

Comprehension

Genre

Nonfiction gives information and facts about real people, places, events, and situations.

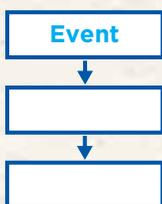


Summarize

Sequence

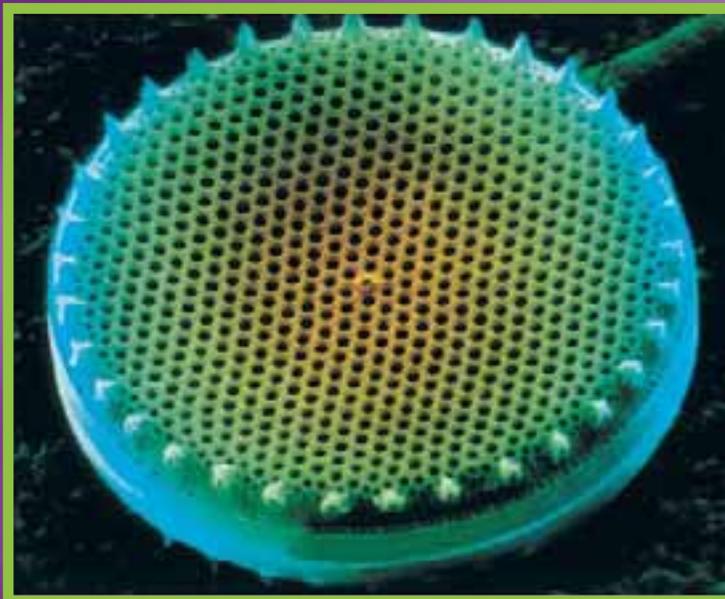
Look for clues that indicate the order of events.

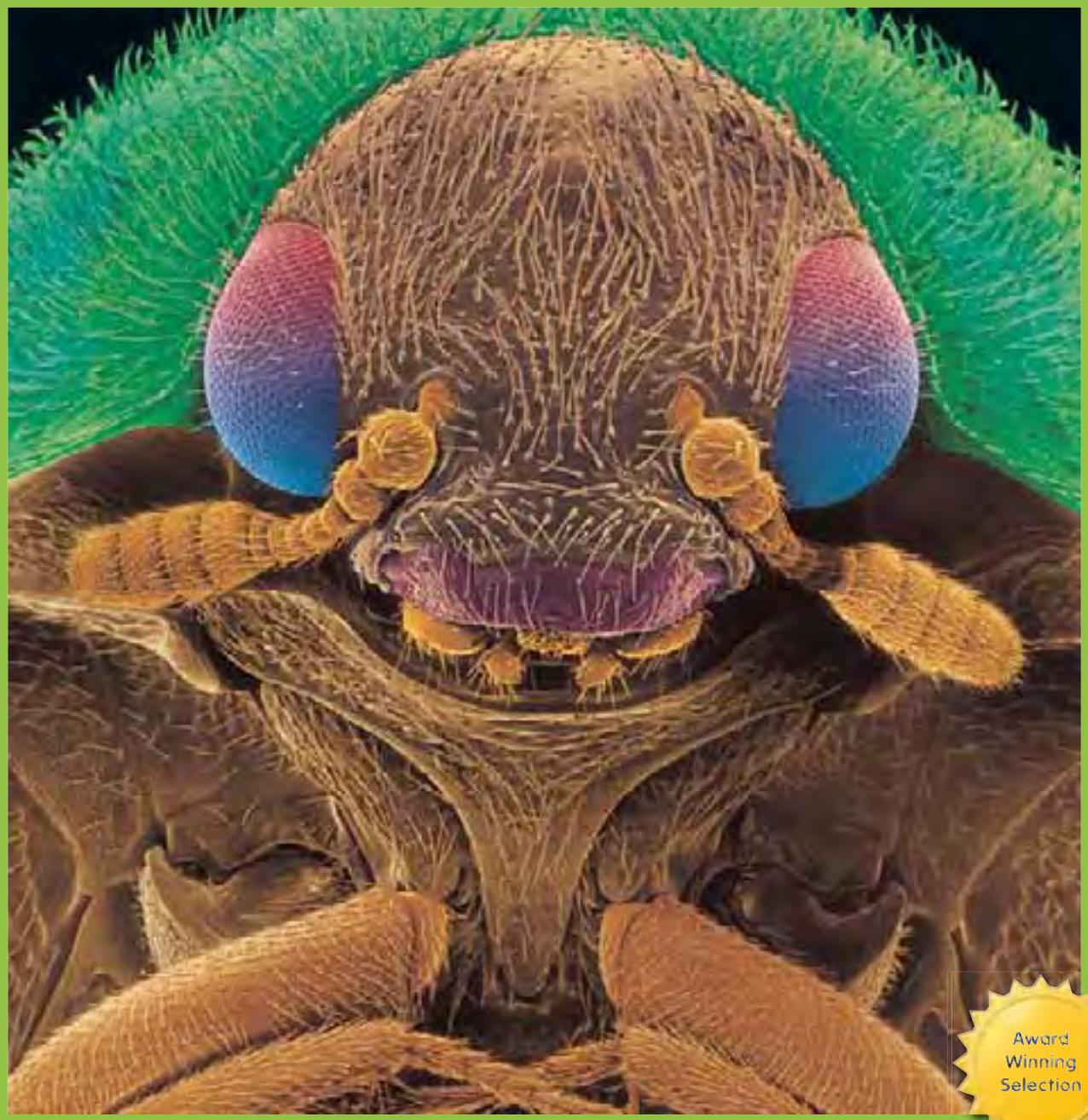
As you read, use your Sequence Chart.



