THAT SUCKS! MOSQUITOES

A MEGA:BITESS Lesson Plan

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Skill Level
Beginner – Intermediate – Advanced (no prior knowledge needed)

Educational Standards
2.LS1, 2.LS2

Learner Outcomes & Successes
The learner will be able to:
• Correctly identify mosquito anatomy, feeding processes, and habitats,
• Recognize and eliminate mosquito oviposition habitats and environments,
• Create and present a presentation on mosquito-borne diseases in Tennessee.

Tag(s)
4-H Science

Time Needed 45-60 minutes for 7 days

Materials Needed
• Science journal
• Hummingbird kits
• Oculus Quest 2
• Computer, tablet, or iPad
• Fact cards
• Habitat checklist
• Disease Instruction Sheet
• Flipgrid account
• https://auth.flipgrid.com/signin?redirect_url=https://my.flipgrid.com/me
• 6 Needles worksheets
• https://www.youtube.com/watch?v=rD8SmacBUcU
• Craft supplies (markers, paper, pencils, scissors, cardboard)
• Apps: Mosquito Insect House Survivor (3D simulation), AR Mosquito Hunter
• Microscope, mosquito body section slides

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Introduction to Content
Mosquitoes are one of the causes of death in over one million people each year. Learning about mosquitoes, the diseases they carry, symptoms, and treatments is important for all humans.

Terms and Concepts
Entomology – the study of insects
Proboscis – an elongated sucking mouthpart that is typically tubular and flexible
Thorax – the middle section of the body of an insect, between the head and the abdomen, bearing the legs and wings
Abdomen – the posterior part of the body of an arthropod, especially the segments of an insect’s body behind the thorax
Virus – an infection or disease caused by an infective agent
Disease – A disorder of function in a human, animal, or plant
Habitat – the natural home or environment of an organism, animal, or plant

Introduction to Methodology
Students need no prior entomology knowledge to participate in this lesson. Students do need basic computer skills and familiarity with PowerPoint. Teachers need to review the links included in this lesson plan to ensure they are active and become familiar with PowerPoint that accompanies the matching game. Teachers can cut the cards in half or like puzzle pieces for matching. Teachers may eliminate activities or days to work it into their schedule. The matching game, habitat audit and project, and presentation are recommended.
Setting the Stage

Ask students, “Do you know what kills over one million people worldwide each year?” They will come up with various answers.

Experience

Day One: Facts!
- Matching Facts - Give students one of the matching mosquito cards. They will then find their match using the image or fact. Once they have found their match, they will write the fact in their Science journal.
- Teacher Presentation - After students have found their match, present the PowerPoint that accompanies the matching cards.

Day Two: Three labs will be set up throughout the classroom. There will be 10-minute rotations based on a 45-minute class.
- iPad Augmented Reality
  - Mosquito Insect House Survivor (students will become mosquitoes and complete tasks that increase their health and fitness).
  - Mosquito Mayhem (educational game that teaches students how to eliminate oviposition habitats and prevent bites).
- Needles Video- (Oculus Quest) - Complete guide.
- Microscope lab - Look at each of the mosquito slides and diagram each body part in your Science journal.

Day Three: Habitat Audit
- Take students outside, each with a Habitat checklist. Have students complete the checklist. Students will work in groups set by the teacher to create a diagram of the school. Have students label each area that is considered a mosquito habitat.

Day Four: Craft It!
- Use the craft items in the makerspace to create a 3D mosquito.
- Use the Hummingbird kits to mechanize a part of the mosquito.
- Have students prepare one question they would like answered from an entomologist in preparation for the next day’s interview.

Strategies to Increase Student Engagement

Students may be slow to start this activity. Model a matching set and place them on the board for students to reference.

Walk around the room and identify students who may be struggling. Ask to look at their card while they hold it and give them a Print a completed matching set to help if students get stuck.

It is a good idea to have a completed mosquito model completed so students can reference.

Create a basic PowerPoint template for students to use so students don’t spend as much time on design.

Notes
Day Five: Researchers
- Participate in the Skype a Scientist: Entomologist.
- Have students document one thing they learned in their Science journals.
- Students will work in groups and be given a mosquito-borne disease (West Nile, Zika or La Crosse Encephalitis). Students complete the guide according to the rubric. Students will use the same rubric to create a PowerPoint presentation about the virus.

Share
The class will have a mosquito concept map on the board. Daily, each student will add one fact to an area of the map. These will be written on a sticky note as they learn it and placed on the map during reflection and discussion at the end of class. It will be important to share what students have learned. Ask questions about the lessons from each day and what new information they have learned. There should be an abundance of new information recorded in their Science journal.

