READING SELECTION

EXTENDING YOUR KNOWLEDGE

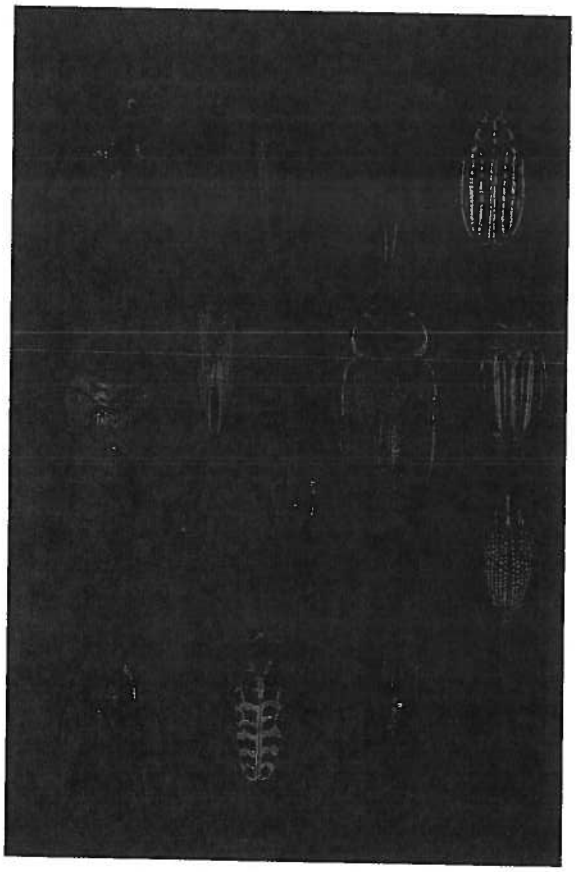
Intriguing Insects

When you think about insects, which come to mind first? Butterflies? Ants? Bees? In fact, beetles are the most common insect. If you lined up every kind of plant and animal in a row, every fourth organism would likely be a beetle. And beetles are only one kind of insect!

There are hundreds of types of insects on Earth, ranging from the common to the exotic. You're probably quite familiar with wasps, flies, mosquitoes, moths, crickets, fireflies, and dragonflies. Have you ever heard of a cicada known as the "buffalo head," whose head resembles a buffalo's, complete with a set of horns? Or the whirligig beetle, which uses its two sets of eyes in a clever way when it goes swimming? One set looks above the water's surface, while the other checks out the action below. And don't forget the fruit fly, *Drosophila*. The scientific study of the brief life cycle of this tiny fly laid the groundwork for modern genetics.

What do all of these insects have in common? They all have three distinct body parts—a head, a thorax, and an abdomen. They also have six legs, four wings, and an outer covering called an exoskeleton.

When you think about it, insects are just about everywhere. They live in our houses, in our gardens, on our pets, and sometimes even on us. You find them in lakes, ponds, and streams. They survive on the coldest mountains and in the hottest deserts.



THESE ARE JUST A FEW OF THE THOUSANDS OF VARIETIES OF BEETLES FOUND ALL OVER THE WORLD.

PHOTO: Chip Clark, National Museum of Natural History, Smithsonian Institution

32 STC Unit: Investigating Biodiversity and Interdependence

GOOD GUYS AND BAD GUYS

Some people don't like insects at all. However, each kind of insect has a role to play in the world, and each affects our lives in a different way.

