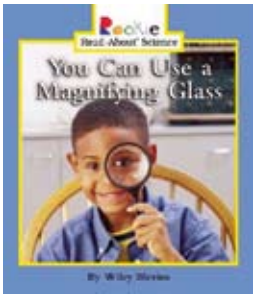
A Closer Look

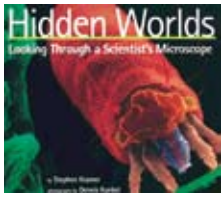
By Karen Ansberry and Emily Morgan

Give a child a hand lens or a microscope and they quickly become fascinated with the hidden worlds these tools reveal. The lessons in this month's column provide opportunities for students to take a closer look at the properties of objects and organisms and explore how magnifying instruments help scientists make observations and discoveries.

This Month's Trade Books



You Can Use a Magnifying Glass
By Wiley Blevins.
Children's Press. 2003.
ISBN 0516273280.
Grades K–4
Through simple text and photographs, this Rookie Read-About Science book describes how to use a magnifying glass and what kinds of things can be seen with it.



Hidden Worlds: Looking Through a Scientist's Microscope
By Stephen Kramer.
Houghton Mifflin. 2001.
ISBN 9780618055463.
Grades 4–8
Hidden Worlds takes you behind the scenes of scientist Dennis Kunkel's work and explains how he captures remarkable images of microscopic life and objects. Stephen Kramer's engaging text and Kunkel's dramatic photographs provide a fascinating look at a microscopist and the hidden worlds he explores.

Curricular Connections

According to the National Science Education Standards, students in kindergarten through grade eight should learn how scientists depend on certain tools to help them make better observations. Instruments such as magnifying glasses and microscopes help scientists all over the world see, measure, and do things that they could not otherwise see, measure, and do. The Standards also highlight the importance of giving students opportunities to increase their understanding of the characteristics of objects and materials that they encounter daily. The lessons presented in this column provide students opportunities to observe, draw, and describe objects and organisms while teaching them how magnifying glasses or microscopes can enhance observations, drawings, and descriptions.

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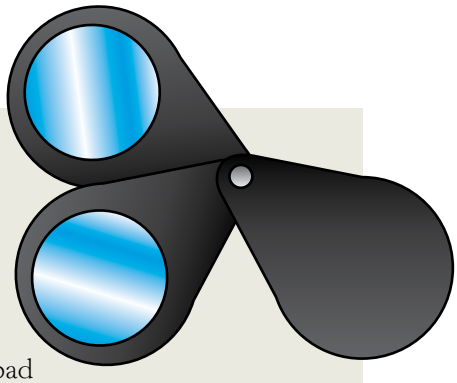
For Grades K–3: With a Hand Lens

Engage: Hand out the Coin Observation Student Page (see NSTA Connection). Ask students to draw the features of a dime's "tails" side in detail, from memory, in the first circle. Have students share their drawings with each other, and then discuss the limitations of drawing details from memory. Next, give each student a dime to observe with the naked eye. Have them use the second circle as an outline to draw the features of a dime (tails side again) in more detail. Then ask, "What scientific tool could you use to observe the details of an object better than you could with your eyes alone?" (e.g., magnifying glass or hand lens, microscope, binoculars, or telescope). Next, hold up a magnifying glass and tell students that it is a scientific tool that can help them see the features of an object in detail. Then, read aloud pages 3–11 of *You Can Use a Magnifying Glass*. Stop after reading *What can you see?*

Explore: A magnifying glass or plastic hand lens will help students get an even closer look at a dime. Model the proper way to use a magnifier (holding the lens close to one eye, shutting the other eye, and bringing the object toward the lens until it comes into focus), and caution them that touching things with the lens can scratch it. Then pass out plastic hand lenses to all students, and have them use the lenses to observe the backs of their hands, fingernails, pencils, and other objects. Some students may have trouble shutting one eye, so you may want to have them cover one eye with a hand or hold the hand lens out further and use both eyes. After a few minutes of exploration and sharing, have students use the third circle as an outline to draw the tails side of a dime as seen through a hand lens.

