In Part Three the team has learned about different types of mosquitoes. Your team may have already collected mosquito eggs during Task 3-1. These eggs are one stage of the mosquito life cycle. Soon they will become adult mosquitoes. It is important to understand all stages of the mosquito life cycle.

Objective

In this task, the team will work to understand the life cycle of the mosquito. If live egg, larvae, or pupae samples are available to the team from Task 3-1, experimentation methods are suggested here. If live samples are not available do not worry. Continue to monitor your collection cups in your research site. You can always come back to this experiment after you collect samples.

In this task, the team will be focusing on the following questions from the question map in Task 1-10. How do mosquitoes develop and reproduce? What factors influence how mosquitoes develop and reproduce?

The team will use this analysis to think about factors that may effect the life cycle and problem question. The team will also think about how understanding the life cycle could be useful when making solutions for the community.

1. Go to the Task 3-4 folder and get the Understanding Mosquito Life Cycle instructions. Choose the Mosquito A or Mosquito B task from the task folder. The Mosquito B task includes the instructions for working with live samples. You can also do both tasks if you want.

2. As a team, discuss how understanding the life cycle of the mosquito could be helpful when thinking about our problem question: How can we ensure health for all from mosquito-borne diseases?

Hooray! You completed Task 3-4. Check it off the task list. Go to Task 3-5!
Task 3-4 Understanding Mosquito Life Cycle—Mosquito A

Cut out the pictures.

Put the pictures in the life cycle chart in the order you think they belong.

Label each stage.

Images: J. Stoffer, WRBU
Use one or both of the following pieces of evidence to assess your life cycle chart.

Image: LCOSMO/iStock/Thinkstock
Additional resources for this task (images and videos) can be found in the Learning Lab Task 3-4 folder. View these resources in the Task 3-4 folder on LearnIR.

Based on this picture and any of the videos you watched, revise your life cycle as needed.

**Mosquito life cycle PowerPoint:** Use the PowerPoint in the task folder to go over life cycle vocabulary and parts of the cycle, as needed.

*Go back to Research Guide now*
Task 3-4 Understanding Mosquito Life Cycle—Mosquito B

1. **Additional resources for this task (images and videos) can be found in the Learning Lab task 3-4 folder. View these resources in the Task 3-4 folder on Learning Lab.**

2. **Mosquito life cycle PowerPoint:** Use the PowerPoint in the task folder to go over life cycle vocabulary and parts of the cycle.

3. **Mosquito life cycle emergence chambers activity:** Follow the instructions in the HHMI mosquito life cycle emergence chambers activity to observe the life cycle with live mosquitoes.

   Build the emergence chamber described in these instructions, and use any eggs or larvae you collected during Task 3-1. Do not use any collected adult mosquitoes for this activity.

   Place the eggs or larvae you collected in Task 3-1 from your research site into the emergence chambers described in this task.

   Record your results and observations according to the instructions in the activity.

   Analyze your results according to the instructions.

   **Safety:** Make sure to follow the disposal instructions after all adults have emerged! If you’re concerned about safety or mosquitos getting released indoors, complete the entire experiment outside.

4. **Extension:** Using the materials, setup, and live egg samples from the life cycle activity, experiment with factors (temperature, light exposure, water composition) that might affect the mosquito life cycle. Use the instructions in the task folder to help set up your experiment and collect the results. Share the results of the team experiments and determine how these results could help with the problem question.

   **Go back to Research Guide now**
GLOBE is a science and education program that connects a network of students, teachers and scientists from around the world to better understand, sustain and improve Earth’s environment at local, regional and global scales.

To date, more than 130 million measurements have been contributed to the GLOBE database, creating meaningful, standardized, global research-quality data sets that can be used in support of student and professional scientific research.

It’s easy to get started! You are here!
What do you know about the life cycle of mosquitoes?
Mosquito Life Cycle

Four stages: Egg, Larva, Pupa, Adult
Important Vocabulary

**Egg:** laid in or near water; hatches to become larva.

**Larva:** (larvae) immature form that lives in water; breathes at surface; eats microorganisms; molts four times to grow.

**Instar:** phase between two periods of molting. (We observe the 4\textsuperscript{th} instar- which is also called a “wiggler.”)

**Pupa:** (pupae) last immature stage before emerging as an adult. Non-feeding stage. Also known as tumblers.

**Adult:** flying insect

*Length of each stage depends on species and ambient temperatures.*
Mosquito Life Cycle

The adult female mosquito lays eggs in or near water. The eggs are deposited singly, or attached together to form rafts.

