



Microscopes: History and Uses for Middle School

Developed by:
Jamie Tubbs, Verity Middle School, Grade Six—Science
Mattie White, Spinning Hills Middle School, Special Education

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(Microscopes: History and Uses for Middle School) Curriculum Unit Overview

Summary

The use of microscopes is prevalent throughout the high-tech world today. This curriculum unit introduces students to the history of microscopes and the various types of microscopes and their uses. It also requires them to research various careers in which knowledge of microscopes is essential. The unit is designed for students at the middle school level, preferably sixth grade.

Big Picture

Show students photos of insects and other living organisms taken on a scanning electron microscope. Pictures should be at high magnification so that the identity of the specimen is not apparent. Ask students what they think is in each photo. Ask them how they think each photo was taken. After a short discussion, reveal what was in each photo and how it is possible to view these organisms at such high magnification on a microscope. Do a K-W-L (What do you **K**now? What do you **W**ant to learn? What have you **L**earned?) with students on the topic of microscopes.

Preparation for the Unit

1. Plenty of research materials—computer with Internet access, encyclopedias, etc.— should be handy at the beginning of the unit.
2. We hope that anyone teaching this module will have access to plenty of microscopes; if not, try to get at least one.
3. Photos of specimens from scanning electron microscopes (SEM) are obtainable on the Internet. The book Microaliens: Dazzling Journeys with an Electron Microscope by Howard Tomb and Dennis Kunkel has many spectacular photos of insects and other creatures taken on an SEM and even lists all of the adaptations.

Overview

On the following page is a summary of the unit including brief summaries of each Authentic Learning Task (ALT). This table provides an overview of the tasks in the unit sections and shows how the activities in the different teaching areas relate to each other.

Microscopes: History and Uses for Middle School Curriculum Unit Summary

| History | Technology | Science |
|---|---|--|
| <p>ALT 1 - History of Microscopes Students will research the history of the microscope and its relevance in the field of technology. <u>Note:</u> This ALT examines the different parts of a microscope and as such will also function as ALT 1 in the technology section.</p> | <p>ALT 1 - History of Microscopes Students will research the history of the microscope and its relevance in the field of technology.</p> | <p>ALT 1 – Animal Physiological Adaptations This activity introduces the concept of animal adaptation. Students will use knowledge of ecosystems and food webs to list characteristics that an animal would need to survive in a particular ecosystem.</p> |
| <p>ALT 2 – Microscopes in the Progressive Era Students will examine the Progressive Era in the U.S. and how events from that period affect us today.</p> | <p>ALT 2 - Using the Microscope Students will engage in the use of microscopes to examine specimens.</p> | <p>ALT 2 - Introduction to Insects Students will observe two different kinds of insects—grasshopper or cricket, fly, beetle, bee, etc—and two different kinds of spiders. They will look for characteristics that distinguish the insects from the spiders (such as number of legs, number of body parts, presence of wings, etc.)</p> |
| <p>ALT 3 – Reform and Technology in the 1900s Students will study reform issues of the Progressive Era. Students will explore how business, science and government interacted for and against consumers and citizens in the U.S. during the early 1900s.</p> | <p>ALT 3 - Microscopes in the Real World Students will research and write a short report about a career where the use of microscopes is prevalent.</p> | <p>ALT 3 – Insect Physiological Adaptations This is the culminating lesson for the unit. It combines the study of microscopes with the study of adaptations and insects. Students will observe scanning electron microscope images and record different insect physiological adaptations. They will focus on the eyes, body parts that help them feed, legs, hair, wings, and antennae.</p> |

Transfer Activity

Students will write a journal response to the following prompt: Explain the importance of microscopes in history and the modern world?

Section One: History

ALT One: History of Microscopes

Summary

Students will learn the history of the microscope and its relevance in the field of technology.

Competencies

1. Students will become knowledgeable of inventors of the microscope.
2. Students will understand how function affected form in the development of the microscope.

