in their *Monarch Daily Observations* chart daily or every other day during the larval stage, and every 4-5 days during the pupa stage. At the end of each stage, fill in the summary section for that stage. To move pupae so that it is possible to weigh them and to measure adult winglengths, see *Rearing and Observing Techniques* in the How-To's section.
3. When butterflies emerge, summarize all data on the *Class Data Sheet*. Adult mass can be measured using a triple beam balance (nearest 0.1g) or an electronic balance (nearest 0.01 g or 0.001 g). In both cases the butterfly should be placed in an envelope while it is being weighed. Be sure to subtract the mass of the envelope. The length of the forewings can also be measured; measure to the nearest millimeter from where the wing attaches to the thorax to its tip, or apex. It is interesting to measure both the right and left forewings and to note the degree of asymmetry (how different the two wings are on each butterfly).
4. Use the class data to answer questions about monarchs. Students can think of questions that interest them, or you can use the following list. In many cases you will need to make a graph to answer the

questions. Whether you do this as a class or as individuals depends on the age and abilities of your students.

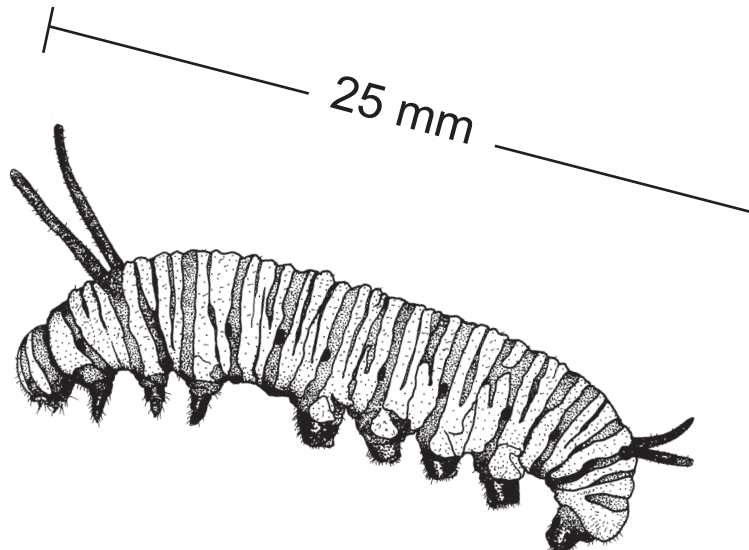
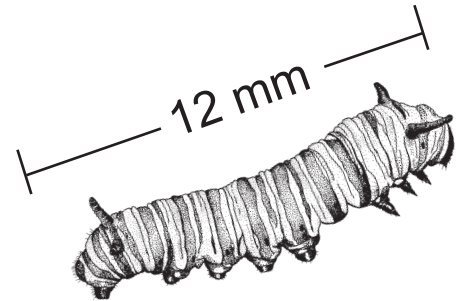
- *Do large caterpillars produce large butterflies?*
- *Which are larger, females or males?*
- *Do males or females emerge sooner from the chrysalis?*
- *Do larger caterpillars take longer to pupate?*
- *What was the average length of time in the pupa stage?*
- *What is the sex ratio of the monarchs our class raised?*
- *How much growth (either mass or length) occurs in a single day at the end of the larval period?*

5. If desired, record life cycle data on a class calendar. Make a drawing for each monarch every day, so that the calendar shows when they form a "J", when they pupate, and when the adult butterflies emerge. You could use a separate calendar for each caterpillar, or show all individuals on one calendar.



Measuring the forewings from one arrow to the other

9 mm



Daily Observations

(page 2)

Individual Monarch Summary

Larva (Caterpillar)

Maximum Length	Maximum Weight	Date larva formed "J"

Chrysalis

Length	Weight	Date of Chrysalis formation	Date Butterfly emerged	# of days in Chrysalis

Adult Butterfly

Number	Male or female?	Weight	Left Forewing length	Right Forewing length