Read to Find Out

What events influenced Dennis's career in science?





Award
Winning
Selection

Hidden Worlds

Looking Through a Scientist's Microscope

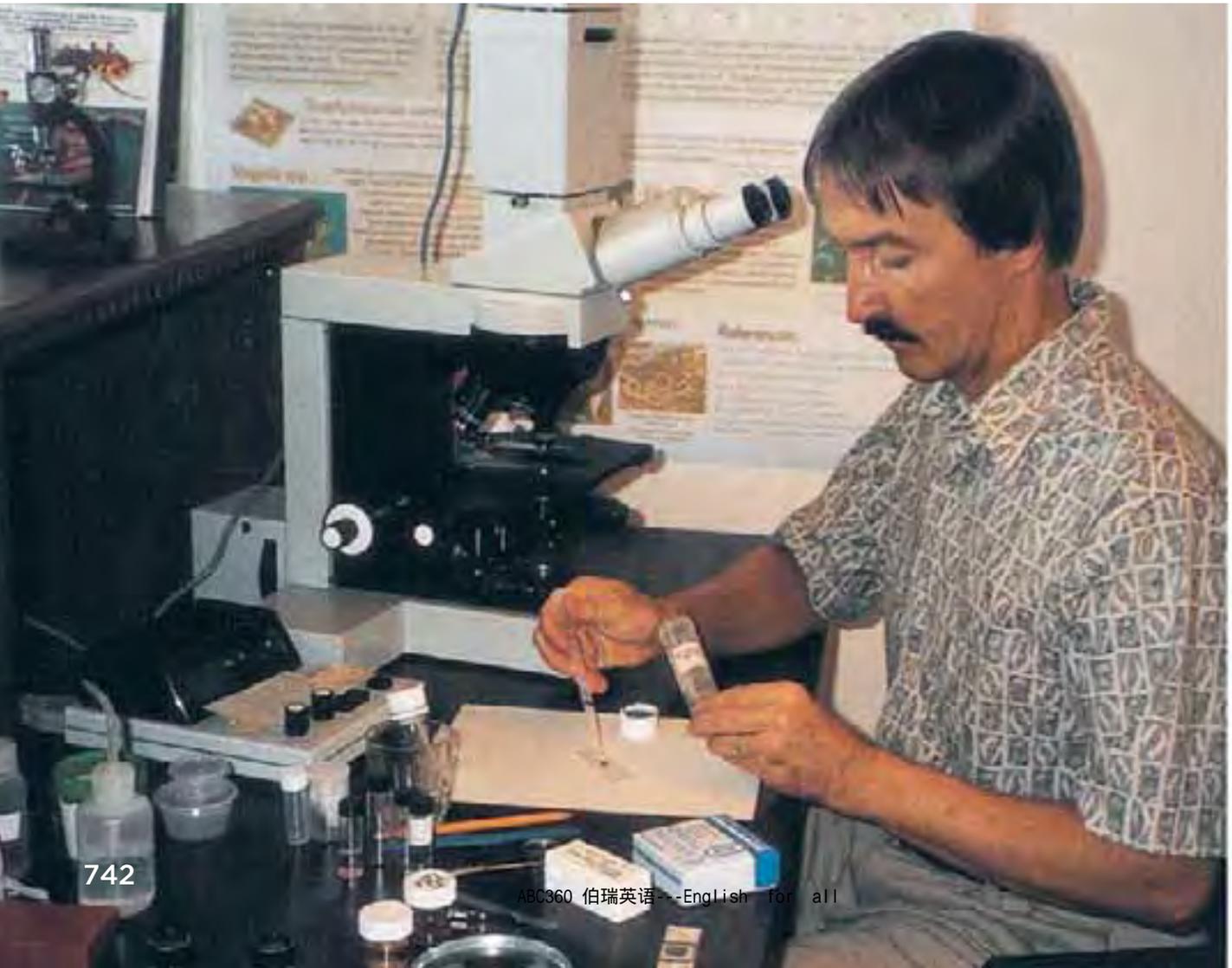
by Stephen Kramer
photographs by Dennis Kunkel

