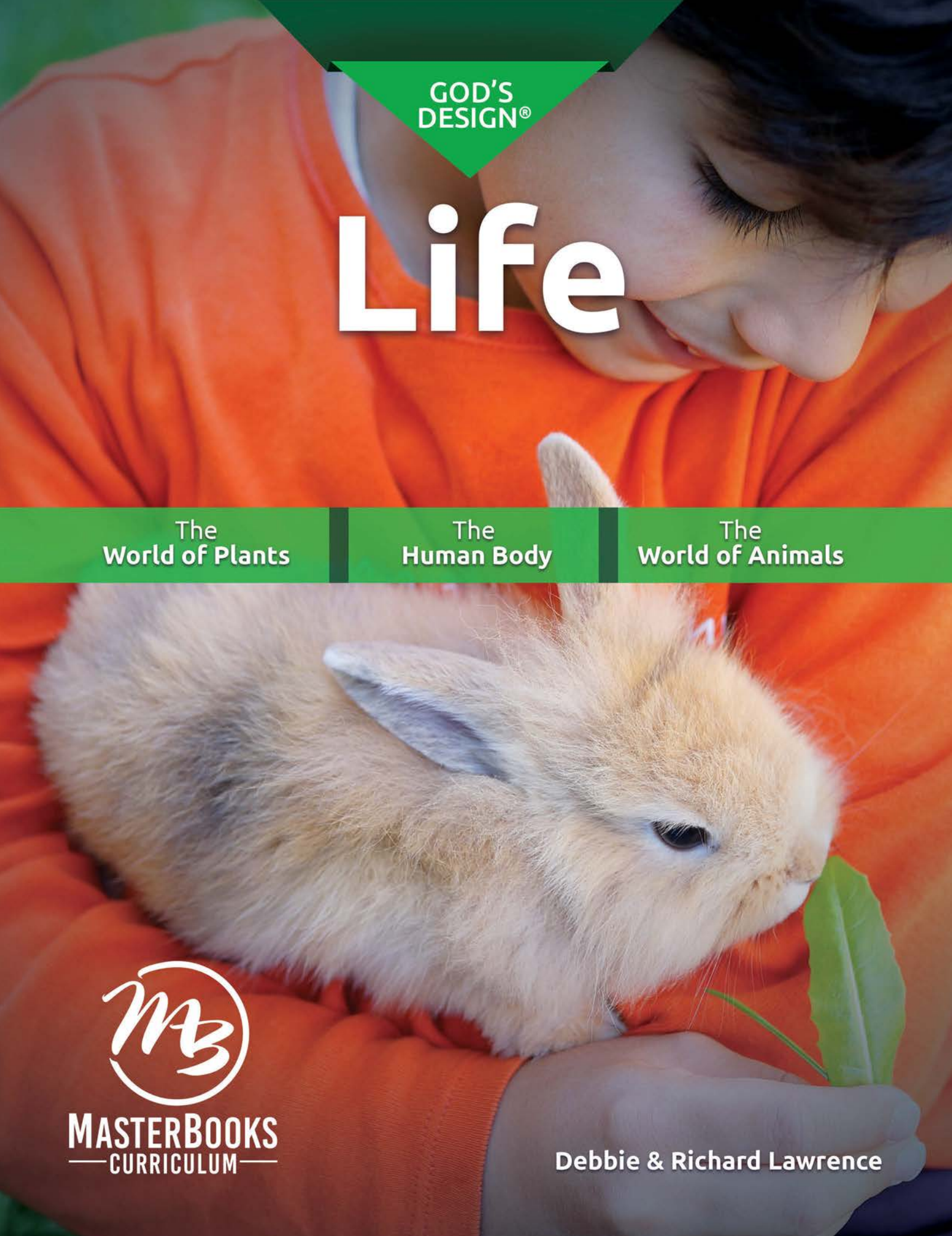

GOD'S DESIGN®

Life

The World of Plants

The Human Body

The World of Animals

MASTERBOOKS CURRICULUM

Debbie & Richard Lawrence

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The World of Plants

The Human Body

The World of Animals

Welcome to GOD'S DESIGN®

LIFE

You are about to start an exciting series of lessons on life science. *God's Design® for Life* consists of: *The World of Plants*, *The World of Animals*, and *The Human Body*. It will give you insight into how God designed and created our world and the things that live in it.