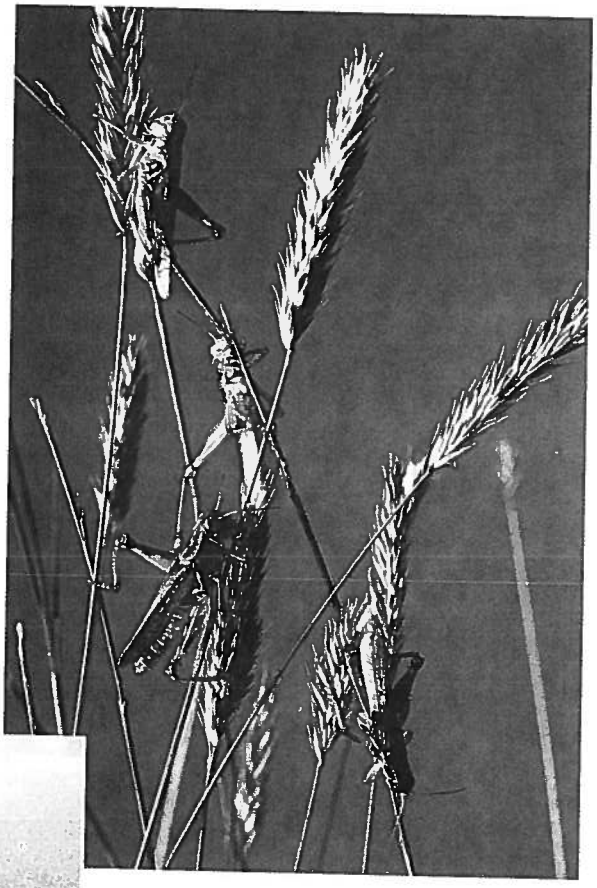
Some insects seem to cause more than their share of trouble. According to Dr. Robert Matthews, a professor at the University of Georgia, insects have caused an enormous amount of human suffering. Some mosquitoes transmit diseases, like malaria and yellow fever, which are major threats to human health in much of the world. Flying grasshoppers called migratory locusts destroy entire fields of crops.

We consider other insects to be good guys. Honeybees pollinate the flowers of many of our favorite food crops. Anyone who has enjoyed a biscuit with honey also appreciates their efforts.

Less familiar insects, such as parasitic wasps, lay their eggs in or on other insects. A parasite is an organism that obtains its nutrients from another organism, generally damaging the other organism in the process.

AS YOU CAN SEE, GRASSHOPPERS CAN DO CONSIDERABLE DAMAGE TO RANGELAND GRASSES SUCH AS WHEATGRASS, AS WELL AS CROPS.

PHOTO: Jack Dykinga, Agricultural Research Service/U.S. Department of Agriculture



FEW CROPS CAN STAND UP TO A SWARM OF INSECTS SUCH AS THIS.

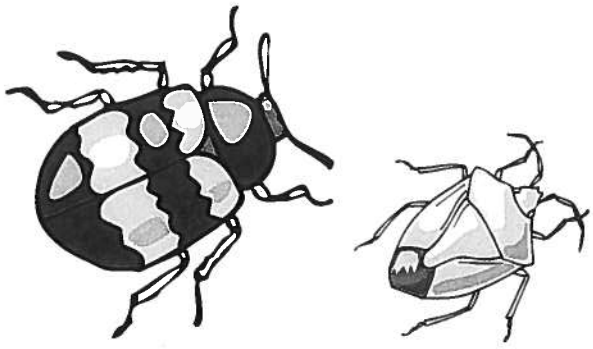
PHOTO: Michel Lecoq (CIRAD)

READING SELECTION

EXTENDING YOUR KNOWLEDGE

A WORLD WITHOUT WASPS

Parasites may sound destructive, but they also play an important role. For example, a world without parasitic wasps would be a very different place. These insects help lower Earth's pest population. In fact, scientists have calculated that a single pair of houseflies, if left alone, could potentially produce enough descendants in a year to cover the surface of the earth several centimeters deep. Fortunately, this doesn't happen, thanks to natural enemies such as parasitic wasps, which kill large numbers of flies every year. ■



DISCUSSION QUESTIONS

1. In many parts of the world, much effort is put into killing mosquitoes to control malaria. What unintended consequences might that have?
2. Insects don't have bones; their exoskeleton is the only skeleton they have. What reasons might there be for creatures like humans (vertebrates) to have developed skeletons inside our bodies, with soft outsides?

