EXPLORING CREATION WITH

GENERAL SCIENCE

3rd EDITION

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THE HISTORY OF SCIENCE—SEARCH FOR THE TRUTH

Get ready for an exciting year! You might wonder why I know it will be exciting. Well, it is because we are beginning a study of the fascinating world of **science.** Before I go any further, let's discuss what science is. The word comes from Latin and simply means "knowledge." But today, the word *science* actually means much more. We can begin with a basic definition.

Science—The systematic study of the natural world through observation and experimentation in order to formulate general laws

FIGURE 1.1
Helium Balloons

Let me break that definition down for you. The end goal of science is found in the second part of the definition. *We use science to come up with general laws that help to explain what is going on in the world around us. Why, for example, do most things fall to the ground when you drop them, yet a helium balloon floats upward? Is there a general law to explain that?* Now, the beginning part of the definition

Quaestio

Why is a Latin word heading this section? Well, this course will be taking you through an overview of all of science, including its development and diversity. A major part of science involves asking questions and doing research. Look closer at those words: QUESTion and reSEARCH. Both words have elements of exploration, don't they? That is a large part of science: exploring the world around us to come up with general laws that God set in place to govern our world since the beginning of time. You will therefore be on a QUEST this year, SEARCHing through all facets of science. *Quaestio* is Latin for "question." Every module will start by reminding you that you are on a quest, searching the world for God's fingerprints. So basically, we'll be explorers together, on an amazing adventure!

explains how we come up with those laws. Scientists look at the world around them and collect facts about it. *Balloons filled with air will fall to the ground.* They also develop experiments to gather more facts. *What happens to balloons filled with other gases when they are released? How are air and those other gases different from helium?* That information is gathered in an ordered way to study and better understand our world. *When the weight of a helium-filled balloon is lighter than the amount of air it takes up, the balloon will float upward in the air.*

Now here is the really exciting part. Believe it or not, you have been a scientist from the day you were born. You have watched and listened to things around you. You learned how things felt, tasted, and behaved. As a baby, when you tossed items off a high chair, you were really exploring what we call gravity (even though that was a messy way to do it!). Then as a toddler, you went outside and examined grass, leaves, ants, and caterpillars. You watched it rain outside and studied the trickling of water as it ran down the window pane. And you were fascinated. That is what we are going to continue to do in this course. We are going to keep observing and experimenting to gather more knowledge with the purpose of better understanding the remarkable world that God created!

FIGURE 1.2
Young Scientist

THE EARLIEST SCIENCE: Ancient Times–600 BC

The best way to study how science works today is to learn about how it has developed throughout history. That's because the history of science will reveal how science should and should not be practiced. We will also learn where it is heading in modern times. So we will use this module to travel through time and observe the history of human scientific inquiry. That will allow you to better understand what science is and what it is not. First, let's travel way, way back to some of the earliest historical records.

Egypt

The first science records we have come from 3,000 years before Christ. Ancient Egypt is where we first see the dawn of what we would call medical care. Many Egyptian medical practices could cure illnesses. However, most of these methods came from trial and error. They would keep trying different things until something helped. If a method didn't work, the patient would have to suffer or even die, but the doctors would know not to use that method on the next patient. If the remedy *did* work, then they knew what to do the next time they saw that illness.

One of the physicians of that time, **Imhotep** (eem' oh tep) [c 2650 BC], was well known for his medical knowledge and ability to heal. People would travel hundreds of miles in the hope that he would be able to cure their illnesses.

Although the trial-and-error method of medicine sounds primitive, Egyptian doc-

tors came up with some pretty successful treatments. For example, they learned that a good way to treat an open wound would be to cover it with moldy bread. That would make the wound heal quickly. Because it worked so well, doctors automatically would apply moldy bread to their patients' wounds. Can you imagine walking through an Egyptian doctor's office and seeing people covered with slices and strips of green, moldy bread? But, believe it or not, they were on to something. Today, we know that some bread molds produce penicillin, which is a chemical that kills the germs that infect wounds! So even though the Egyptian doctors knew *nothing* about germs, they still were able to treat open wounds by preventing them from getting infected.

FIGURE 1.3
Moldy Bread

Some people might see these slices of bread and think they should be thrown away, but Egyptian doctors saw their medical value!

