26: Kinds of Scientists

Remember, I told you a few lessons back that scientists like to classify things. Well being a good scientist, today I want to classify scientists.

Most scientists fit into one of two broad categories. Some are **descriptive** scientists. These are people whose main job is to describe what they see. Others are **experimental** scientists who work in a research setting. These scientist are actively involved in finding the answers to questions. Let's describe each of these and their jobs in greater detail.

Descriptive Scientists

As you can tell, the word **descriptive** is related to the word *describe*. Many of the early scientists were of this type. They were not able to explain a lot of what they saw, but they were able to write down or draw what they saw. Many early scientists wrote huge volumes of information about plants, animals, rocks, stars or anything else they could observe.

Among descriptive scientists were the people (called "anatomosts") who dissect the bodies of dead people and described every part in great detail. Doctors must still study human anatomy and must cut apart a dead person (which they call a **cadaver**) as part of their training. This allows them to know human anatomy in great detail so they can understand how a person is put together and can know the locations of all the body parts. Anatomy is an example of a descriptive science.

Biologists collect plants and animals and describe them thoroughly. They compare different species and varieties of animals so they can tell one from another. They place type in a "type collection," like the one at the Smithsonian Institute in Washington, D.C. It contains the largest plant, animal, mineral and human skeleton collection in the

This is a drawing of the Smithsonian Institute as it looked in 1849.

world. A professional biologist who wants to study the specimens in the Smithsonian can do so by appointment.

Suppose you live in Kentucky and you need to know something about snakes. Rest assured that one of the universities in Kentucky will be the home of one of the most expert snake biologists in the state. He or she will be able to tell you just about anything you want to know about every snake in that part of the country.

This is an eastern garter snake. A good herpetologist (one who studies reptiles) can tell you exactly where to find it, what it eats, how long it lives and all the details of its anatomy. They may even be able to tell you how many scales it has from the tip of its nose to the tip of its tail.

Descriptive scientists answer questions such as, what does it look like? how many teeth does it have? where does it live? what does it eat? or how many eggs does it lay? These scientists used to be called "naturalists." Charles Darwin (famous for his observations of many types of living things that led to his theory of evolution), John James Audubon (famous for his observation and paintings of birds), and Jane Goodall (famous for her observation of gorillas) were/are all descriptive scientists. Just because a scientist spends most of his time observing and describing that doesn't mean he can never do experiments, but observing and describing is the way he spends most of his time.

Experimental Scientists

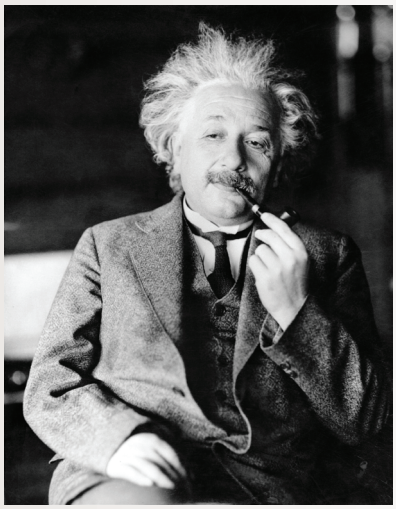
The other kind of scientist, the experimental scientist, may also describe what he sees but also has questions that he wants answered, so he designs experiments to answer them. There are fewer descriptive scientists these days and more experimental scientists. That's because most of the plants and animals (with the exception of small insects) on Earth have now been described in great detail. Most of the surface features of the planet and minerals within the Earth are known and have been described in great detail. But there are still many unanswered questions, and there will continue to be as long as life continues.

As long as there are diseases, there will be researchers who will try to overcome them. As long as there are problems, scientists will attempt to solve them. As long as people are curious, they will seek to know the things that they do not know. All of these goals may be accomplished through scientific research—asking good questions and then trying to find answers using scientific methods. As I explained in Lesson 19, the scientific method is a set of principles scientists use in designing experiments to answer questions.

Others

Aside from these two main kinds of scientists, there are also several kinds of people who use scientific information in a practical setting. We don't necessarily even call these people scientists, although they might be considered **applied scientists**. That's because they have science training and are busy applying scientific information in a specific way. For example, a doctor or a pharmacist has to make use of scientific information in healing people. Engineers use scientific information to build things such as bridges, water treatment plants, skyscrapers, mechanical objects, computers and robots.