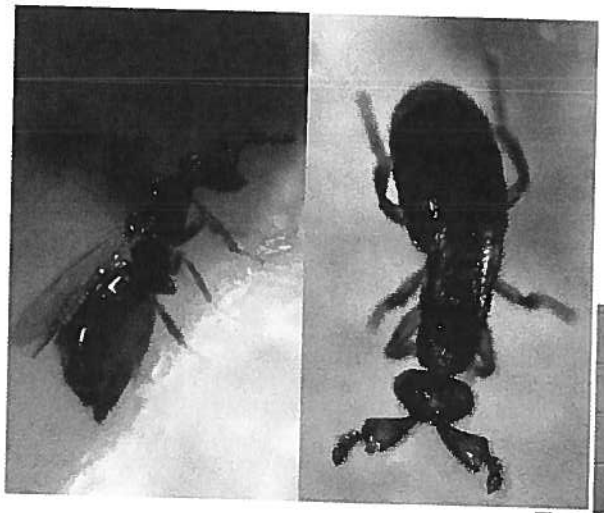
34 STC Unit: Investigating Biodiversity and Interdependence

Dr. Matthews and the WOWBug

Dr. Robert Matthews is an entomologist, a scientist who studies insects. He has studied insects for many years and in many parts of the world.

One of Dr. Matthews's favorite insects is a small parasitic wasp called *Melittobia digitata.* That's quite a mouthful, which is why Dr. Matthews nicknamed it the "WOWBug." He and his students have learned much about the strange habits of this intriguing insect. Through their efforts, the WOWBug has become one of the newest organisms studied in the science classroom.

What's so special about WOWBugs? And how did they make their way into the classroom? It was an unlikely beginning. Dr. Matthews did not find the bugs—they found him! While he was a graduate student, Dr. Matthews decided to examine the nests of some little wild bees he found outdoors. He took the nests inside and put them on a shelf in his laboratory. Later, he got the nests down to study them. To his surprise, he found not little bees, but WOWBugs! Unnoticed, they had sneaked into the nests, fed, and multiplied. They had destroyed nearly all of his bees, and Dr. Matthews was pretty angry.



THESE WOWBUGS ARE ONLY 1.5 MILLIMETERS (0.06 INCHES) LONG, BUT THEY PLAY A VERY LARGE ROLE IN HELPING TO CONTROL BEE AND FLY POPULATIONS. FEMALE (LEFT); MALE (RIGHT). NOTE THE MALE'S UNUSUAL ANTENNAE.

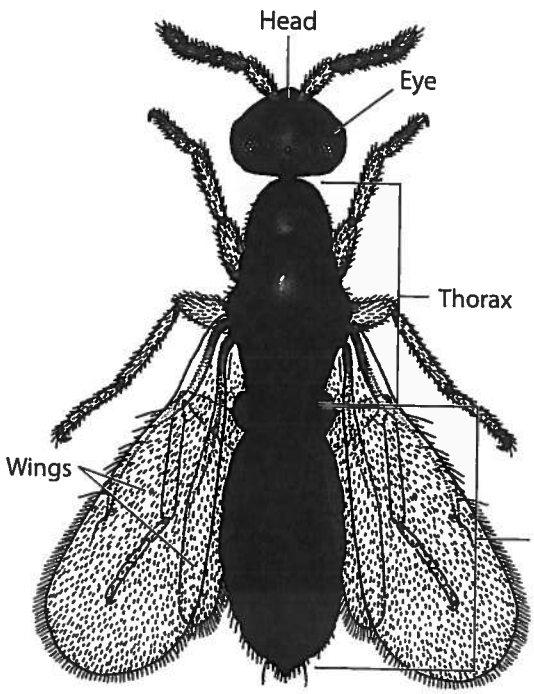
PHOTO: Courtesy of Carolina Biological Supply Company

DR. MATTHEWS, SECOND FROM LEFT, SHARING A BUTTERFLY COLLECTION WITH MEMBERS OF THE WOWBUGS TEAM.