No matter what grade you are in, third through eighth grade, you can use this book.

3rd–5th grade

Read the lesson.

Do the activity in the light blue box (worksheets will be provided by your teacher).

Test your knowledge by answering the **What did we learn?** questions.

Assess your understanding by answering the **Taking it further** questions.

Be sure to read the special features and do the final project.

There are also unit quizzes and a final test to take.

6th–8th grade

Read the lesson.

Do the activity in the light blue box (worksheets will be provided by your teacher).

Test your knowledge by answering the **What did we learn?** questions.

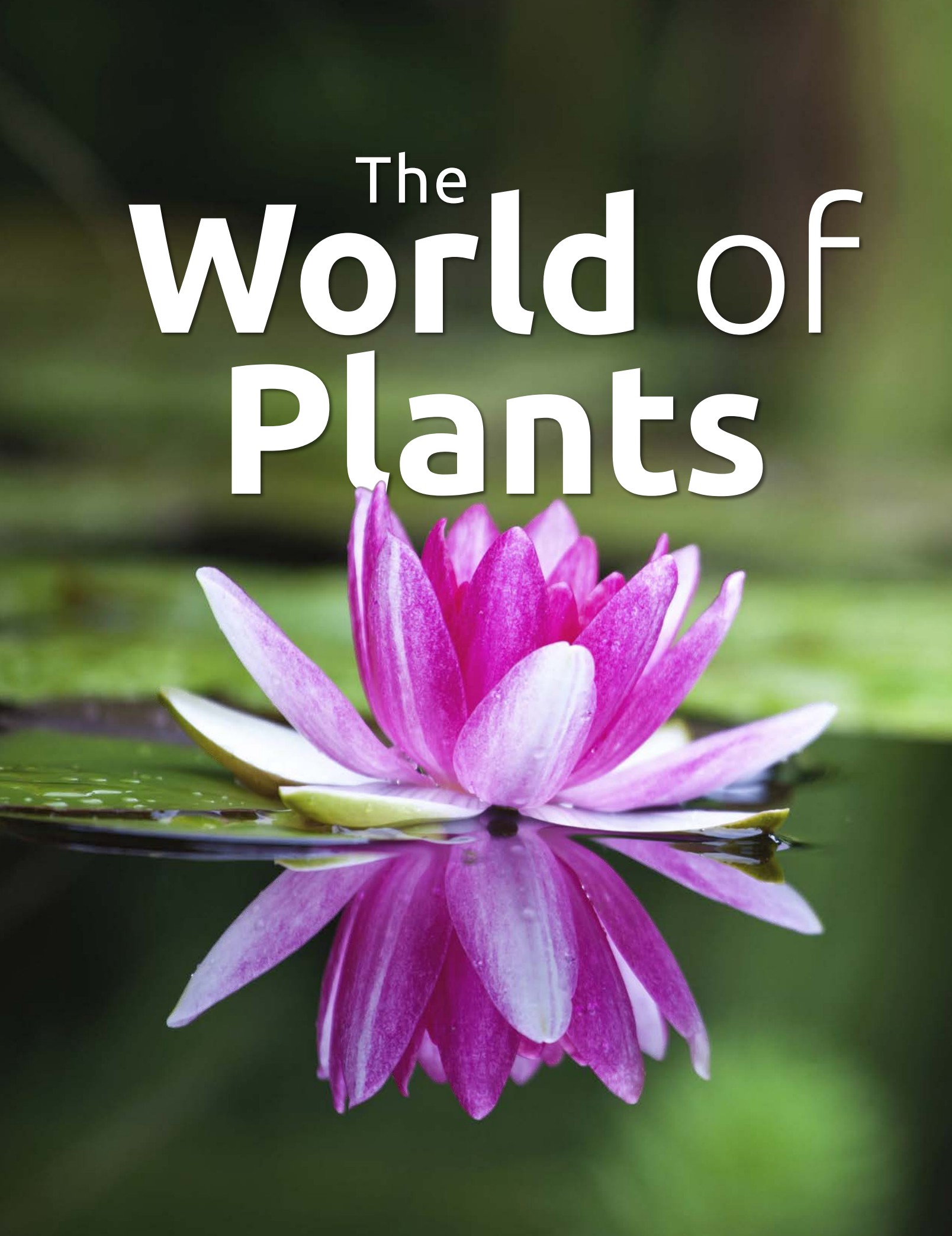
Assess your understanding by answering the **Taking it further** questions.