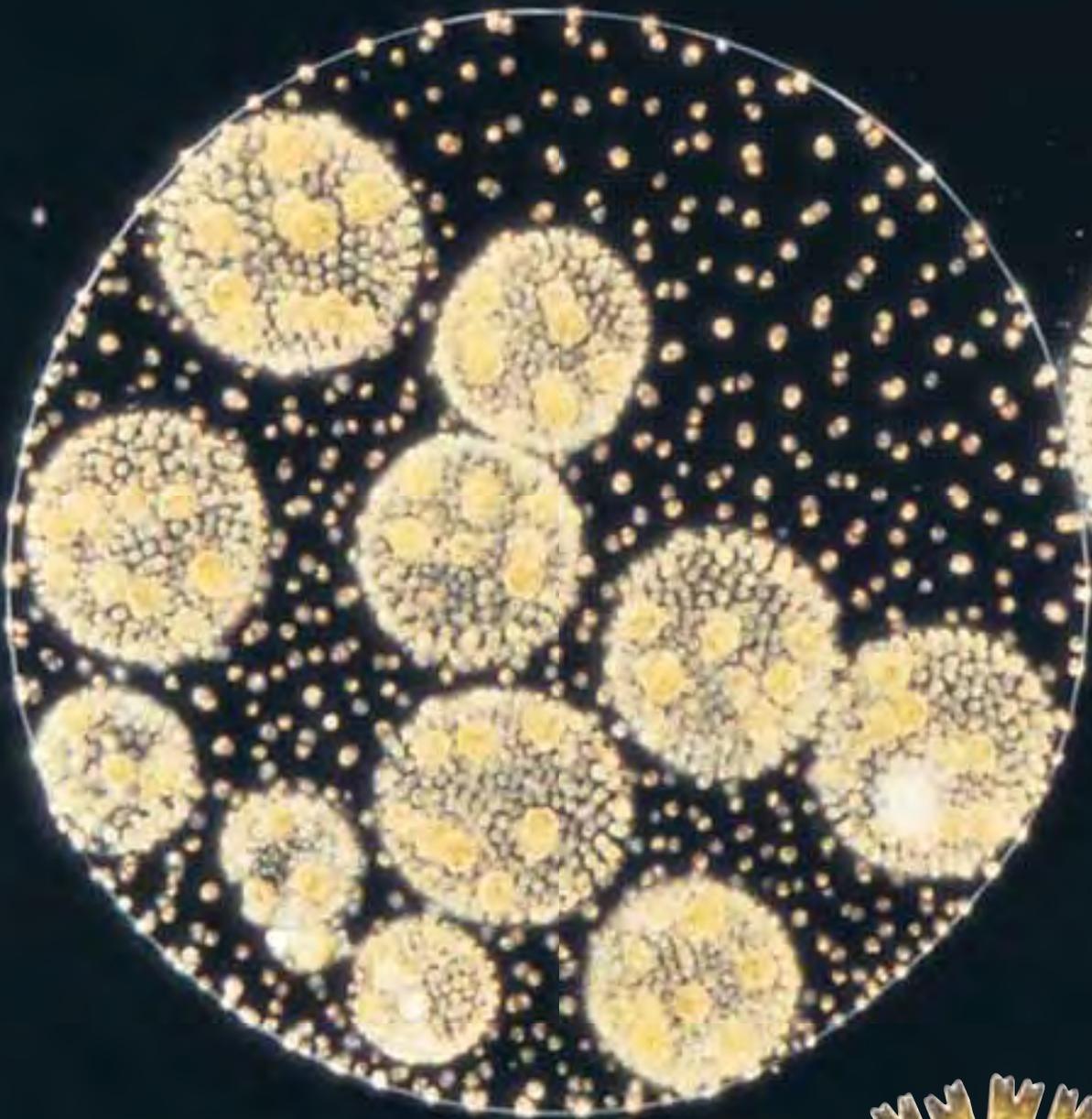
Becoming a Scientist

Dennis Kunkel grew up in the Iowa countryside, where cornfields stretched for miles in all directions. Dennis helped tend the flowers and vegetables in the family garden. He went on weekend fishing trips with his parents and his sisters, and he took care of the family pets. Dennis loved nature and being outdoors, but he did not know that someday he would become a scientist.

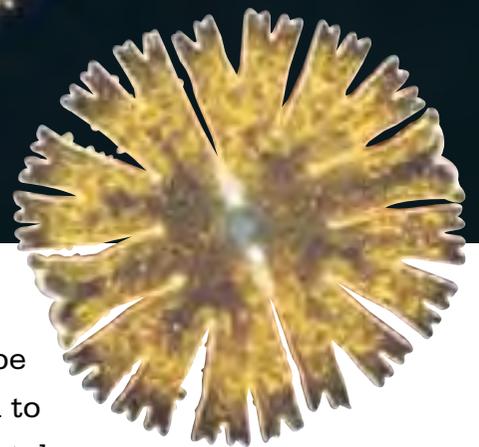
Then Dennis received a gift that changed his life. "When I was ten years old, my parents gave me a microscope for Christmas," he recalls. "It came with a set of prepared slides—things like insect legs, root hairs, and tiny creatures called protozoans. As soon as I unwrapped the microscope, I forgot about my other presents and tried to figure out how to use it."

Dennis working at one of his microscopes





When Dennis looked at pond water with his first microscope, he saw these kinds of simple plants. They are green algae. Above: *Volvox*. Right: *Micrasterias*.



The prepared specimens that came with the microscope were dead. Dennis quickly discovered that it was more fun to observe things that were alive and moving, so he began to take collecting trips. One of Dennis's first trips was to a pond about a mile and a half from his house. "I started hiking down there with my little collecting bottles and bringing back water samples to look at under my microscope," he explains. "I couldn't wait to get home from school in the afternoon so I could go to the pond. Before long I was looking at all kinds of fascinating creatures."

Dennis used his microscope to look at anything he could fit under its lenses. He examined insects, soil samples, and parts of plants. He looked at fur from his pets and seeds from nearby fields. Dennis made drawings of the things he observed, and he spent many hours reading about them.

After Dennis graduated from high school, he enrolled in a junior college in his hometown. A **biology** teacher there encouraged his love of science and microscopes. Dennis often worked in the science lab after school, using microscopes to study the things he collected.