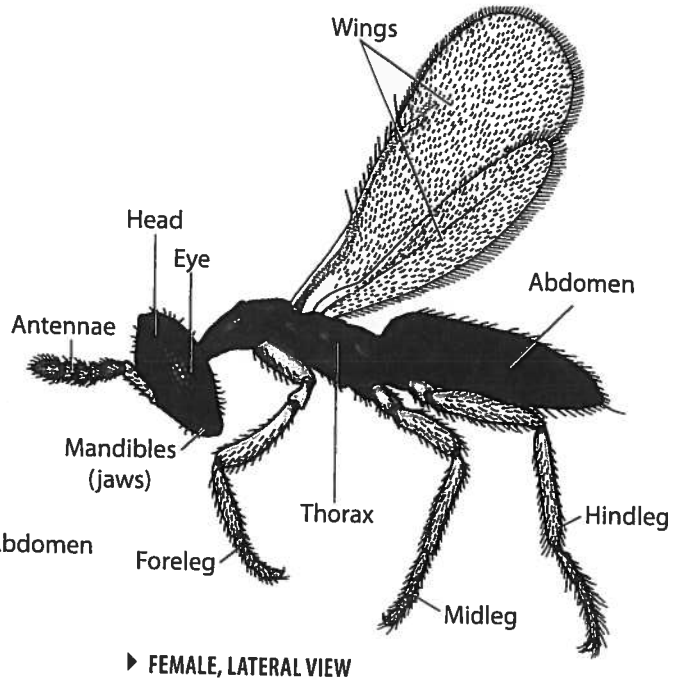
PHOTO: Courtesy of R.W. Matthews

READING SELECTION

EXTENDING YOUR KNOWLEDGE



▶ FEMALE, DORSAL VIEW



▶ FEMALE, LATERAL VIEW

Many years later, while thinking about new ways to teach biology, Dr. Matthews remembered the WOWBug. He realized that the same WOWBug behaviors that nearly ruined his early research would make these little parasites wonderful in the science classroom. WOWBugs breed easily in large numbers, they have a very short life cycle, and they don't take up much space. Best of all, they can't hurt humans with their stingers.

As he worked with WOWBugs, Dr. Matthews continued to learn new and fascinating things about their biology and behavior. He wanted to share what he was learning. With the help of other scientists and teachers, Dr. Matthews developed a set of teaching activities to help students learn science concepts and skills by working with WOWBugs.

Scientists on the WOWBugs team at the University of Georgia continue to make new discoveries every day. They write a newsletter, give workshops for teachers, and develop new lab investigations. Wow! There is a lot to learn from such a tiny insect! ■

DISCUSSION QUESTIONS

1. What about WOWbugs has made them an excellent subject for laboratory research?
2. How might the WOWBugs' shape help them to be good parasites?

36 STC Unit: Investigating Biodiversity and Interdependence

READING SELECTION

EXTENDING YOUR KNOWLEDGE

Microscope PIONEERS

You can't study organisms thoroughly without a good microscope. This tool, which today's scientists take for granted, has played a major role in helping scientists understand more about living things.

Robert Hooke and Antony van Leeuwenhoek were important pioneers in the development of this important scientific instrument. Hooke was born in England in 1635. A member of the Royal Society of England, he was one of the most famous scientists of his time. Leeuwenhoek was born in the Dutch town of Delft in 1632.

HOOKE: DISCOVERING THE MYSTERIES OF CORK

Today, Robert Hooke is remembered more as a mathematician than as a biologist. But like all scientists of his day, he had broad interests. He made many contributions to biology. In his book, *Micrographia*, Hooke described and illustrated the discoveries he had made using a compound microscope that he'd built. Hooke used the microscope to observe familiar objects such as insects, sponges, and feathers. When he put a thin slice of cork under the lens of his microscope, Hooke made a very important discovery. He saw the cell walls in the cork tissue. Hooke had discovered plant cells.

Even though his discoveries were amazing in his day, Hooke's microscope was quite crude. It didn't look that different from today's microscopes, but it had poorly ground lenses, which caused Hooke's view of the objects to be blurred or distorted. What's more, early microscopes could not magnify objects more than 20 or 30 times their actual size. By contrast, most microscopes found in secondary schools today can magnify objects up to 430 times.

LEEUWENHOEK PERFECTS THE LENS

Leeuwenhoek's major contribution to the development of the microscope was to make lenses that were much more finely ground than those used by Hooke and others. He never went to college, and he earned a living by selling fabric in a small shop. For him, making microscopes was a hobby that became a lifelong obsession.