Do the challenge section in the light green box. This part of the lesson will challenge you to do more advanced activities and learn additional interesting information.

Be sure to read the special features and do the final project.

There are also unit quizzes and a final test to take.

When you truly understand how God has designed everything in our universe to work together, then you will enjoy the world around you even more. So let's get started!


The
World of
Plants

UNIT 1

Introduction to Life Science

- **Identify** the six characteristics of living things.
- **Identify** the five kingdoms of living things.
- **Identify** the method of classification of living things.
- **Describe** the need for scientific names.
- **Describe** basic parts of a cell using models.

1

Is It Alive?

Biology is the study of living things.

How do we know if something is alive?

Words to know:

respiration

Challenge words:

spontaneous generation	abiogenesis
law of biogenesis	chemical evolution

How can we tell if something is alive?

Look at the things around you. Is an animal alive? Is a plant alive? Is the table alive? How about your computer? Some things are obviously alive while other things are obviously not alive. Still other things might be a little more confusing. We are getting ready to study plants, and the study of plants is part of the study of life science. Before we can study life science, we need to know what is considered alive scientifically and what is not. It will help you to identify living things if you realize that all living things have six common characteristics:

1. Living things eat or absorb nutrients. All living things need food and water. Most animals take in food and water through their mouths. Plants absorb nutrients from the soil through their roots.
2. Living things perform **respiration**—they "breathe" or exchange oxygen and carbon dioxide as they turn food into energy. Both plants and animals need oxygen to survive. Animals get oxygen from their surroundings in many different ways. We are most familiar with animals that breathe with lungs. But some animals, such as fish, breathe with gills, and others, such as Earthworms, can

absorb oxygen through their skin. Plants also "breathe" by exchanging carbon dioxide and oxygen through their leaves. During the day, when sunlight is abundant, plants use carbon dioxide to produce food through photosynthesis; however, at night, plants use oxygen to break down some of that food for energy to grow. The type of respiration performed by all living things is called cellular respiration. It involves using oxygen to break down sugars to release energy needed for the processes of life. Different processes are used to exchange the gases required for and produced by cellular respiration—how it "breathes"—but all organisms use energy.

3. Living things grow. All plants and animals have a life cycle in which they are born, develop and grow, and then die.
4. Living things reproduce. Animals and plants reproduce in many different ways, but God designed each living thing to be able to produce more of its own kind. Most animals have babies and most plants produce seeds, but there are other ways of reproducing such as dividing or producing spores.
5. Living things move and respond to their environment. Animals can move in many different ways: some run, some fly, some slither, some swim. Plants can't move around like animals but they do respond to their environment. Plants turn their leaves to face the sun. Their roots grow down and their stems grow up. Many flowers close at night and open in the morning. This is their way of moving and responding.
6. Living things have cells. Even though we can't see plant and animal cells without the aid of a microscope, we know that all living things are made up of living cells.

Are Plants Alive Biblically?

When we talk about the study of living things from a scientific perspective, we use a definition of living things that is based on what we can observe about the organism God has created. But, according to the Bible, there is a difference between plant life and animal and human life. Throughout the Bible, the Hebrew words *nephesh chayyâh* are used to describe human and animal life. When referring to mankind, *nephesh chayyâh* means "living soul" or "soulish creature," and when it refers to animals, it means "living creature." However, this word is never applied to plant life. There is a plain distinction. It is easy to see that plants do not experience pain, suffering, or death in the same way that humans and animals do. Plant death is not the death of a "living soul" or "living creature."

As you consider the six characteristics above, keep in mind that we are using the scientific definition of a living thing. To see a biblical example of the distinction, read the following passages and compare how they talk about humans or animals and plants: Genesis 2:7, 6:17, 7:15, 7:22; Leviticus 17:10–12; Psalm 104:24–30; Matthew 6:25–34.