Time

One class period – 50-55 minutes

Materials

Research materials

Pictures of microscopes

Microscopes

Internet Access—pictures and a short history of the development of microscopes can be found at [Discovery School.com](http://Discovery.School.com)

Instructions

1. Explain to students that the technological advancement of microscopes have aided in increasing our knowledge of living things including microorganisms. Explain that microorganisms are living things that the human eye cannot see. Inform students that microscopes used today originate back to the 17th century. Explain that microscopes were not just scientific tools but the upper class owned them as recreational toys.
2. Provide research information (index cards/other teacher made history cards) on inventors such as Marcello Malpighi, Robert Hooke, Galileo, Leeuwenhoek, John Yarwell and Antoni Van Leeuwenhoek. Select students to read information on cards. Students will record salient points given by readers. Students will work collectively and organize points in chronological order.
3. Students will receive information about significant modifications in the microscope and inventors of the various periods. Describe to students the

improvements made and what precipitated/caused the modification. Share with students that with the evolution of the microscope came more knowledge of the alien world- from observing living organisms to cell structure.

4. Show pictures of old and new microscopes.

Evaluation/Assessment of Student's Competency

Students will develop a timeline indicating inventor and the development of the microscope.

Closure

Review history of microscopes with class.

Section One: History

ALT Two: Microscopes in the Progressive Era

Summary

Students will examine the Progressive Era in the U.S. and how events from that period affect us today.

Competencies

1. Students will learn historical events of the Progressive Era.
2. Students will understand how history, technology, science and business affect our lives.

Time

One class period – 50-55 minutes

Materials

History Textbook
Reference material on microscopes

Instructions

1. Review significant events of the Progressive Era/Reform Era such as the Alcohol Prohibition Act and the Food and Drug Act. Discuss the social and health ills that led to controversy.
2. Discuss the development of the microscope and inventors of the microscope during this time. Inform students that science is important to other disciplines, political science business, technology and history. Explain how the realization of microorganisms as a part of our living world led to requirements for immunizations, food processing in processing plants and industry.
3. Ask students to respond to what if microscopes were not available to scientists during time? Allow time for students to relate responses to events of the period they are studying. Discuss possible implications for the present. Examples are population growth, the health care system, and economic and political systems.

Evaluation/Assessment of Student's Competency

Students will write a paragraph on how science, business, technology and government can work together.

Closure

Recap the history of microscopes and the Reform Era. Students will complete transfer activity – timeline.

Section One: History

ALT Three: Reform and Technology in the 1900s

Summary

Students will study reform issues of the Progressive Era. Students will explore how business, science and government interacted for and against consumers and citizens in the U.S. during the early 1900s.

Competencies

1. Students will understand why regulatory agencies were established.
2. Students will understand how microscopes aided scientists' work to improve health conditions during the 1920s.

Time

One class period – 50-55 minutes

Materials

History Textbook
Microscopes
Access to the Internet
Book- The Jungle by Upton Sinclair

Instructions

1. Explain to students that the Progressive Era (1900s-1920s) was a time of reform in the United States. Discuss how legislators passed laws with the intent to improve the quality of living for U.S. residents. Inform that this was the advent of regulatory agencies such as the FDA (Food and Drug Administration). Explain how Upton Sinclair's novel, The Jungle influenced political action and consumer awareness. Read excerpts from The Jungle.
2. Explain how disciplines such as science and technology contributed to the solution of many health issues during the Progressive Era and even today. Businesses were also affected because there was a need to preserve food and to prevent the spread of bacteria to retard spoilage. Explain how French biologist and chemist Louis Pasteur found bacteria in milk using a microscope. Inform students that the microscope provided data that led to the process of

pasteurization. Define pasteurization- the sterilization of milk or other liquids by heating to a boiling temperature and cooling it.

3. Students will examine drops of sterilized and unsterilized milk/liquid under microscopes. Slides from the Internet and books may be used. Have students to record observations and to discuss them.

Evaluation/Assessment of Student's Competency

Students will write a response to how microscopes helped scientists develop a process for clean food.

Students will chart the pros and cons of regulatory agencies.

Closure

Explain how history helps us to understand how civilization is advanced. Have students to access the Internet for slides of specimens for homework. Explain that the next ALT will include looking at specimens/sample.

Suggested websites: Discovery.com and AskJeeves for Kids.

Section Two: Technology

ALT Two: Using the Microscope

Summary

Students will engage in the use of microscopes to examine specimens.