The doctors also discovered a way to manage pain. If a patient was hurting, they would feed the patient seeds from the flowering poppy plant. Eating the poppy seeds seemed to bring pain relief. Again, the doctors didn't know *why* it worked. But modern science has shown us why. It turns out that poppy seeds have both morphine and codeine, which are pain-relieving drugs. In fact, they work so well, those drugs are used in medicine today.

One of the major reasons Egyptian medicine progressed so well as compared to the medicine of other ancient nations is that they invented **papyrus** (puh pye' rus).

Papyrus—An ancient form of paper, made from a plant of the same name

As early as 5,000 years ago, Egyptians took the pliable stems of the papyrus plant, sliced them into thin strips, laid them in a crosswise manner on top of each other, wet them, and then allowed them to dry. That resulted in a type of paper that they could write on and store.

Well, that enabled them to document information and send it from person to person. Up to that point in history, Egyptians, Sumerians, and other people groups wrote on clay tablets or on rocks. You can imagine that writing on rocks and clay and toting them around or storing them would be much more difficult. When Egyptians began writing on papyrus, that all changed. It could be readily rolled up into scrolls for easy transport or storage. That meant the knowledge of one scholar could be easily sent to other scholars. Their gained knowledge could accumulate and more easily be passed down to future generations. That helped to make Egyptian medicine the

FIGURE 1.4
Live Papyrus Plants

most respected form of medicine in the known world.

Other Cultures

But let's not leave out other cultures. They had some great inventions, too. At the same time papyrus was first used in Egypt, the Mesopotamians were employing the first known potter's wheel to make pottery. Horse-drawn chariots were being used as well. And as early as 1,000 years before Christ, the Chinese were using compasses to help them navigate. So we can say the ancient world was filled with inventions that transformed life during those times. These inventions are history's first beginnings of science.

FIGURE 1.5
Egyptian Pyramids at Giza

WHAT TO DO

Notetaking: One of the goals of this course is to help you learn to identify main points as you read information in order to get it "into your brain." Reading is only one way to do that. By writing down the important facts and definitions, you are giving your brain another way to review them and, therefore, you will better remember them. Plus, notetaking provides you with an easy way to review the module when it comes time for a test. Don't worry. I'll walk you through that step, too. The *Student Notebook* that accompanies this textbook is designed specifically to help you become comfortable with notetaking. Now, notice that there are 2 definitions in the previous section (science and papyrus). Words and their definitions (in bold and blue font) should be written in your notebook. You will need to memorize them. Your notebook is also designed to give you notetaking prompts. These will help you remember important information. Taking notes while you read your text will become easier with practice, and you will better recall what you have read.

"On Your Own" Questions: As we come to the end of this first section in the module, you might notice the rest of the module is divided up into other titled sections. At the end of each section will be one or more "On Your Own" questions. You should answer these questions (spaces for answers are in your *Student Notebook*) as soon as you come to them in your reading. You can look back at the module as well as your notes to find the information

in order to answer the questions. These questions will help you to think about what you just read in the previous section to make sure you understand it. You will check your answer against the solution located at the end of each module in your textbook. If you got the answer correct, you are ready to move on. If you didn't get the answer correct, don't panic. Go back and reread the section of your textbook to try to understand the answer. You can also find additional materials on the textbook's Book Extra page. Make sure you understand the information before you continue your studies. Science builds on itself, so it is important to have a strong foundation.

Timeline: Finally, for this particular module only, we will be time-traveling through the history of science and meeting several notable scientists. Though you will not be required to memorize everything about all of them, you *will* be instructed to learn a bit more about a few. An important activity for this module will be to create a timeline, beginning at 3000 BC to AD 2000. This activity is found in your notebook. As you study each scientist, write his name under the date they lived and include one or more important facts you learned. For example, you learned about Imhotep in this section, so go ahead and add him to your timeline beneath the date 2650 BC. For this module, when I introduce a scientist from history, there will be a bracketed date after the name so you can place the scientist on your timeline.

ON YOUR OWN

1.1 Although the ancient Egyptians had reasonably advanced medical practices for their times, and although there were many inventions that revolutionized life in the ancient world, most historians of science do not think of Egyptian doctors as scientists. Why? (Hint: Look at the entire definition of science.)