What did we learn?

- What are the six questions you should ask to determine if something is biologically alive?
- Does the Bible refer to plants as living things?

Taking it further

- Do scientists consider a piece of wood that has been cut off of a tree living? (Hint: Is it growing? Can it respond?)
- Is paper alive?
- Is a seed alive?

Is it alive? scavenger hunt

Use a copy of the "Is it Alive? Scavenger Hunt" worksheet to determine whether items inside and outside of your house are alive or not.

Law of biogenesis

Now that you know how to determine if something is alive, you understand that living things come from living things. An apple tree produces seeds that grow into new apple trees; a dog gives birth to puppies that grow up to be dogs. This observation is completely consistent with the Bible when it says in Genesis that plants and animals were created to reproduce after their own kind. Also, in Matthew chapter 7, Jesus said that people could tell a plant by its fruit—a thorn bush does not produce grapes and a thistle plant does not produce figs. Today, scientists better understand plant and animal reproduction and realize that DNA in the cells determines what kind of plant or animal will be produced.

However, people did not always understand that living things must come from living things. At one time, people thought that rats were produced by garbage because they observed that rats were more abundant when there was more garbage. People also thought that rotting meat produced maggots, which grow into flies, because they observed that when meat was left to rot, maggots often appeared within a few days. This idea is called **spontaneous generation**. People believed that these animals were somehow suddenly produced by their surroundings. It took the work of a some very persistent scientists to dispel this idea.

In about 1665 an Italian scientist named Francesco Redi did several experiments to show that spontaneous generation did not occur. He believed that maggots came from flies, not from rotting meat. To prove this he put some meat into three different jars. The first jar was left open to the air. The second jar was covered with a layer of gauze which allowed air to pass through. The third jar was covered with a thick parchment that prevented anything from passing into or out of the jar. What do you think happened in each of the three jars?

In the first jar maggots appeared in a few days, just as people had seen before. In the second jar, eggs and later maggots were found on top of the gauze, but no maggots were found inside the jar. There were no eggs, maggots, or flies in or around the third jar. This experiment showed that the maggots came from eggs that were laid by flies which were attracted by the smell of the decomposing meat. When the jar was sealed the flies did not smell the meat and did not lay their eggs, so there were no maggots. This experiment did much to dispel the idea of spontaneous generation; however, many people still believed

that simple organisms such as bacteria might still be produced without parents.

In the 1800s Louis Pasteur worked to show that even simple organisms such as bacteria only come from other bacteria. Pasteur experimented with different samples of broth. He showed that bacteria freely reproduced in an open container of broth. He then boiled the broth to kill all of the bacteria. Some of this broth was exposed to the air and other broth was kept in a sealed container. The broth exposed to the air developed new bacteria but the sealed jar did not. Pasteur believed that bacteria were entering the jar on dust particles in the air. To show that this was true, he created a bottle with a zigzag neck that allowed air to enter but prevented dust and other particles from entering the jar. The broth in this jar did not develop any bacteria even after four years. In fact, even after 100 years, no bacteria were found in this jar, which is now on display in the Pasteur Institute in Paris. Pasteur's experiments laid to rest the idea of spontaneous generation.

These experiments proved that life only comes from other life. This is such an important idea that it is called the **law of biogenesis**. Every experiment has shown that in order to get something that is alive, you must start with one or more living things and that you always get what you started with. Bacteria produce bacteria, flies produce flies, and people produce people. This is exactly how God designed the world to work.

Despite the fact that biogenesis is what we always observe, many scientists today believe that at one time life came from nonlife. They refer to this occurrence as **abiogenesis** or **chemical evolution**. These scientists believe that many millions of years ago under just the right circumstances, chemicals accidentally combined to form proteins, which are


Louis Pasteur

the building blocks of living cells, and that these proteins combined to form simple living creatures. Scientists have even tried to reproduce this event in the laboratory; however, even with a very controlled environment, no one has ever built living cells from just chemicals. Even if they could produce life in a lab, all it would prove is that intelligence can produce life. It would not prove that life can evolve from chemicals on its own.