Then Dennis transferred to the University of Washington, in Seattle. Finally he could learn and do things he had dreamed about. "I had the chance to work in labs with good microscopes," explains Dennis. "I spent hours speaking with professors and students about science. I had dreamed of exploring and learning about undersea life like Jacques Cousteau, but until I left Iowa I had never even seen the ocean. While I attended the University of Washington, I learned how to scuba dive. It was thrilling to go underwater to observe and collect the plants and animals I wanted to study."

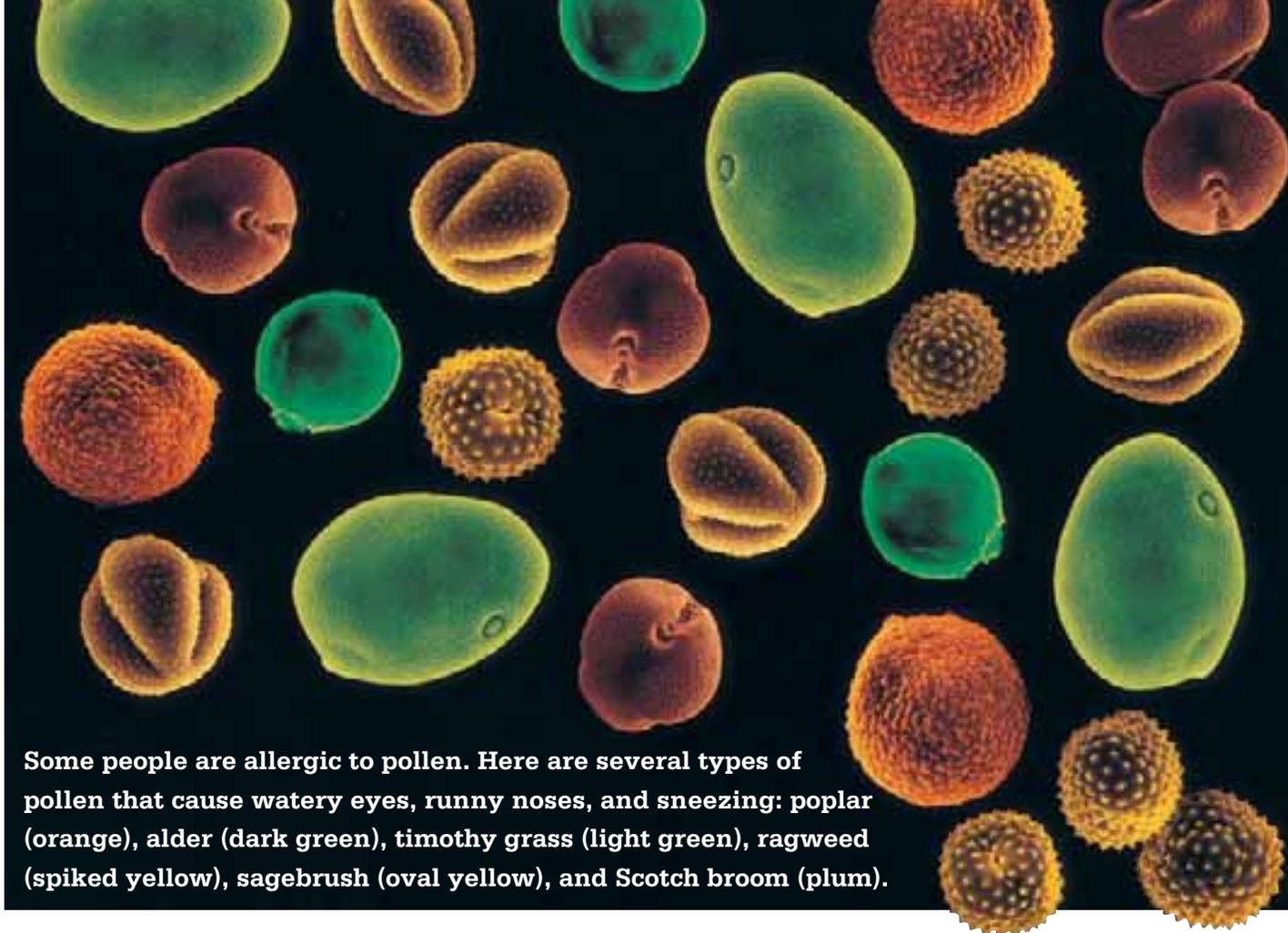
**Dennis examines leaves
with two young scientists.**



Sequence

What clue words does the author use to indicate the time order of events in Dennis Kunkel's life?





Some people are allergic to pollen. Here are several types of pollen that cause watery eyes, runny noses, and sneezing: poplar (orange), alder (dark green), timothy grass (light green), ragweed (spiked yellow), sagebrush (oval yellow), and Scotch broom (plum).

In graduate school, Dennis began to use the science department's electron microscopes for his own **research**, studying tiny living things called cyanobacteria. But Dennis also used the microscopes to help other scientists. He helped one of his professors study and classify pollen grains from different kinds of flowers. He helped a fellow graduate student examine wood with an electron microscope to learn about how plant cells deposit minerals and create "hard" wood. He helped other students with their studies of algae, fungi, and flowering plants.