Competencies

1. Students will demonstrate use of the microscope.

Time

Two class periods – 50-55 minutes

Materials

Sputtered mosquito
Microscopes
Specimens on slides/slides on the Internet
Student collected samples/specimens
Picture of Microscope

Instructions

1. Review the function of microscopes.
2. Show students sputtered samples. Explain that insects have a metallic coating. Inform students that electrons/particles in the scanning microscope allow them to see images on a screen and take pictures of the coated sample.
3. Students will spend time collecting samples around the school ground and view them under the microscope. Students will record observations.

Evaluation/Assessment of Student's Competency

Teacher will observe student use of the microscope and note mastery of skills.

Closure

Recap how microscopes are instrumental in helping us to understand the world of living things.

Section Two: Technology

ALT Three: Microscopes in the Real World

Summary

Students will research and write a short report about a career where the use of microscopes is prevalent.

Competencies

1. Student will be able to write an informational report.

Time

Two to Three 50-60 minute sessions

Materials

Computer with Internet capabilities
Research materials—encyclopedias, books on careers, etc.
Library

Instructions

1. Ask students to write a five-sentence paragraph about what they would like to be when they grow up.
2. Tell students that there are several careers that require knowledge of microscopes. Today they will begin researching a career that requires that knowledge.
3. Allow students to search for information on the following careers: microscopist, engineer, chemist, medical researcher, and any other careers that you can think of that may require knowledge of microscopes.

Evaluation/Assessment of Student's Competency

Length of report will vary with student. The minimum they should include is: a general description of the career, amount of education needed, why knowledge of microscopes is essential, and what types of microscopes are used in that career.

Closure

Students will present their findings to the class.

Section Three: Science

ALT One: Animal Physiological Adaptations

Summary

This activity introduces the concept of animal adaptation. Students will use knowledge of ecosystems and food webs to list characteristics that an animal would need to survive in a particular ecosystem.

Competencies

1. Given an animal and its environment, identify and justify physiological and/or structural adaptations that enhance survival.

Time

One 50-60 minute session

Materials

Photos of animals to use as examples of adaptation
Paper and pencil

Instructions

1. Recall “hook” activity at beginning of unit. Explain that today students are going to learn about specific ways animals have adapted to the ecosystem in which they live.
2. Brainstorm with students the various ecosystems that exist on our planet. Choose five and write them on the board. Next, describe how these ecosystems differ based on three components of ecosystems: climate, water, and living organisms.
3. Tell students that over time (years, not days or hours) animal bodies adapt themselves to life in a particular ecosystem to help them survive, move, locate food, and protect themselves. Show some examples of animals that have developed certain adaptations to their ecosystems (a polar bear is a good example).
4. Choose an ecosystem from the board and brainstorm with students what adaptations an animal living there may have to help them survive, protect themselves, move, and locate food.
5. Assign each group an ecosystem and have them repeat brainstorming on their own. Give them five to ten minutes and then have each group report their characteristics to the class.

Evaluation/Assessment of Student's Competency

Students use any materials they wish to design an organism that will survive in their group's ecosystem. Students must be prepared to explain how their animal will move, protect itself, find food, and survive. They must be able to support their animal's adaptations by relating them to the three components of ecosystems mentioned above.

Closure

Teacher asks each group to collaboratively define the word "adaptation" and report it to the class.

Section Three: Science

ALT Two: Introduction to Insects

Summary

Students will observe two different kinds of insects—grasshopper or cricket, fly, beetle, bee, etc—and two different kinds of spiders. They will look for characteristics that distinguish the insects from the spiders (such as number of legs, number of body parts, presence of wings, etc.) Students will work in groups and the specimens will rotate between the groups. By helping the students construct some knowledge of insects, this lesson prepares them for the culminating activity where they will observe photos of insects taken on a scanning electron microscope (SEM).

Competencies

1. Identify body parts of an insect.
2. Given an insect and its environment, identify and justify physiological and/or structural adaptations that enhance survival.

Time

One 50 to 60 minute session.

Materials

Glass jars with collected live insects
“Insect Anatomy” worksheet
Spider – Insect Venn Diagram Overhead

Instructions

1. As a “hook” activity, ask students about a scary experience that they may have had with an insect or a spider. Then ask them if a spider is an insect. For those who answer no, ask them what the difference between a spider and an insect is. Finding the answer to the question “Is a spider an insect?” becomes the purpose of the day’s activity. Have a short discussion about this question and then introduce the activity and objective.
2. Pass out an insect or spider specimen to each group and allow them to observe it for 5-7 minutes. They should record their observations on the “Insect Anatomy” worksheet. You should spend 2-3 minutes with each group as a facilitator.