Another kind of scientist, a **theorist**, works on looking at the information we have in different ways that will affect guide the general direction of science in the future. For example, Albert Einstein was a famous theoretical physicist. These people try to reach beyond what we know today to help us know what to study tomorrow. They also help us to create a framework to fit lots of bits of knowledge in a big, beautiful picture.


Albert Einstein

If you think you want to be a scientist someday you can choose an area that interests you, but you mustn't forget that, unless you are very wealthy, you will also have to find a job that someone will pay you to do. Science is big business, and the U.S. is not preparing and training scientists and engineers fast enough to satisfy the demand. For that reason, you will notice a lot of people who come from other countries holding these jobs. If you should decide to become a scientist or work in a technical discipline such as medicine or engineering, and you work hard, you will probably have a lot of opportunity and be paid pretty well for what you do. Keep your eyes open from an early age to see what kinds of opportunities are available for someone with your interests.

Even technical jobs can be hard to find if you work in an area that does not have much demand. If your job is to study animals you will have to compete for the jobs available against all the others who also want to study animals. There are not as many of those jobs as there are jobs for people (for example) who develop new medical devices. If you want to make it easy on yourself to find a job and to get a good paycheck, look for the areas that have high demand and good funding. Ask people you trust for advice as you go through school to help you fulfill your goals.

Now please read the biography for today before turning to your activites.

Antony van Leeuwenhoek (1632–1723)

Antony van Leeuwenhoek (LAY-ven-hook) was born in the Netherlands. As a young man he was an apprentice to a draper. He used lenses to carefully examine the cloth that would be used to make drapes. He learned the art of making lenses and turned his interest to making very powerful ones. He is known to have made at least 247 different microscopes.

Some of Antony's microscopes had the ability to magnify an object up to 270 times. No one had ever before seen things so tiny as Leeuwenhoek saw. The strongest light microscopes today are only four times stronger than these. Just think about it—this man was able to create instruments with his own hands that were almost the same strength as instruments we can create now, 300 years later. Today there are microscopes capable of greater magnification than simple light microscopes, but they operate using different principles that Antony could not have known.

Antony gave us our first complete descriptions of bacteria—the smallest of all living things. He also described protozoa which he called *animalcules*, meaning "little animals." That is still a pretty good description of these little creatures, although some might be better described as plants rather than animals.

Those powerful microscopes opened up new worlds of discovery. As far as we know, Leeuwenhoek was the first to study spermatozoa ("sperm"). These are the male sex cells that fertilize eggs in females to produce children. He also studied muscle cells and blood. He did a detailed study of the circulation of blood throughout the human body.

Also from this work, people came to realize (despite many wacky things people had come to believe) that life comes from life. A new "theory" of life came about called **cell theory** that states that living things reproduce after their own kind through living cells. Eventually we would come to realize (through the work of Robert Hooke and many, many others) that all living things are made from cells.

Not only did Leeuwenhoek make many discoveries on his own, he also prepared the way for other important discoveries that would follow because of a new awareness of the tiny forms of life that could not before be seen. Even though he was not a nobleman, and not well educated, he was rightly honored for his pioneering work by the educated community.

One of the things that continues to please me as a Christian is how much good, basic information was written in the Bible long before its time. When great discoveries come about, they often bring us right back to what Moses wrote around 1500 B.C. He wrote that life reproduces itself, each living thing after its own kind. This is one of the most obvious repeated themes of Genesis, Leviticus and Deuteronomy (See Genesis 1:11,12, 24, 25 for example).

Up to a few hundred years ago it was popular for educated people to believe that living things came about from non-living things by **spontaneous generation**. In this theory, mice came from dirty laundry, frogs came from leaves of trees and flies came from spoiled meat. Mankind could have been spared many hundreds of years of superstition if they had believed these simple words of Moses. Today, the idea that animals come from other animals of their own kind is what we call a "no-brainer." The idea that life gives rise to life after its own kind is a simple fact of nature. That fact was recorded in the Bible 3500 years ago. This is just one example of the many bits of ancient knowledge recorded there.