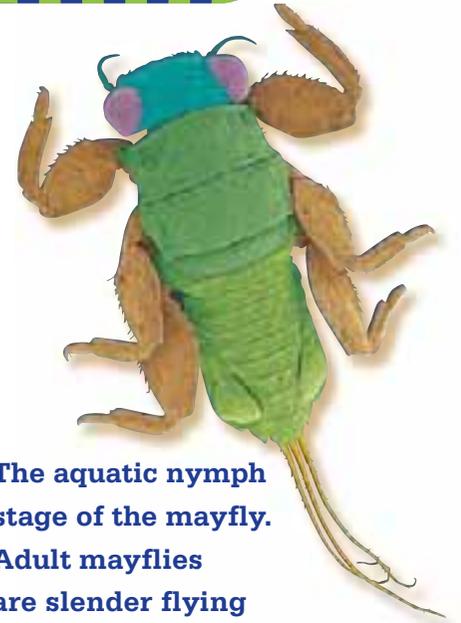
After eight years of graduate work—including thousands of hours of research and work with microscopes—Dennis earned a Ph.D. in botany, the study of plants. Although Dennis was finishing his schooling, he was just beginning a lifetime of scientific learning and discovery.

Dennis worked on research projects at the University of Washington and the University of Hawai'i for about twenty-five years. Now he does much of his work in his home on the island of O'ahu, Hawai'i.

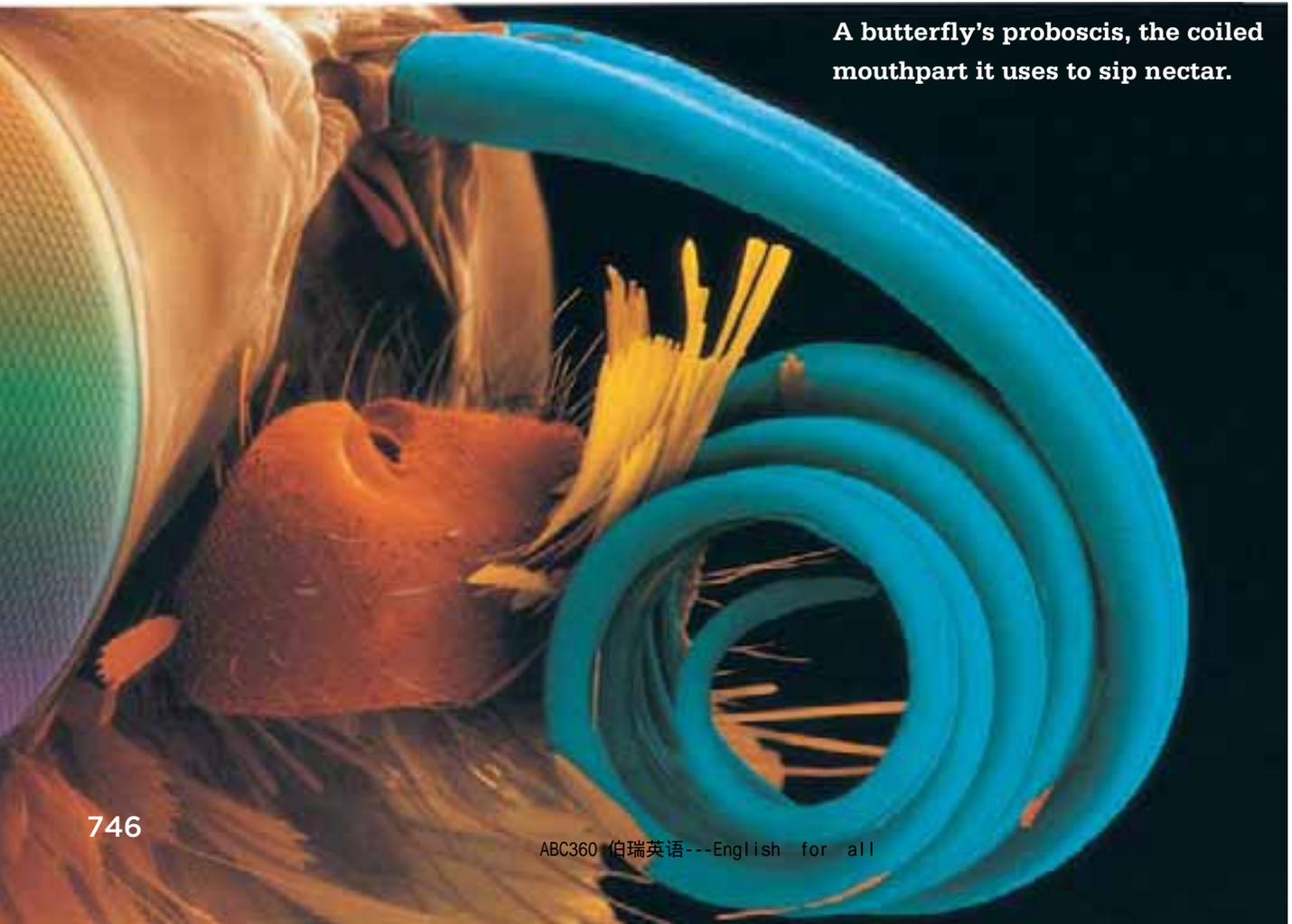
Working as a Scientist

Scientists are explorers. They usually make discoveries by asking questions and then trying to answer them. Some scientists find their answers in laboratories, surrounded by equipment and instruments. Others travel to natural areas to find their answers. Dennis's work has taken him to mountains, rainforests, deserts, caves, beaches, and into the sea.

Whenever Dennis goes on field trips, he takes along collecting boxes and bottles. When he returns to the lab, the boxes and bottles are usually full of interesting **specimens**: algae, lichens, mushrooms, seeds, leaves, insects, bark, soil, and flowers. Dennis has explored hidden worlds in places ranging from the blast zone of a volcano to the dust balls underneath people's beds!