3. After all groups have seen all of the specimens, begin a discussion of the differences between spiders and insects. Students will report their observations to teacher. You will write observations on Venn Diagram overhead.

Evaluation/Assessment of Student's Competency

On a separate sheet of paper, students will write a five to six sentence paragraph answering the question posed earlier—are spiders insects. They will then support their answer by using information from their observations. The format for the paragraph will be (1) Topic Sentence (2)-3 – 4Supporting Details (3) Conclusion. Good paragraphs will show sound reasoning and have ample support from observations.

Closure

Return to “hook” activity question: Are spiders insects? Ask students to answer and then explain why. Then ask students if they think that there may be differences between insect

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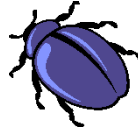
ALT Two: Handout A—Insect Anatomy

Insect Anatomy

Name _____



Spider 1



Insect 1



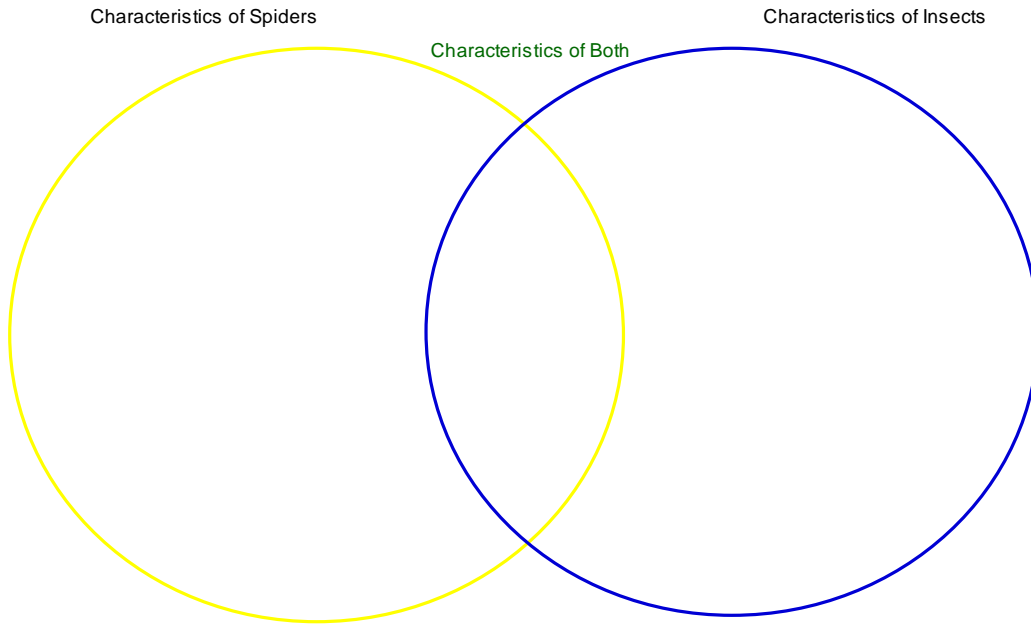
Spider 2



Insect 2

| | | | | |
|-------------------------|----------------------|----------------------|----------------------|----------------------|
| Number of Legs | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |
| Number of Body Segments | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |
| Antennae (Yes or No) | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |
| Wings | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |

Microscopes: History and Uses for Middle School ALT Two: Venn Diagram Overhead



Drawing Conclusions: On a separate sheet of paper, write a paragraph that explains why spiders are not insects. You will want to list their differences in a logical order.

Section Three: Science

ALT Three: Insect Physiological Adaptations

Summary

This is the culminating lesson for the unit. It combines the study of microscopes with the study of adaptations and insects. Students will observe scanning electron microscope images and record different insect physiological adaptations. They will focus on the eyes, body parts that help them feed, legs, hair, wings, and antennae.

Competencies

1. Given an insect and its environment, identify and justify physiological and/or structural adaptations that enhance survival.