God's Word is true, and as you learn more about living things, you will be amazed at how beautifully God designed each living thing to reproduce to continue the cycle of life.

2

What Is a Kingdom?

It's alive, but what is it?

How are plants different from animals?

Words to know:

taxonomy
anatomy
zoology
kingdom
botany

Challenge words:

dichotomous key

Once we determine that something is alive, how do we tell what it is? Scientists have grappled with this question for centuries. Carl Linnaeus is credited with developing the method of classification, or **taxonomy**, that we use today. But that classification system has been modified over the centuries to reflect new understanding of the living world.

The study of living things can be divided into three broad categories. The study of animals is called **zoology** while the study of plants is called **botany**. We use the word **anatomy** to talk about the different parts of plants, animals, or humans. But as scientists have learned more about the world of living things that God created, they have discovered that not everything fits neatly into plants or animals.

One system divides all living things into five kingdoms. A **kingdom** is a group of living things that has broad common characteristics.

The first two kingdoms are *plants*, which include all green plants that perform photosynthesis, and *fungi*, which cannot make their own food. The final three kingdoms are *animals*, which are multi-celled creatures, *protists*, which are single- and multi-celled creatures, and *monerans*, which are bacteria. Some scientists divide the kingdom Monera into two groups (Eubacteria and Archaea) based on their differing characteristics. For simplicity, we are going to treat them as one kingdom.

Because most protists and monerans are microscopic, plants and animals are the living things that most people recognize. To separate living things into different kingdoms, we must look at what is the same and what is different, and then sort them based on their differences. By answering the following questions, we can begin to determine whether a living thing is a plant or an animal.

For both plants and animals:

- Is it alive? All plants and animals are alive.
- Does it have cells? All plants and animals have cells.
- Does it reproduce after its own kind? God created

all plants and animals with the ability to make more plants and animals just like themselves.

- Does it need oxygen? All plants and animals need oxygen. We will see that the way they obtain that oxygen can be very different from one living thing to another, but they all use it.
- Do they demonstrate God's design? All plants and animals are special and created just the way God wanted them to be. You will see this great master plan as you study the plants and animals in more detail.

For plants only:

- Do the cells have chlorophyll? Chlorophyll is what makes leaves green. Plants have it; animals don't.
- Does it make its own food? Plants use chlorophyll to change the sun's energy into food for the plant. Animals cannot do this and must eat either plants or other animals that eat plants.
- Does it need the sun to survive? Many animals live in places that receive little or no sunshine. But all green plants must have sunshine to make food.
- Do they need carbon dioxide? Plants use carbon dioxide in photosynthesis when they make food. Animals do not need carbon dioxide. It is a waste product that they must get rid of.

For animals only:

- Can it move about freely? Although plants and animals both move in some sense, animals move about freely in their environment. Plants are rooted to the ground and therefore cannot move from one place to another.

Plants are different from animals because plants can produce their own food using carbon dioxide, chlorophyll, and the sun. Also, plants are limited in their movement. Animals, on the other hand, move freely, but must eat plants or other animals for food. 1Jn4

Fun Fact

Did you know that plants were created before there was even a sun? According to Genesis chapter 1 plants were created on Day Three of creation, and the sun, moon, and stars were created on Day Four. The plants could not have survived very long if the sun had not been created the next day.

Animal or plant game

Purpose: To play a game as you identify the characteristics of plants and animals

Materials: "Clue Cards" handout, poster board, pen, scissors

Procedure:

1. Divide a piece of poster board into three sections as shown here. Label the left column *Animals*, the right column *Plants*, and the center section a few inches up from the bottom *Both*.

   Animals Plants

   Both

2. Cut out the clue cards, mix them up, and place them face down on the table.
3. Have a person draw the first card and place it in the correct column. If the card describes a characteristic of plants only put it in the *Plants* column, if it describes only animals put it in the *Animals* column. If it describes both plants and animals put it in the *Both* column.
4. Have the next person draw the next card and so on. If someone has difficulty choosing the correct column, review the questions in this lesson or let the others help.

What did we learn?

- What do plants and animals have in common?
- What makes plants unique?
- What makes animals unique?

