Why Ask Why?

What are some parts that make up scientific investigations?

The work that scientists do can vary greatly. Some scientists spend much of their time outdoors. Others mostly work in laboratories. Yet scientific investigations have some basic things in common.

Hypothesis

A **hypothesis** (hy•PAHTH•ih•sis) is a testable idea or explanation that leads to scientific investigation. A scientist may think of a hypothesis after making observations or after reading findings from other scientists' investigations. The hypothesis can be tested by experiment or observation.

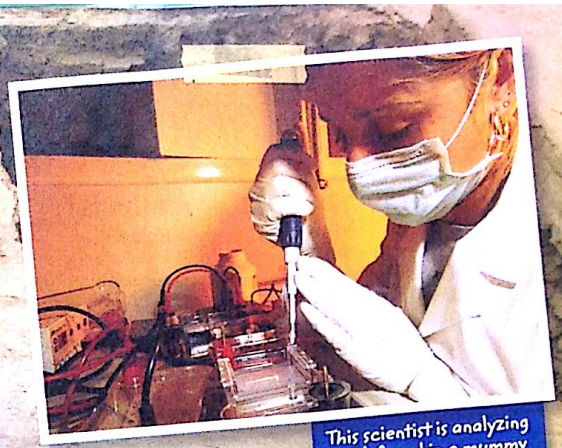
For example, imagine that while outside after a snowstorm, you notice that plant leaves seem to be healthy. You wonder how the leaves stayed alive because the temperature was below freezing during the storm. You also know that heat does not pass as easily through snow as it does through air. With this information, you could make the following hypothesis: "The leaves on the plants stayed healthy because the snow cover slowed their loss of heat." This is a hypothesis that could be tested by an experiment.

Mummies such as this one have been preserved by the cold, dry climate of the Andes Mountains in Peru.

These scientists are removing a mummy discovered in Peru. Because Peru's climate is so dry, some DNA is preserved.

Think Outside the Book

8 Apply Think of something you have observed or read about that interests you. Then, write a hypothesis about it.



This scientist is analyzing DNA found in a mummy from Peru.

Variables

A **variable** is any factor that can change in an experiment, observation, or model. When scientists plan experiments, they try to change only one variable and keep the other variables constant, or unchanged. However, it may not be possible to control all the variables that can affect the results.

Suppose you decide to test the hypothesis that snow protects leaves from below-freezing temperatures. If you did the experiment in the field, you would not be able to control many variables. But you could set up a laboratory experiment to test your hypothesis. First, you would put similar plants in two chambers. Both chambers would be cooled to the same temperature. You would cover the plants in one chamber with snow and leave the plants in the other chamber without a snow cover. The snow cover is the variable you want to test. You would try to keep all the other variables the same in both chambers. For example, when you open one chamber to pour snow on the plants, you would keep the other chamber open for the same amount of time.

Observations and Data

Data are information gathered by observation or experimentation that can be used in calculating or reasoning. Everything a scientist observes in an investigation must be recorded. The setup and procedure of an experiment also need to be recorded. By carefully recording this information, scientists make sure that they will not forget important details.

The biologist shown in the photo above would record the results of her analysis of mummy DNA. In addition, she would identify the type of tissue that was examined—whether it came from a tooth or bone, for example. She would also record the type of instrument used to examine the tissue and the procedures that she followed. All of these details may be important when she reports her findings. The information will also help other scientists evaluate her work.

9 Identify What kind of data would you record for an experiment testing whether snow protects leaves from cold temperatures?