Generalize
Ask students, “Why is it important for us to learn about mosquito-borne diseases?” Tell them, “Knowing what mosquitoes can do to you will help you be more aware and be able to pinpoint symptoms should you ever get bitten.”

Apply
Ask students, “If you are bitten by a mosquito, what should you do?”

TIPPS
Life Skills
- Gather relevant information for decision-making (HANDS - Working)
- Select a way of living that is in accordance with sound condition of body, mind, and prevention of disease and injury (HEALTH – Living)
- Learn to form ideas, make decisions, and think critically (HEAD – Thinking)
Supplemental Information
Educational Standards Met

Life Sciences

2.LS1: From Molecules to Organisms: Structures and Processes
1. Use evidence and observations to explain that many animals use their body parts and senses in different ways to see, hear, grasp objects, protect themselves, move from place to place, and seek, find, and take in food, water, and air.
2. Obtain and communicate information to classify animals (vertebrates-mammals, birds, amphibians, reptiles, fish, invertebrates-insects) based on their physical characteristics.
3. Use simple graphical representations to show that species have unique and diverse life cycles.

2.LS2: Ecosystems: Interactions, Energy, and Dynamics
• Develop and use models to compare how animals depend on their surroundings and other living things to meet their needs in the places they live.
• Predict what happens to animals when the environment changes (temperature, cutting down trees, wildfires, pollution, salinity, drought, land preservation).

References


Matching Game

Not all mosquitoes bite. They don’t always drink blood.

It’s not the bite that causes the itch.

Mosquitoes prefer darker clothing.
Mosquitoes do prefer to bite some people over others.

Full moons can increase activity.

Mosquitoes need only one tablespoon of water to breed.
Mosquitoes do lay eggs.

There are around 3,5000 species of mosquitoes.
The wings of mosquitoes make the buzzing sound.

Mosquito Pupae are called “Tumblers.”

Adult mosquitoes emerge from Pupae.
Mosquitoes have been around since the Jurassic period.

Mosquito is Spanish for “little fly.”

Teacher’s Guide to Matching Cards

https://docs.google.com/presentation/d/1GJlvJxLEfx69O1a7P-43KNKZFWdCxGbJHJHLXkV8cE/edit?usp=sharing
Entomology Interview if Skype is Unavailable

Entomology Society of America- https://www.entsoc.org/resources/education/berte

Colonel Stephen Berté, Military Entomologist

Military entomologists are primarily responsible for protecting the health of the U.S. military. Throughout history, infectious diseases (including those transmitted by insects) and other non-battle injuries have produced more casualties in armies than actual combat actions. Diseases carried by insects and other arthropods make up a large portion of infectious diseases, such as malaria, dengue, and Leishmaniasis, that are important to the military. Entomologists in the military are uniformed officers who are part of a team of preventative medicine professionals.

While military deployments make the news, much training and preparation of military forces occurs between such events. Military entomologists provide support to the day-to-day operations of all military installations, seafaring vessels, and aircraft of the U.S. Department of Defense (DOD). Because of this broad mission, they also work in other entomological fields such as the management of urban and vertebrate pests, and even weeds. They also conduct entomological research.

Military training and sustainment operations take place on bases and aboard ships that can have populations exceeding many small towns and even small cities in America. Military entomologists support these populations by providing technical advice, conducting surveillance of insect-vectors (that cause disease) and other pests, and implementing insect control methods to protect the health of military personnel and to protect military property.

The military also conducts entomological research to develop new insect repellents and new methods to rapidly diagnose insect vectors. The diversity of military entomology assignments allows officers to serve as pest controllers, consultants, teachers, and researchers. These assignments can occur throughout the United States and in Africa, Asia, Europe, the Middle East, and South America.

Interview with Colonel Stephen Berté

Dr. Stephen Berté is a Colonel in the U.S. Army assigned in the Washington, D.C. area. He started his career in Maryland with an Army organization that provides entomological consultant services for installations in 17 Northeastern states. He went on to other military positions, including commander of a deployable entomology detachment, chief of a preventive medicine section at an Army hospital, instructor at the Army’s Academy of Health Sciences, product manager for repellent products, and an assistant director in the Army’s Medical Infectious Disease Research Program. He also served in Japan as an entomologist and deputy commander of a preventive medicine organization that supported the Army in the Pacific islands and in all Eastern countries that border the Pacific.