The aquatic nymph stage of the mayfly. Adult mayflies are slender flying insects found around streams and ponds.



A butterfly's proboscis, the coiled mouthpart it uses to sip nectar.



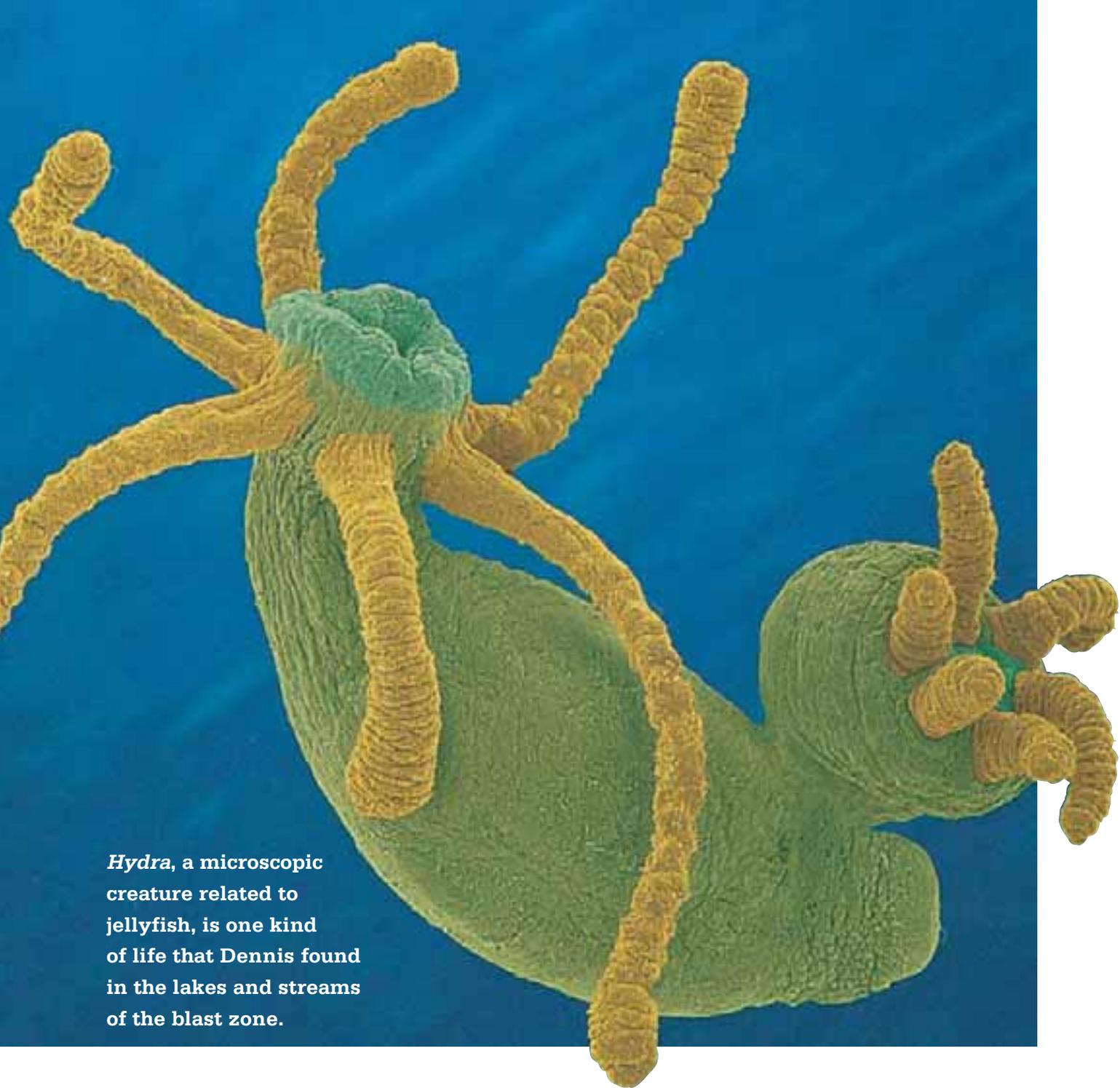
Dennis and the scientific team collect water samples.

Mount St. Helens

In 1980, a **dormant** volcano called Mount St. Helens **erupted** in Washington State. The blast from the eruption flattened huge forests of tall trees. Floods of boiling mud and water from melting snow **scoured** riverbeds. The countryside was covered with a thick layer of ash for miles around.

Some of the first people allowed to visit the blast zone were biologists, scientists who study living things. They were stunned by the destruction. One of the first things they wanted to know was whether any living things had survived.

A team of scientists from the University of Washington made plans to study the lakes and streams of the blast area. Since Dennis was an expert on algae, the simple plants found in lakes and streams, he was invited to help with the study. The scientists traveled to a camp set up on the north side of Mount St. Helens. Twice a day, a helicopter flew them into the blast zone. All they could see, for miles in every direction, were dead trees blanketed by a heavy layer of ash.