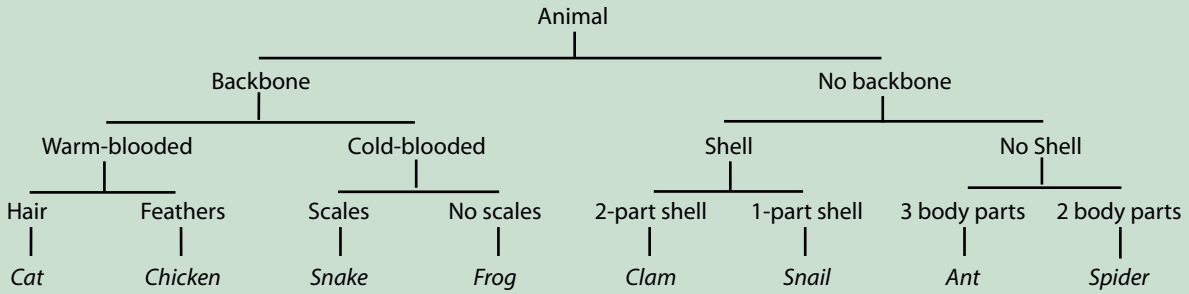
Taking it further

- Are mushrooms plants?
- Why do you think they are or are not?

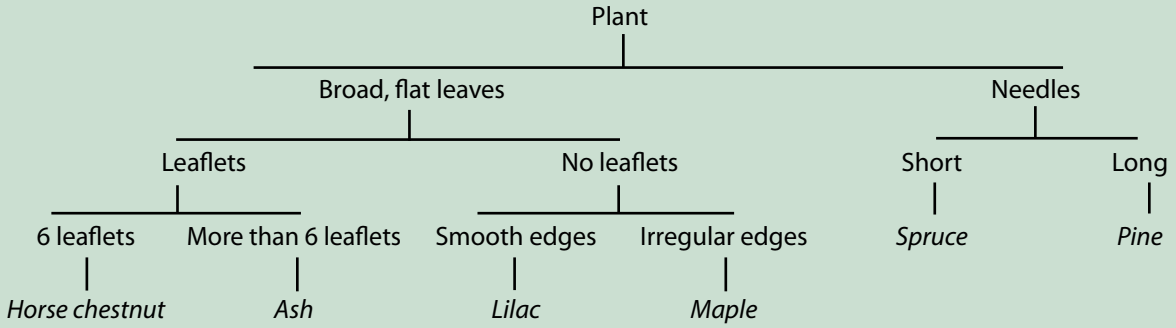
Dichotomous key

When scientists try to identify a living organism, they often use charts that have been developed by careful observation. These charts begin with two questions or options that describe a particular characteristic that helps divide the organisms into two groups. Based on the answer to the first question, the chart then presents two new questions/options to further help identify characteristics of the organism. Because there are always two possible answers, the chart is called a **dichotomous key**. To see how this works, use the dichotomous keys below to help you identify the animals and plants that are shown. Choose one of the plants or animals listed at the bottom of the chart. We will use the cat for our example. Go to the top of the chart and ask yourself the question, "Does this animal have a backbone or no backbone?" It has a backbone, so you follow that branch of the chart. The next question is, "Is this animal warm-blooded or cold-blooded?" The cat is warm-blooded so you move down that branch. Finally ask, "Does this animal have hair or feathers?" The cat has hair so you follow that branch and identify the animal as a cat. Follow the branch for each plant and animal on each chart. It is okay if you do not know the answers for every question for every example. This will still give you an idea of how these charts work. These charts are very simple compared to the detailed charts used by scientists.

Animal Identification Key



Plant/Leaf Identification Key



3

Classification System

Taxonomy—classification of living things

How are living things classified?

Words to know:

phylum	family
vascular tissue	genus
class	species
order	binomial classification

Determining if something is a plant or an animal is just the beginning of classification. One modern classification system uses a seven-level method for describing what something is. The top level is the kingdom. As we learned in the last lesson, there are five kingdoms recognized today: plants, animals, fungi, protists, and monerans. Once a specimen is determined to fit into one of these kingdoms, it is then placed into a **phylum** (FI-lum). A phylum (plural: phyla) separates the specimens in a kingdom by common characteristics. For example, animals are separated into a phylum based on whether they have a backbone or not—vertebrates and invertebrates. One of the characteristics used to divide plants into phyla is whether or not they have **vascular tissue**, a series of tubes to carry nutrients throughout the plant.

