READING

Studying people *scientifically* presents some interesting challenges. One challenge is that different people react differently to identical events. Think about the results of your experiments on touch sensitivity. You probably discovered that not everyone could feel two points at the same distance. How do you think scientists deal with this type of challenge?

CHALLENGE

How are qualitative and quantitative data used when testing a hypothesis about people?

READING

Scientists usually begin with an idea about what they want to investigate. This is also true for scientists who study people. This idea, or hypothesis, is the basis for their study. As you now know, a **hypothesis** (hi-PAH-thuh-sis) is an explanation based on observed facts or on an idea of how things work. For example, Dr. Goldberger hypothesized that there was a relationship between pellagra and diet.

Doctor and patient

In some cases, scientists predict the possible outcomes of an experiment. A hypothesis can include a prediction of what might happen. In the last activity, your hypothesis included a prediction about the results. To make sure they don't influence results, scientists studying people often do *not* predict the possible results of their experiments.
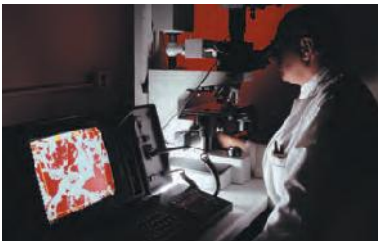
Scientist examining rat brain scan

After developing a hypothesis, scientists usually plan and conduct experiments. The results of an experiment can provide evidence for or against a hypothesis. In some cases, an experiment provides new information. This new information can produce another hypothesis and another experiment. In this way, a hypothesis can be a "work in progress" that is continually revised.

Doctor and nurse working on computer

*The word **data** (DAY-tuh) is plural. It refers to a set of information. The singular form is* datum*, one piece of information.*

STOPPING TO THINK 1

You hear your friend Yoshi tell someone that a hypothesis is the same as a guess. Explain whether you agree with Yoshi.

In the case of pellagra, Dr. Goldberger conducted an experiment on prisoners to test his hypothesis. During the experiment, 7 out of 11 prisoners, or 64%, developed pellagra after six months. Even though all of the prisoners ate the same diet, they did not respond in the same way. Scientists try to account for individual differences by studying a large enough **sample size**.

STOPPING TO THINK 2

Explain whether Dr. Goldberger provided enough evidence to prove that pellagra is not contagious.

In the United States today, government agencies, such as the Food and Drug Administration (FDA), tightly control and review experimentation on humans. After receiving government approval, companies often search for volunteers to participate in clinical trials. Clinical trials test medicines, food, medical procedures, and medical equipment. **Data** collected during these trials provide evidence for making conclusions about a product or treatment. The type of data collected depends on what is being investigated.

For example, imagine a company that is conducting trials of a new hearing aid. The company would like to know how clearly volunteers can hear when using the hearing aid. People will try out the hearing aid and report how clearly they hear sounds, and whether they hear any buzzing or other undesired noise from the hearing aid. They may also report whether they find the hearing aid comfortable to wear and attractive in appearance. These are all examples of qualitative data. **Qualitative** (KWAL-i-tay-tiv) **data** describe properties or characteristics (qualities) that are used to identify things. Qualitative data often result from putting things into categories.

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STOPPING TO THINK 3

You notice a skateboard for sale on an Internet website. The price is good, but the website provides no picture or other information. What qualitative data would you like to have before you decide if you will buy it?

What if you were interested in buying the hearing aid? You would probably want to know how well it works when compared with other hearing aids. In clinical trials, people with hearing problems might be tested to measure the softest sound they could hear with and without the different hearing aids. The volume of sound (how loud it is) is measured in decibels. The company might report that in clinical tests 90% of the people wearing the hearing aid heard sounds as low as 35 decibels, when only 10% could hear these sounds without the hearing aid. In this case, numerical, or quantitative, data were collected. **Quantitative** (KWAN-ti-tay-tiv) **data** are values that have been measured or counted. The word *quantitative* is related to the word *quantity*, which means "number" or "amount."

Consider an everyday example of qualitative and quantitative information. Imagine you are at a large store with a friend when suddenly you turn around and she's not with you anymore. You look around, but you don't see her anywhere nearby. You ask a store employee if he has seen her. You describe your friend as a tall 13-year-old girl with short brown hair, brown eyes, a red jacket, two braids, and a dimple when she smiles. You have included important qualitative and quantitative information about your friend.

Medical products, such as hearing aids, pacemakers, and contact lenses are tested before being sold to the public.

STOPPING TO THINK 4

Reread the description of your friend in the above paragraph. Create a list of each of her characteristics. Identify each characteristic as either qualitative or quantitative.

Both qualitative and quantitative evidence are important in identifying your friend. Qualitative data provide information about important characteristics that are difficult to measure but can be described and categorized. But in some cases quantitative data help give a clearer description. Think about the description of your friend in the previous paragraph. A height that seems tall to you might seem short to the store employee. But if you tell him that your friend is 5 feet 7 inches tall, you will both have a clear idea of how tall she is.

STOPPING TO THINK 5

a. What kinds of qualitative data are useful in studying people scientifically? Provide at least two examples.

b. What kinds of quantitative data are useful in studying people scientifically? Provide at least two examples.

ANALYSIS

1. You decide to take a medicine for your upset stomach. You have a choice of two medicines. Both medicines are advertised as safe based on clinical trials. Medicine A was tested on 100 people. Medicine B was tested on 10,000 people.

a. Which medicine would you take? Explain. Support your answer with evidence.

b. Was your decision based on qualitative or quantitative information?

2. You're a volunteer at a local hospital. While you are there, you read a patient chart containing the data below. Identify each item of patient data as quantitative or qualitative.

3. Imagine conducting a clinical trial of a headache medicine. Based on your research, you hypothesize that the medicine will successfully treat headaches in people. Before the Food and Drug Administration (FDA) will approve your study, you must explain the type of data you will collect to test your hypothesis.

Skin tone: Flushed

Heart rate: 77 beats per minute

Weight: 129 pounds

Height: 5 feet 5 inches

Body temperature: 100°F (38°C)

Response to touch: Slow

a. List at least three kinds of qualitative data you will collect. **Hint:** Think about what information you would collect from the volunteers and what information you would collect about the medicine in order to determine the safety and effectiveness of the medicine.

b. List at least three kinds of quantitative data you will collect. **Hint:** Think about what information you would collect from the volunteers and what information you would collect about the medicine in order to determine the safety and effectiveness of the medicine.

4. Think about the activities you have done so far in this unit. What are the common elements of a well-designed experiment?

5. Reflection: Both qualitative and quantitative data provide evidence for making decisions. How have you used each of these types of data to make decisions? Describe your experiences.