Explain: Have students explain how the hand lenses helped them see details of things that they could not otherwise see. Then ask, "How does a hand lens work? What other things can you see with a hand lens?" Read the rest of *You Can Use a Magnifying Glass* and then discuss the answers to your questions. (As light hits a hand lens, the light rays bend. This makes things look bigger. You can see how a fly's eye is made up of lots of small pieces, you can look closely at jewels, and you can see the patterns in a fingerprint.)



Elaborate/Evaluate: Now students are going to use hand lenses to help them solve a mystery! In advance, prepare the "evidence." Have a fellow teacher use an ink pad to make a fingerprint at the top of a sheet of paper. Below that, have this person as well as several other teachers make fingerprints on the paper. Write their names below their respective prints. Then, explain to the class that something was borrowed from your classroom (e.g., a candy jar, a stapler), and you have collected a fingerprint from the missing object as evidence. You want to find out who "borrowed" the object so you have collected fingerprints from some of the teachers in your school. But before they can solve the mystery, your students must first practice using hand lenses to study their own fingerprints. Reread pages 23–27 in *You Can Use a Magnifying Glass*. Have students use ink pads to carefully make their fingerprints, observe them with hand lenses, and compare them to other students' prints. Next, give each student or team of students a copy of the "evidence" and the "suspects." As they use their hand lenses to solve the mystery, observe whether or not they are using them correctly and safely. Then discuss how hand lenses can help people and scientists observe the properties of objects more closely.

Connecting to the Standards

This article relates to the following *National Science Education Standards* (NRC 1996).

Content Standards

Standard A: Science as Inquiriy

- Abilities necessary to do scientific inquiry (K–8)

Standard B: Physical Science

- Properties of objects and materials (K–4)

NSTA Connection

The Coin Observation Student Page is available for download at *www.nsta.org/SC0801*.

For Grades 3–6: With a Microscope

Engage: In advance, print pictures of images taken with a Scanning Electron Microscope. A good resource is the University of Hawaii's MicroAngela website: *www5.pbrc.hawaii.edu/microangela* (for example, fly face, mosquito, jumping spider face, etc.) Invite students to guess what each picture shows. After they guess, reveal the true identity of the object, and ask them how they think the picture was taken. Tell students that the photos were taken with a special kind of microscope called a Scanning Electron Microscope (SEM). Ask, "Who uses microscopes? What are they used for?"

Explore: We recommend low-powered microscopes (with a maximum magnification of 40× or less) for elementary students. Before doing the following activities, model how to properly operate and take care of the microscopes available for your classroom use. Tell students that they are going to learn how to make their very own microscope slides. First demonstrate how to prepare simple, homemade slides by cutting index cards or cardstock into 1" × 3"strips, punching a hole in the center of each, and covering the hole with clear tape. Model how to mount specimens on the sticky side of the tape within the punched hole and label slides with the name of the specimen and the power of magnification. Next, have students make a slide of a lowercase "e" from a piece of newspaper and look at it through their microscopes. Ask, "Does the letter *e* look different through a microscope? How is it different?" (Students should notice that the letter *e* is not only larger and more detailed, but upside down and backwards as well.) Allow students to create several slides of everyday items such as salt, sand, paper, fabric, thread, and so on. Have them draw and label what they see in the microscope and write a few detailed observations about each specimen. Ask, "What kind of information can scientists gain from using a microscope?" "What kinds of scientists use microscopes?" Tell them that you have a book to help answer these questions.