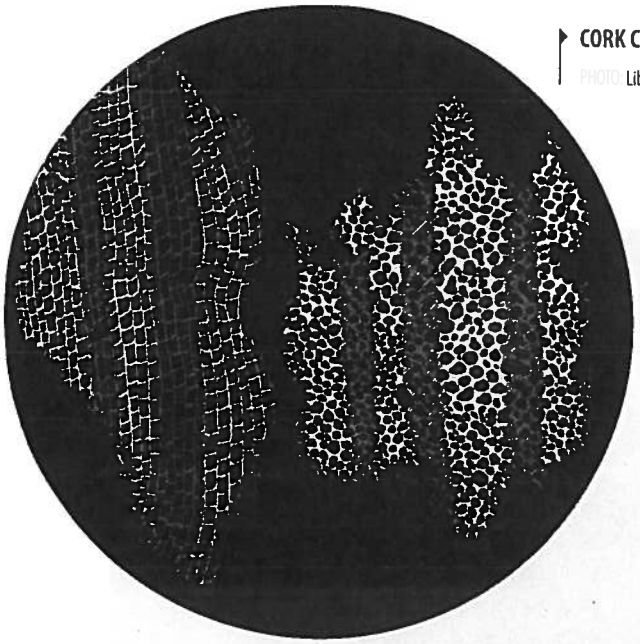
Leeuwenhoek learned to grind lenses by observing the craftsmen who made eyeglasses in Delft. Leeuwenhoek's lenses, often no more than 0.3 centimeters (0.1 inches) across, were so even and perfect they provided clear images that were free of distortion. They could magnify objects to between 50 and 300 times their actual size. He mounted the tiny lenses in frames of gold and silver that he also crafted himself.

Unlike Hooke's compound microscope, Leeuwenhoek's device had only one lens. It was mounted in a tiny hole in a brass plate. Leeuwenhoek placed the object he wanted to examine on a sharp point in front of the lens. He adjusted the position with the screws. The entire device was less than 10 centimeters (3.9 inches) long.

LESSON 2 THE WOWBUG: GETTING A CLOSER LOOK

READING SELECTION

EXTENDING YOUR KNOWLEDGE



CORK CELLS AS SEEN BY ROBERT HOOKE

PHOTO: Library of Congress, Prints & Photographs Division, LC-USZ62-95187

HOOKE'S MICROSCOPE WAS CALLED A "COMPOUND MICROSCOPE" BECAUSE IT HAD TWO LENSES.

PHOTO: Library of Congress, Prints & Photographs Division, LC-USZ62-110443

38 STC Unit: Investigating Biodiversity and Interdependence

For a scientist, good tools are just the start. Scientists also need the ability to observe carefully and to record their findings accurately. They need patience. Leeuwenhoek had all these qualities; in addition, he was very curious. He wrote about everything he saw, from algae on pond water to mineral crystals and fossils. He discovered microscopic organisms in rainwater. He discovered blood cells and was the first to see living sperm in an insect. He is credited with publishing the first drawing of bacteria.

Leeuwenhoek stuck just about everything under his lens—including plaque from his own teeth! What did he see? Something that wouldn't surprise your dentist at all. "I saw . . . many very little living animalcules," he wrote. "Very prettily a-moving. The biggest . . . had a very strong and swift motion . . . and shot through the water. The second . . . spun around like a top."

Hooke passed away in 1703, and Leeuwenhoek died in 1723, at the age of 91. Both had become world famous. Leeuwenhoek was so famous that Peter the Great, czar of Russia, once came to Delft to visit him at his home.

The science of microscopy has made great progress since the time of Hooke and Leeuwenhoek. To get an idea of how much progress, take a look at the image of a mite. It was taken through a scanning electron microscope that has a magnification range of 15 to 200,000 times! ■

THIS MITE, WHICH MEASURES 150–200 MICRONS IN LENGTH (1/1000 MM), IS MAGNIFIED 850 TIMES ITS ACTUAL SIZE.

PHOTO: Photo by Eric Erbe, digital colorization by Chris Pooley, Agricultural Research Service/U.S. Department of Agriculture

DISCUSSION QUESTIONS

1. Early microscopists had to draw pictures of what they saw through the lenses if they wanted anyone else to see it. Modern microscopes are able to take digital images. Which kind of picture do you think gives a more accurate view of the object?
2. Why is it useful to be able to see tiny organisms so clearly?

STC Life Science Strand: Life on Earth 3