WHAT SCIENTISTS DO

A scientist is a person who wonders why. Most scientific discoveries start when a person asks a question. Why do objects fall when we drop them? How can some animals live underwater? What is beyond the stars? The answers to these questions and many more were all discovered because people wondered why.

The process of finding answers to scientific questions is called *scientific inquiry*. It involves many different steps. The first step is to make an observation. The second step is to ask a question that comes to mind as a result of making the observation. The third step is to come up with an idea that might answer your question. This idea is called a *hypothesis*. For example, after a few weeks without rain, you might observe that the plants in your garden are dying. This leads you to come up with the question, "Why are the plants dying?" Your hypothesis might be, "Plants need water to live." You would base your hypothesis on your own observations and on what you already know about the world.

The fourth step is to test your hypothesis by conducting an experiment. Just watching the plants in your garden usually does not give you enough information to find out if your hypothesis is correct. There are many other conditions besides

rainfall that might affect your plants. For example, they might be getting too much or too little sunlight. The temperature might be too hot or too cold. They could be planted in different types of soil. These factors and conditions that can change and might affect the experiment are called *variables*.

To conduct a fair experiment, you must control all of the variables except for the one you are testing. Therefore, you would need a minimum of two identical plants for such an experiment. A better experiment could be conducted with two identical sets of plants that contained five plants each. You would have to expose both sets of plants to the same amount of sunlight. You'd have to keep them at the same temperature. The only variable in your care for these plants would be in the watering. You would water one set of plants once a day for 2 weeks. You would not water the other set of plants at all.

After you completed your experiment, you would observe the results. In the example above, the plants that were not watered would die. The other plants would live. This would tell you that plants need water to live. Your idea has now been tested.

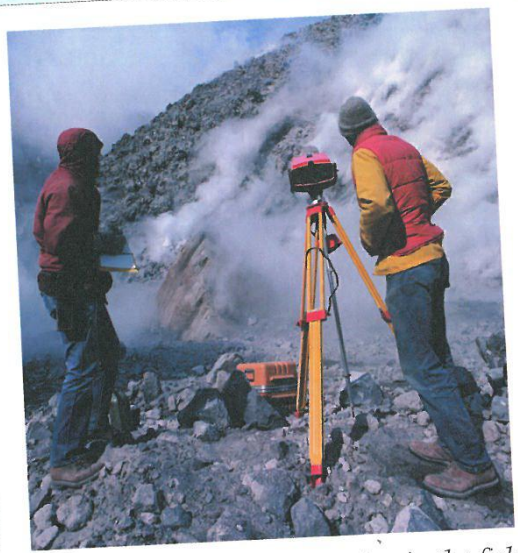
Sometimes a scientist's hypothesis turns out to be wrong. The scientist might conduct several experiments to test the hypothesis, only to discover that the results don't support it. But this does not mean the scientist has failed. The scientist still learns something by conducting the experiments and making further observations. These observations often lead to new questions, new hypotheses, new experiments, and new knowledge.

Demonstrating that a plant needs water to live is easy. But how do scientists develop explanations for events that happen far out in space? How do they look at organisms, objects, and systems that are too small to see? How do they organize the results of their experiments?

Scientists use *instruments* to help them make observations, conduct experiments, and organize *data,* or information. Some instruments help us see things that are very tiny. These include magnifying lenses and microscopes. Other instruments show us things that are far away. These include telescopes and satellites. Instruments such as thermometers and barometers provide precise data about temperature and weather conditions. Computers help scientists to organize and analyze the data and get results much faster than any human brain can. All these instruments help scientists find answers to questions.

An important part of scientific inquiry is to make the results of experiments known to the public. Scientists write articles about their experiments and what they think they've proved. These articles are published in *scientific journals.* Some scientific journals are magazines mostly for scientists, and others are for the general public.

It is important that a scientist explain exactly how he or she conducted experiments. That allows other scientists to repeat the experiments to see if they get the same results. If they do, they will probably agree that the first scientist's ideas are correct. But sometimes other scientists do not get the same results. They may conclude that the first scientist did something wrong or that there is another explanation for the results of the original experiment. Having scientists review and ask questions about each other's work is an important step in scientific inquiry.



Scientists gathering information in the field