On returning to the United States, Berté was assigned as the contingency liaison officer for the Armed Forces Pest Management Board in the Washington, D.C., area.
His permanent assignments have taken him to several U.S. states, and even Japan. His business trips and temporary assignments have taken him to 21 states, Cambodia, Eniwetok Atoll, Honduras, Mexico, Panama, South Korea, Thailand, and the United Kingdom.

Berté received a B.A. in biology from West Chester University in Pennsylvania, his M.S. in entomology from the University of Delaware, and his Ph.D. in biology, specializing in aquatic entomology from the University of Calgary in Canada.

When did you first become interested in entomology?
I was a late bloomer. Although I had a long-standing interest in the outdoors that led me to study field biology, I didn’t focus on entomology until nearly the end of my undergraduate training.

What made you want to become an entomologist?
When I was an undergraduate, I took an introductory course in entomology and loved it. The more I got into entomology, the more the diversity of the field appealed to me. The professor who taught the course helped me decide on a graduate school to attend and off I went to the University of Delaware for my Master’s degree.

Can you describe a typical day? Is there such a thing?
I’ve never had the same type of job twice, but here are a few things military entomologists do.
As technical consultants to installations and military units, entomologists work from a central office from which they advise their customers on pest management issues, but they travel to their customers and provide advice by telephone, e-mail, and written reports. They may conduct surveillance of disease-causing pests such as ticks, mosquitoes, fleas, biting flies, and rodents; provide pest identification, and evaluate installation pest management programs.
Entomologists serving in deployable units are not only responsible for entomology-related issues, but also other concerns in preventive field medicine. They also must ensure that the soldiers maintain their military and technical skills and that the unit is always healthy and prepared to deploy if called to do so.

Some entomologists serve on military staffs where they provide advice on entomological and preventive medicine issues that could adversely affect the health of a command. They review the readiness and training of preventive medicine units, advise commanders on entomological threats associated with military operations, and review and recommend entomological and preventive medicine policies.

Entomology instructors teach general and medical entomology, and train military and civilian technicians to be certified DOD pesticide applicators. They also may teach at the Uniformed Services University of Health Sciences in Maryland.

Military entomologists also may conduct research to rapidly diagnose pathogens in vectors, to develop new compounds for and formulations of insect repellents, and to determine vector competency and epidemiology in such places as Egypt, Kenya, Peru, and Thailand.
What is the best part of your job?
What drew me to entomology is its diversity, and the military offers careers with a great diversity of assignments. I truly believe that every job or experience in life is an opportunity to learn, and my military career has offered me many great learning opportunities.

What is the most difficult part of your job?
What makes the military a great career is also what makes it most challenging. The great diversity of assignments brings leadership and technical challenges. Organizational skills and a strong sense of personal responsibility are indispensable to a successful military career.

What is the most challenging thing in becoming an entomologist?
Entomology is an incredible field. The sheer number of species there are to study can be daunting. Initially, it can be difficult to narrow the path in entomology you want to take, and once you take a path, you may feel you’ve become too narrowly focused in your interests. I think the important thing is to learn the fundamentals of entomology and to learn how to think critically and objectively. Those skills are needed no matter which path you take through the field of entomology.

Is being an entomologist as you imagined it would be?
At first, I imagined my life as an entomologist could turn out one of a few different ways. I might have found myself studying a group of insects and sharing what I learned to help develop new pest management products. I thought I might do entomological research and teach entomology. Over time, I hoped that no matter what I did, I’d gain enough knowledge in my field that I could advise others on how to best reach common goals. It turns out a career in military entomology has allowed me to do all of these things.

Are you glad you became an entomologist?
Absolutely. I’ve grown as an entomologist, a leader, and a person throughout the course of my career. If I were given a chance to do it over again, I would do it in a heartbeat.

What do you think students need to know about being an entomologist? In other words, how do you think their perception differs from reality?
I think when we are first starting in entomology we picture ourselves in some position that’s all about insects. We see ourselves in the field or lab, immersed in our work, learning more and more, and having a great time doing it. The reality is that any career is more complex and changing than that. Wherever we work, we will be part of a team of people trying to reach a common goal. We have to learn how to assess our own strengths and weaknesses to see how we best fit into that team. As we progress in our field, we will have to take on administrative and managerial roles. Students need to realize that life’s all about developing as a person, not just an entomologist, and that being a team member who grows on several different personal levels is a very rewarding experience. You’ll find that if you work hard and strive for excellence in whatever you do, you’ll be ready and able to handle any new challenges life may throw at you.
What advice would you give to someone who wants to become an entomologist? Set a goal for yourself and work hard to achieve it. I think that students, who worry about whether the choice they make now is the right one, fail to make any choice at all. Don’t get hung up on whether the goal you choose now is the right one. There are many “right” choices in life. You may find that as life goes on, your goals change. That’s fine. The point is to have some direction to your life at all times to help guide your choices. If you do, you will learn and develop as a person and will have an ever-stronger foundation on which you build the rest of your life. Without a goal, people often drift from course to unrelated course and eventually do the same with jobs, so they have a more difficult time developing a strong foundation that stabilizes their life. The bottom line is that you should make a decision and go for it! It’s far better and easier to change your course in life if you know where you are and where you’ve been than to try to find your way after wandering aimlessly.