***Hydra*, a microscopic creature related to jellyfish, is one kind of life that Dennis found in the lakes and streams of the blast zone.**

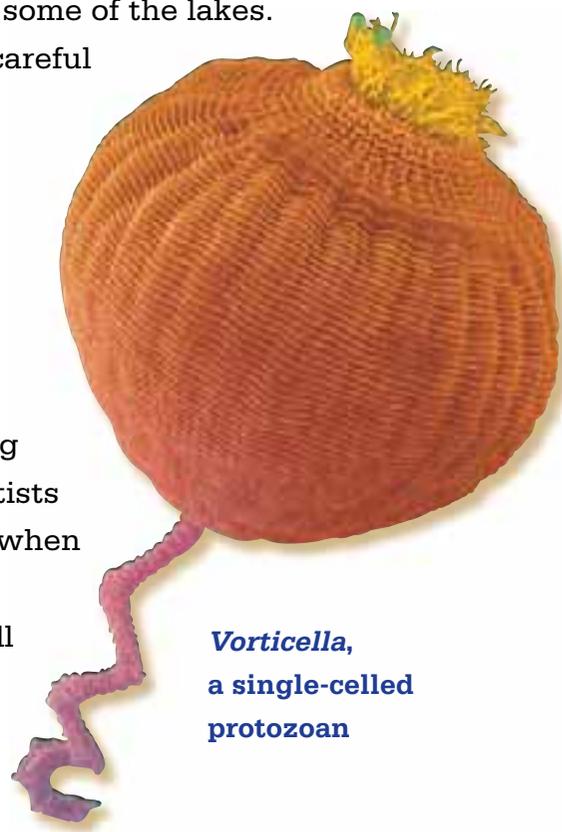
The scientists were thrilled because they had never explored the area around an active volcano so soon after this type of eruption. But no one knew when the mountain might erupt again. In fact, no one even knew for sure whether it was safe to land a helicopter in the blast zone. Some pilots thought the ash stirred up by the whirling helicopter blades might choke the engines. So Dennis and the other scientists weren't allowed to land in the study area on the first few trips. They had to collect their water samples while the helicopter was in the air!

As Dennis and the team crisscrossed the blast zone in the helicopter, they kept their eyes open for water. When they spotted a lake or pond that had survived the blast, the pilot flew the helicopter into position. As the helicopter hovered over the **murky** gray water, Dennis lowered collecting bottles on ropes. The bottles had triggers so Dennis could open them at different depths. This allowed him to collect some water samples from near the surface and others from deep in the lakes.

The first water samples the scientists collected showed that some of the lakes were completely dead. Nothing had survived the heat, gases, and choking ash of the eruption.

Just a few weeks later, Dennis used microscopes to look at new water samples he had collected from the same lakes. He was amazed to see algae, protozoans, and bacteria living in the water. Within several months, small crustaceans—animals that feed on algae and bacteria—began to reappear in some of the lakes.

Dennis and the other scientists kept careful records of the kinds of living things that returned to the lakes and when they reappeared. They identified the kinds of algae, protozoans, bacteria, and crustaceans they found. Later, Dennis and the team also discovered that frogs and fish were returning to some of these lakes, apparently carried in by surrounding streams. Their studies helped other scientists understand what happens to life in lakes when a nearby volcano erupts—and how living things eventually return to areas where all life was destroyed.



Vorticella,
a single-celled
protozoan



Sequence

List the different life forms that developed in the dead lakes near the volcano in the order that they appeared.