TRUE SCIENCE BEGINS TO EMERGE: 600 BC—AD 500

The ancient Greeks are believed to be the first true scientists. Remember our definition of science. It is when observations and facts are gathered and are then used to come up with general laws about our world. So although the ancient Egyptians and Chinese had collected lots of observations and had recorded facts, they didn't go the next step to use those facts to develop explanations of the natural world. In fact, historians believe that didn't happen until the sixth century BC with the Greeks.

FIGURE 1.6
Solar Eclipse

A solar eclipse occurs when the Moon passes between Earth and the sun. The Moon either fully blocks or partially blocks the sun from view.

Three Greek Scientists

Three Greek scientists, Thales (thay leez) [640s–540s BC], Anaximander (an axe' uh man der) [c 500 BC], and Anaximenes (an axe' uh me' neez) [c 546 BC] are believed to be the world's first real scientists.

Thales studied the sky and tried to come up with a unifying theme to explain how the planets and stars

moved. He was successful in predicting certain planetary events. In fact, he received notable recognition in his day for correctly predicting what he called the "short-term disappearance of the sun." This was a solar eclipse, which is when the Moon moves between Earth and the sun, blocking most of the sun from our view.

Historians believe Anaximander was one of Thales' students. He studied living organisms and is believed to be the first scientist to try to explain the origin of the human race without reference to a Creator. He suggested that all life began in the sea and at one time in history, humans were a type of fish. This idea was revived much later in history by some other scientists, including Charles Darwin (whom I will introduce in just a bit), and today is known as evolution. We'll discuss evolution later in the course and see what scientific data exist.

Anaximenes was probably an associate of Anaximander. He believed air was the most basic material in nature. He also believed that everything was made of air. So when air is thinned, he thought it would warm and turn to fire. When air is thickened, it would become liquid or solid material. Today, we know that those ideas are incorrect, but Anaximenes did try to explain all things in nature as being made of a single substance. That eventually led to one of the most important scientific ideas introduced by the Greeks: the concept of atoms.

Two More Greek Scientists

Another Greek scientist, **Leucippus** (loo sip' us) [early 400s BC], built on Anaximenes' thinking, and historians believe he proposed that all matter is composed of little units called atoms. Leucippus had a student, **Democritus** (duh mah' crit us) [460–c 370 BC]. Democritus' works are well preserved. He came up with a great analogy to help explain his ideas about atoms. Think about walking toward a sandy beach. When you are a long way from the beach, the sand looks like a smooth, yellow blanket. As you get closer to the beach, you might notice that there are bumps and valleys in the sand, but the sand still looks solid. When you reach the beach and actually kneel down to examine the sand, you see it is not solid at all. It is made up of tiny particles called sand grains.

FIGURE 1.7
Sand

Democritus noticed that from a distance the sand on a beach appeared to be connected like a smooth, solid blanket. But as the sand was more closely observed, it was evident that it was made up of small grains. This idea helped him to suggest that all matter was like sand, made up of small particles even though it appeared solid.

Well, Democritus thought that all matter was like sand. Even though it might appear smooth and solid, it is made up of very tiny particles called atoms. **It turns out that some materials in nature have atoms that are more tightly packed together than others.** That makes them behave differently from each other. Explore this idea more in Experiment 1.1.

WHAT TO DO

Before you begin any experiment, you should read **all** of the instructions to make sure you have the materials needed and understand what you will be doing.

EXPERIMENT 1.1
DENSITY IN NATURE

PURPOSE: To understand how atoms could explain things we see in nature

MATERIALS:
- A tall, clear canister or jar with a lid
- A ping-pong ball
- A 3-oz. lead sinker (the kind used for fishing)
- A bag of unpopped popcorn (small dried beans will also work)

QUESTION: What happens to 2 objects of different densities when they are in the same container?

HYPOTHESIS: Make sure you know what you think will happen to the less dense ball before you complete step 4 of this experiment.

PROCEDURE:
1. Fill the canister with popcorn so that it is about ¾ full.
2. Bury the ping-pong ball into the center of the popcorn so that it is just below the popcorn's surface. You should not be able to see the ping-pong ball; it should be completely covered.
3. Set the lead sinker on top of the popcorn and seal the canister.
4. Vigorously swirl the canister around and around in a circular motion from side to side and watch what happens to the balls. Use common sense when shaking so that your container does not crack.
5. Record in the lab notebook section of your *Student Notebook* what you saw.
6. Clean up and return everything to the proper place.

CONCLUSION: What happened to the ping-pong ball and the lead sinker when you swirled the canister?