For more information on military entomology, visit the Armed Forces Pest Management Board web site and click on the various services’ entomology links near the bottom of the page.
How Mosquitoes Use Six Needles to Suck Your Blood

Video by: Deep Look

https://www.youtube.com/watch?v=rD8SmacBUcU

1. (True or False) Female mosquitoes do not need blood for egg development.

2. (True or False) Mosquitoes carry disease agents, like viruses, that can make humans sick.

3. Use the word bank below. What two things do female mosquitoes need to make eggs?
   
   _______ and ________
   Grass       Heat
   Water       Blood

4. What part of the body does the female mosquito use to bite?
   a. Needle
   b. Teeth
   c. Proboscis

5. How many needle-like mouthparts do mosquitoes have in their proboscis?
   ________
Mosquito-Borne Disease Prompt

Purpose: This task will give you an opportunity to further explore diseases that can be carried by mosquitoes.

Task: Disease Guide

Identify the disease

Definition of the virus

How many cases of the virus in the world each year?

List 3-5 ways to prevent the mosquito-borne disease

Task: Peer Journal

Listen to your peer's disease presentations.

Detail in your Journal

- Disease name
- Pathogen Definition

Prevention

Task: Written & Oral Presentation

- Slide One: Disease name
- Slide Two: Pathogen Definition
- Slide Three: How many cases in Tennessee and the US occur each year
- Slide Four: List three ways to prevent the disease
- Slide Five: Include one video about the disease.
- Give presentation to class
Task: Disease Guide

1. Identify the disease: _______________________

2. Definition of the pathogen:
_________________________________________________________________
_________________________________________________________________
_________________________________________________________________
_________________________________________________________________
_________________________________________________________________

3. How many cases of the virus are diagnosed in TN and the US each year?
_________________________________________________________________
_________________________________________________________________
_________________________________________________________________
_________________________________________________________________
_________________________________________________________________

4. List 3-5 ways to prevent the disease
_________________________________________________________________
_________________________________________________________________
_________________________________________________________________
_________________________________________________________________
_________________________________________________________________
Mosquito Habitat Elimination Project Guide

Follow the prompts to complete this project.

ENGINEERING DESIGN PROCESS

ASK to identify the need and constraints

RESEARCH the problem

IMAGINE possible solutions

PLAN by selecting a promising solution

CREATE a prototype

TEST and evaluate the prototype

IMPROVE and redesign as needed

TeachEngineering.org
1. Ask
What is the need?

2. Research
What is the problem? Use the mosquito facts and disease presentations for background.

3. Image
Brainstorm different solutions. Remember these can be anything you can think of.

4. Plan
As a group, pick the solution that is most effective and doable.
5. **Implementation**

How would your group implement this plan?

_____________________________________________________________________

_____________________________________________________________________

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_____________________________________________________________________
# Mosquito Habitat Tally Sheet

Look for places where water has collected. Anything that collects water could become a mosquito habitat, increasing your risk of mosquito-borne diseases, like malaria and Zika. By identifying and eliminating mosquito habitats, you are helping your community and increasing the safety and enjoyment of your outdoor spaces.

## Still Water
- Lake
- Pond
- Ditch
- Swamp or Wetland
- Puddle, Vehicle or Animal Tracks
- Reservoir
- Bay or Ocean
- Other:

## Flowing Water
- Still Water Beside a Stream or River
- Estuary
- Other:

## Natural Container
- Plant Husk
- Animal Shell
- Tree Holes
- Plant Clumps
- Other:

## Artificial Container

### Water Storage Container
- Cement, Metal or Plastic Tank
- Well or Cistern
- Animal Trough or Water Bowl
- Jar
- Fountain or Bird Bath
- Dish or Pot
- Other:

### Discarded Item or Trash
- Can or Bottle
- Tire
- Old Car or Boat
- Trash Container
- Other:

Did you see any mosquitoes while looking for potential habitats?

- [ ] Larvae
- [ ] Pupae
- [ ] Adults

[mosquito icons]
Example of a Mosquito Classroom Concept Map