Explain: Show students *Hidden Worlds: Looking Through a Scientist's Microscope* and ask them what they think is pictured on the cover. Tell students that it is a microscopic animal called a *leaf gall mite* that has been magnified 2,530 times using a Scanning Electron Microscope. Next, read "A Note to the Reader" on page 7, which explains how the colors added to the images in the book were computer generated (and not necessarily the natural colors of the objects) and how the letters and numbers in parentheses throughout the book represent the type of microscope used and how many times the object was magnified. Next, read the text and captions on pages 8–13. Ask, "What are some of the ways that Dennis Kunkel has used microscopes for his own learning and to help other scientists?" (He has used a microscope to learn more about living and nonliving things that interest him and has helped scientists determine what meteorites are made of, identify a new species of ants, and figure out why spider silk is so strong.) Then ask, "How do you think Dennis got his start as a scientist?" and read pages 9–18 (second paragraph) about how Dennis began taking "collecting trips" as a child and later became a microscopist. Show the photos of the containers he uses for collecting on p. 19, and then flip through the book to share some of the remarkable photos he has taken through a microscope. Next, announce that the class is going to take their own collecting trip to find specimens to examine with microscopes.

Check your district policy on taking students outside during the school day or away from the school grounds before doing the following activity.

Elaborate: Take students on a collecting trip to a natural area nearby. Provide small containers or film canisters with lids for collecting specimens in the field. Have each student collect 3–5 small items that will fit on a slide (no live animals), such as blades of grass, small pieces of tree bark, soil, seeds, flower petals, and so on.

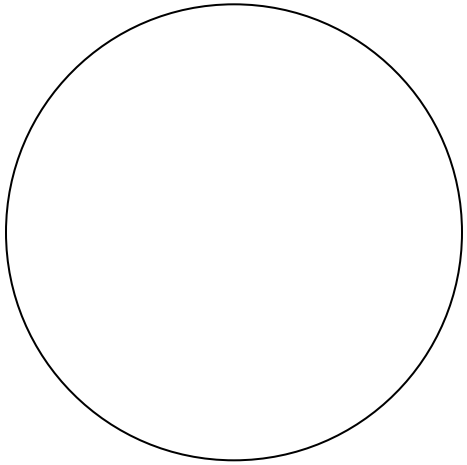
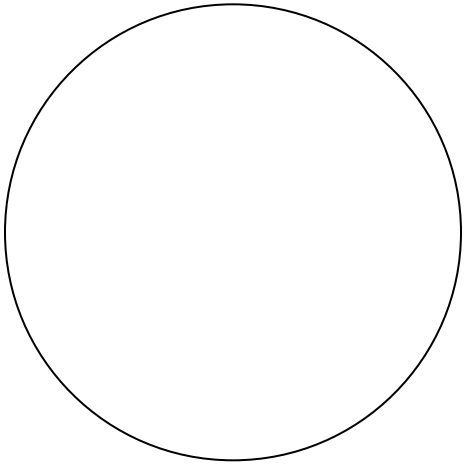
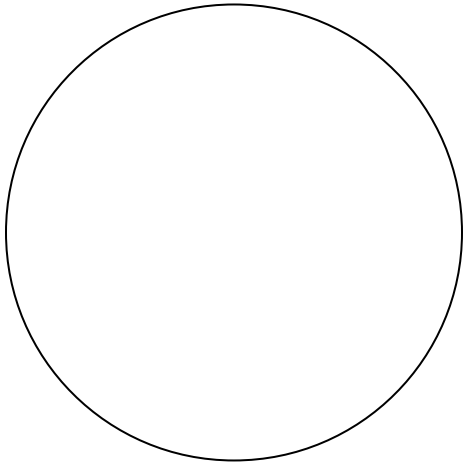
Evaluate: When you return to the classroom, evaluate students' abilities to make and label a handmade index card slide, operate a microscope properly, and draw and describe each magnified specimen in detail.

Reference

National Research Council (NRC). 1996. *National science education standards*. Washington, DC: National Academy Press.

Coin Observation

Name:_____

Draw a dime from memory.	Look at a dime. Draw it.	Use a hand lens to look at a dime. Draw it.
		

Which picture has the best details? _____

Why do you think so? _____

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