Mosquito Inquiry Experiment
Teacher Notes

This inquiry-based lab can be integrated into biology or environmental science in middle or high school life sciences.

Students will investigate aspects of climate change that could affect mosquito development and determine which variables to test. The primary climate-related issue is the effect of temperature increase or decrease on the life cycle of mosquitoes, but students may also be allowed to pursue other environmental options. Examples could include density of organisms, food availability, pH of water or water source.

Background
Learning Objectives
• Students will identify variables that affect the growth and development of mosquitoes using observations and recorded data.
• Students will draw conclusions about how global climate change can affect individual species.

Introduction
• Have students brainstorm factors that affect mosquito development.
• Guide the discussion to highlight the theme of climate change.
• Ask probing questions to get students to think about possible variables that can be investigated in the lab. There are many variables to consider and each can be addressed in the design of the experiments.

Time Requirement
• One full class period for students to design and set up their experiments.
• A minimum of four additional days (10 minutes per day) for students to observe larvae develop into pupae and to collect data.
• Additional time required for students to write up results or a lab report.
• Additional time required for teachers to set up a rearing chamber and submerge mosquito eggs two days before the student experiment begins (see Mosquito Rearing Instructions).

Experiment
The following experiment is designed to measure the effect of different temperatures on the development rate of mosquito larvae. If your students choose other variables to test, you can make the appropriate changes to the materials, preparation, and procedures.

Materials
• Mosquito rearing chambers: any clear containers such as canning jars, baby food jars, or a BioQuip Breeding Chamber
• Spring water, distilled water, or conditioned tap water
• Mosquito food (ground dry fish food pellets or flakes)
• Covering for containers: tulle or netting squares, cheesecloth, screen, rubber bands
• Hatched Aedes sp. mosquito larvae (approximately 30 larvae per student group)
• Plastic pipets (with tips cut off to transfer larvae)
• Graduated cylinders
• Microaquaria, Petri dishes, deep-well slides
Pathogens and Vectors Unit

- Thermometers
- Chick incubator (Hovabator)
- Cooler with ice packs
- Safety equipment as required (goggles, apron, gloves)

See source list for these materials.

Preparation
- See Mosquito Rearing Instructions for information on conditioning water and submerging eggs.
- Submerge the mosquito eggs for two to three days before students begin the experiment. Hatch all eggs in one container so temperature and food are kept constant until the inquiry experiment.
- Refer to Mosquito YOLO for preliminary companion activities that provide experience observing the mosquito life cycle before students begin the experiment:
- See Mosquito Life Cycle Background for a detailed discussion of complete metamorphosis, including scientific illustrations.

Procedure
- Ideally start the experiment two days after submerging the eggs.
- The student experiment usually takes five days. Recommendation: Submerge eggs on a Friday and start the student experiment on Monday. Larvae will be more visible for students to observe after two days of development over the weekend. Adjust schedule accordingly for different class schedules.
- Divide students into lab groups to design and conduct an experiment. Teams of two students are ideal for laboratory work, but circumstances may necessitate teams of three or four students.
- Have lab groups create a hypothesis, procedure, and data table to record observations.
- Distribute larvae in multiples of 10 to simplify estimating averages.
- Allow larvae to grow under experimental conditions such as different temperatures, food supply, or population density.
- Students can test any range of temperatures; however, recommended temperatures for a five-day experiment are as follows: 37 °C, 30 °C, and 22 °C (approximate room temperature). Cooler temperature options such as 10 °C (cold chamber) will inhibit development of the larvae. Temperatures in a refrigerator will prevent further development.
- Individual larvae do not simply grow larger, but develop through four stages called instars. All instars look alike, except the size of the larvae increases with each new stage. In this experiment, mosquito larvae complete the development cycle more quickly at the higher temperature (37 °C), so they reach the next instar stage in a shorter time.
- Each day, record the number of pupae and calculate the percentage of total.
- Chart a graph with results.
- Determine at which temperature the larvae become pupae in the shortest amount of time.

Teacher Tip
You may continue the experiment for 7 to 10 days if you wish to observe adults emerge. The experiment measures the number of days needed for larvae to develop into pupae under different environmental conditions. This unit of measurement is used because the time to mature to the adult stage is not as accurate. Development of larvae into pupae is not 100% and development of pupae into adults is not 100%. This discrepancy will be cumulative and affect your results. Students might wait a very long time on larvae that will never become pupae or pupae that will never become adults.
Sources of Mosquito Eggs, Larvae, and Food

Eggs
- State Agricultural Experiment Stations
- Centers for Disease Control and Prevention: www.cdc.gov (Ask for local mosquito supplier.)
- Local researchers or professors

Larvae
Starting with larvae is an alternative if eggs are unavailable.
- Native larvae (collected in the wild)
- Larvae from pet stores (raised to feed fish)

Food
- Pet stores: Ground dry fish food pellets or flakes; ground dog, cat or rodent chow, or a mixture of ground fish food and animal chow.
- Mosquito Diet (Carolina Biological Supply)