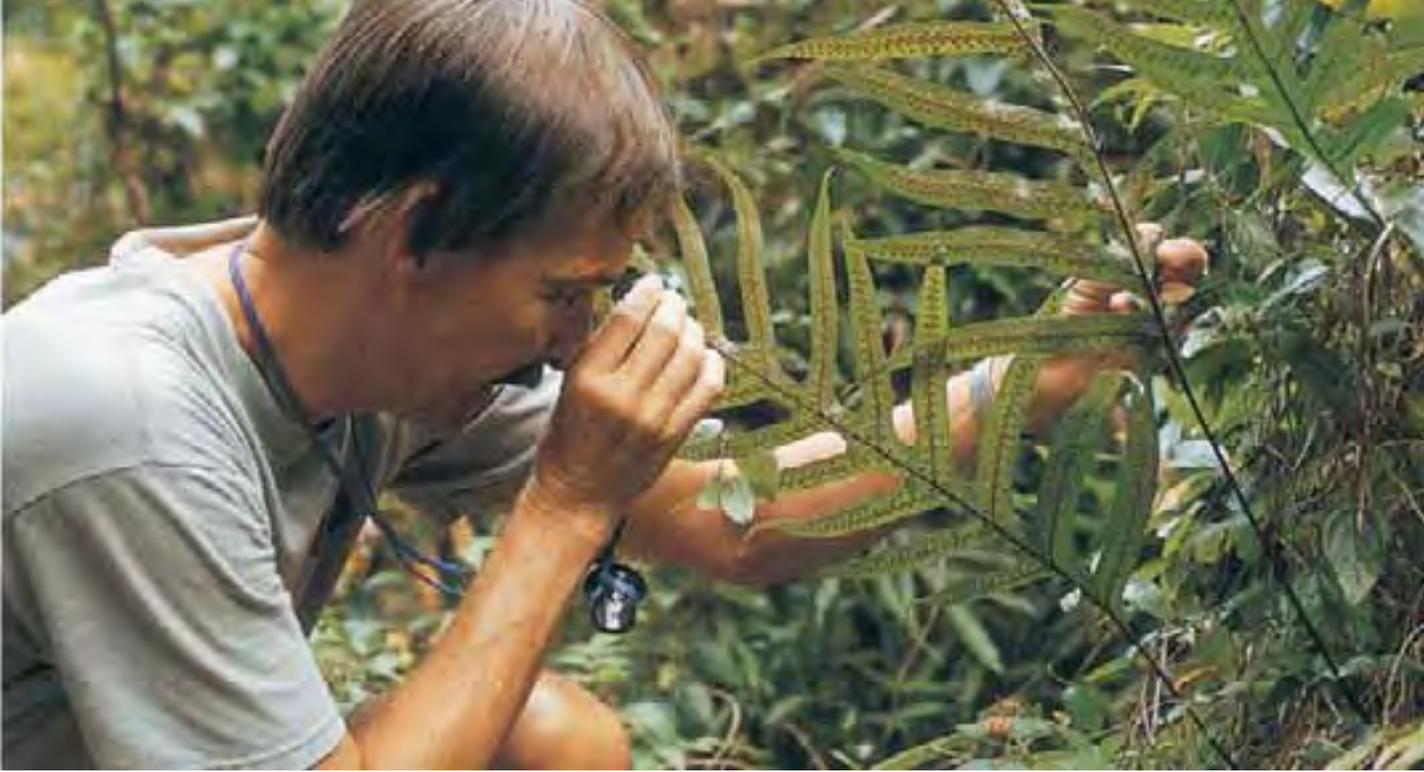
How to Become a Scientist

Here is Dennis's advice for students who think they might like to become scientists:

Become an **observer**. One of the most important things you can do to become a good scientist and microscopist is practice being a careful observer. Find a comfortable chair and put it in the middle of your garden, yard, or a park. Sit in the chair for ten minutes or thirty minutes or an hour. Watch the insects that fly past or land on the plants. Look at the shapes of leaves and stems and branches. Listen to the sounds of buzzing bees and chirping crickets. See if you can find a sight or smell or sound that surprises you. Use a loupe or magnifying glass to look closely at interesting objects.

Dennis and graduate student examine a South African clawed frog.





Dennis looking closely at a fern leaf

Learn everything you can about a topic that interests you.

Suppose you'd like to explore flowers by using a microscope. Go to the library and check out some flower books. See what you can find on the Internet. Pick some flowers and carefully take them apart. Use a loupe or a magnifying glass to see how everything fits together. The more you know about flowers from reading about them and observing them, the more you'll understand when you begin looking at them with a loupe or a microscope.

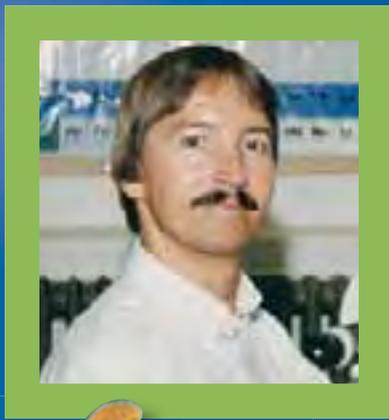
Ask for help from a knowledgeable person. After you've learned everything you can on your own, ask someone else to help with questions you still have. Maybe there's someone at a nearby school or museum who knows about insects, spiders, algae, moss, or something else you'd like to learn about. If you don't have a microscope of your own, maybe a teacher would help you look at some specimens with a school microscope.

Find a scientist to talk to or find a place where scientific research is being done. If you still want to learn more, you may be able to find a scientist to talk to at a nearby college, university, or research station. Write a letter or an e-mail message to the scientist, explaining what you're interested in. Ask if you can schedule a time to visit. Most scientists are happy to talk to students who share their passion for science.

Under the Microscope with Stephen Kramer and Dennis Kunkel

Stephen Kramer is an author and teacher. When he is not writing about avalanches or following Dennis Kunkel into a volcano, he is teaching fifth graders. Both of his careers focus on a love of science and teaching. He especially enjoys teaching children different scientific facts about bats, rainforests, or machines. Stephen lives in Vancouver, Washington, with his wife and their two sons.

Another book by Stephen Kramer:
Tornado



Dennis Kunkel is often found looking at fleas, bacteria, and blood cells under his microscope. He has made large contributions to the science world with what he has witnessed through his lens. Dennis loves the new information his microscope unveils because he appreciates the beauty of what is missed by the naked eye. Dennis's research and pictures have appeared in magazines, museum exhibits, and even movies.



Find out more about Stephen Kramer and Dennis Kunkel at www.macmillanmh.com

Author's Purpose

How can readers tell that Stephen Kramer respects scientists greatly? Give examples from the text, headings, or photos.



Comprehension Check



Summarize

Use your Sequence Chart to summarize important information from *Hidden Worlds: Looking Through a Scientist's Microscope*.



Think and Compare

1. Describe the steps Dennis thinks are important in becoming a better scientist. **Summarize: Sequence**
2. Reread page 749. Why do you think Dennis looked for living things after the eruption of Mt. St. Helens? Include facts from the selection in your answer. **Analyze**
3. Explain how you would practice becoming a careful **observer**. Include where you would choose to observe and what you might see, smell, hear, and touch. **Evaluate**
4. What effect do scientists like Dennis Kunkel, Albert Einstein, and others, have on the world? Explain your answer. **Analyze**
5. Reread “Dr. Priscilla C. Grew, Geologist” on pages 738–739. Compare and contrast Dr. Grew’s experiences with Dennis Kunkel’s career. Use details from both selections in your answer. **Reading/Writing Across Texts**