Some mosquitoes, like those that transmit yellow fever mosquito and dengue, prefer to lay their eggs in small containers near humans - like flower pots and water containers.

Most eggs hatch into larvae within 24-48 hours after becoming moist but some can also persist for weeks or months through dry periods. Others can withstand subzero winters!
Mosquito Life Cycle

Egg

Many mosquitoes lay eggs on the surface of fresh or stagnant water. If they prefer open air, breeding sites they usually choose where the water is sheltered from wind by vegetation. Other mosquitoes prefer a protected habitat, such as a natural container (tree or rock holes) or an artificial container, such as a dish or cup. Eggs can be found in pastures, tree holes, and stream bottoms and hatch when flooded with water.

- *Culex* lay eggs in a “raft” that floats on the surface of the water.
- *Anopheles* lay single eggs on the water surface
- *Aedes* lay eggs in damp soil or on the sides of containers; the eggs begin to develop when the water level rises and floods the eggs.
The larva hatches from the egg and lives in the water. Some mosquito eggs, however, need to be dried completely before they will hatch.

Most species, such as found in *Culex* and *Aedes* genera, have a siphon or air tube and spend most of their time on the surface breathing. *Anopheles* does not have a siphon. Instead, it lays parallel to the surface and breathes through openings on its 8th abdominal segment (spiracles).

Some species have specialized siphons and attach to emergent plants found in water, using the plant tissue to access air to breathe.
Mosquito Life Cycle

Larva

Larvae eat constantly - feeding on algae, plankton, fungi, bacteria and other aquatic organisms. One genera of mosquito is specifically adapted to eat other mosquito larvae!

The larvae hang on the surface of the water with their mouths open. They have brushes (hairs around their mouth) that filter water - so only particles small enough to be eaten enter the mouth.
Mosquito Life Cycle

Larva

- During growth, the larva molts (sheds its skin) four times. (The fourth molt results in the change from larva to pupa)
- The stages between molts are called instars.
- At the 4th instar, the larva can a length of almost 10 mm. Toward the end of this instar feeding ceases.
Mosquito Life Cycle

Larva

• When the 4th instar larva molts, it becomes a pupa.

• When identifying mosquito larvae, look for the largest larvae in your sample, the 4th instar. The diagnostic features you are looking for are most pronounced in this stage.
Mosquito Life Cycle

Pupa

- Mosquito pupae, commonly called "tumblers," live in water from 1 to 4 days, depending upon species and temperature.

- The pupa is lighter than water and therefore floats at the surface. It takes oxygen through two breathing tubes called "trumpets."

- The pupa does not eat, but it is not an inactive stage. When disturbed, it dives for safety in a jerking, tumbling motion and then floats back to the surface.
Mosquito Life Cycle

Pupa

The metamorphosis of the mosquito into an adult is completed within the pupal case.

- The pupal case is like a “factory” where the mosquito larva becomes an adult. The adult mosquito splits the pupal case and emerges to the surface of the water where it rests until its body dries and hardens.
Mosquito Life Cycle

Adult

- Adults emerge, and fly away looking for their first meal and to mate.
- Adults eat nectar, like many other insects.
Mosquito Life Cycle

**Adult Female**

- Only female mosquitoes bite, seeking blood from humans and other animals. Blood provides pre-natal supplements needed for egg development.

- After her blood meal, the female lays eggs on or near the water. The eggs can survive dry conditions for a few months.

- Not all species of mosquitoes require females to eat a blood meal to make eggs, but those are the mosquitoes you are most familiar with!
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This presentation was prepared by the Institute for Global Environmental Strategies (IGES) and does not necessarily reflect the views of the NASA or USAID. For more information, contact the Principal Investigator, Dr. Russanne Low, at IGES:

**Educators: did you modify this file for your class? Put your name here!**

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Activity Link for Task 3-4

Mosquito! Task 3-4 Understanding Mosquito Life Cycle - HHMI Activities
https://www.hhmi.org/biointeractive/mosquito-life-cycle-activity
Videos for Task 3-4

Life Cycle of a Mosquito - Video
Description: Watch this video to see the entire life cycle of a mosquito. Think about how this could be useful when thinking about the problem question.
https://www.youtube.com/watch?v=AYpFTrVnteg

Animated Life Cycle of a Mosquito Explained
Description: Use this video to learn more about each stage of the mosquito life cycle.
https://youtu.be/93wPfE78SYY