Time

One 50-60 minute session

Materials

Photographs of insects taken on a scanning electron microscope (6)
Microaliens: Dazzling Journeys with an Electron Microscope by Howard Tomb and Dennis Kunkel used for photos and for teacher information
Table for recording reasons for insect adaptations

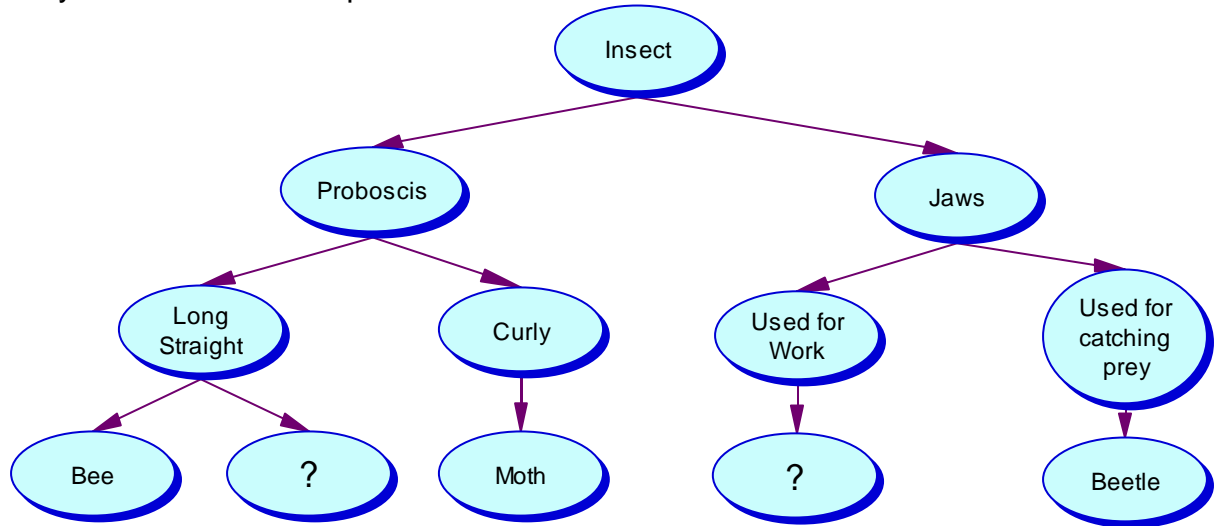
Instructions

1. Recall ALT from yesterday. Just as there are differences between spiders and insects, there are differences between different kinds of insects. Recall ALT 1. Explain that one of the reasons that there are differences between insects is that they have adapted to different kinds of environments, or ecosystems.
2. Tell students that today they will be using the tools that an actual scientist would use. Recall their study of SEMs and tell them that they will be using photos taken from SEMs to identify the different adaptations of certain insects.
3. The structure of this activity is similar to ALT 2—completed in groups, photos rotate. Emphasize that students will simply be describing what they see, not drawing any conclusions about it. The body parts that they need to describe are way of getting food, hair, wing, antennae, and eyes. Allow each group three to five minutes to record observations.
4. When each group has seen each photo, ask class to report their observations. As students report descriptions, class brainstorms possible uses for each body

part; if class does not come up with correct use of body part, teacher gives use. Students record all reasons on Insect Adaptations chart.

Evaluation/Assessment of Student's Competency

Create several dichotomous keys that require students to use data to figure what the mystery insects are. Example:



Use the classification system above to figure out what the two mystery insects are.

Closure

This is the final lesson of the unit.

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ALT Three: Handout A—Adaptations Table

Table for recording reasons for particular insect adaptations.

| | Proboscis | Hair | Wings | Antennae | Eyes |
|----------|-----------|------|-------|----------|------|
| Bee | | | | | |
| Strider | | | | | |
| Mosquito | | | | | |
| Beetle | | | | | |
| Ant | | | | | |
| Moth | | | | | |

Transfer Activity

Students will write a journal response to the following prompt: Explain the importance of microscopes in history and the modern world.

Students will have one period (50-60 minutes) to write their response.

Best responses will include the following:

- An introductory paragraph
- A concise history of the microscope
- An example of a career that requires knowledge of microscopes
- An example of how a microscope could be used (i.e. describe how the SEM photos helped us learn about insect adaptations)
- A concluding paragraph