Each phylum is then divided into classes—again according to common characteristics. Each **class** is divided into orders. Each **order** is divided into families. A **family** is divided into genera (plural of genus). And each **genus** is divided into **species**. This may seem complicated, but a couple of examples should help you understand how this works.

The strawberry plant is classified below:

Kingdom	Plant	
Phylum	Tracheophyta	Has vascular tissue
Class	Angiosperm	Reproduces with flowers, fruits, and seeds
Order	Rosales	Flower grows from beneath ovary
Family	Rosaceae	Flowers grow up to four inches wide
Genus	*Fragaria*	Leaves grow in groups of three
Species	*vesca*	Strawberry

Now let's look at an example of an animal classification. Your pet dog is classified below:

Kingdom	Animal	
Phylum	Vertebrate	Has a backbone
Class	Mammal	Has hair, nurses young, warm-blooded
Order	Carnivore	Flesh-eating
Family	Canidae	Dog-like
Genus	*Canis*	Dog
Species	*familiaris*	Domestic

Fun Fact

Mountain lion, cougar, catamount, wildcat, and puma all refer to the same animal, depending on where you live. So it's a good thing that scientists use Latin names, like *Puma concolor*, to describe living things to avoid confusion.

Generally, a living thing is identified by its Latin genus and species names. For example, the family dog would be identified as a *canis familiaris*. This **binomial**, or two-name, **classification** system was adopted by Carl Linnaeus in the 18th century and is still used today to help scientists easily identify what they are talking about. Common names are not used for scientific purposes because the common name can be different from one area to another or even from one person to another. For example, one group of people might call a plant a chickpea plant and another group might call it a garbanzo bean plant. So using the Latin names helps avoid confusion.

Dividing plants and animals into this classification system can be subjective. And scientists do not always agree on where a creature or plant should be placed. Also, some modern scientists are attempting to change the classifications to reflect supposed evolutionary chains. There is no evidence for these evolutionary classifications, and good scientists use what can be observed and tested to make good conclusions.

Finally, when evolutionists talk about one animal evolving into another, they are referring to one kind of creature or plant changing into another. For example, they say that dogs, bears, seals, and raccoons all came from a common weasel-like ancestor millions of years ago. But what we actually observe is that dogs reproduce dogs, bears make bears, etc. Some wild dogs such as wolves and domestic dogs can interbreed. They came from a common dog kind that was on the Ark and survived the Flood. But a dog is still a dog, and a cat is still a cat.

What did we learn?

- What are the five kingdoms recognized today?
- How do scientists determine how to classify a living thing?
- What are the seven levels of the classification system?

Taking it further

- Why can pet dogs breed with wild wolves?
- How many of each animal kind did Noah take on the Ark?

Remembering the system

You can memorize one of the following sayings to help remember the classification system:

Keep	Penguins	Cool	Or	Find	Good	Shelter
Kings	Play	Chess	On	Fine	Green	Squares
(Kingdom	Phylum	Class	Order	Family	Genus	Species)

Look up the classification for some of your favorite plants or animals in a reference guide or on the Internet.

Plant classification

You will be able to understand plants better if you understand how scientists classify plants. First, plants are divided into two groups: plants with vascular tissue and plants without vascular tissue. Plants are further divided based primarily on how they reproduce.

Plants with vascular tissue have a series of tubes throughout the plant. These tubes function very much like the blood vessels in a human. They carry nutrients throughout the plants. Whether a plant has vascular tissue or not determines which phylum the plant belongs to.

Nonvascular plants are divided into three groups: mosses, liverworts, and hornworts. Together these are called bryophytes. These nonvascular plants have leaves and stems, but do not have true roots. They reproduce by spores, not with flowers. The bryophytes tend to grow in clumps in moist areas. You may find them growing on tree trunks or along streams, but don't confuse them with the algae growing in the water. Even though algae contain chlorophyll, they are not plants since they do not have leaves, stems, and roots.

Vascular plants are divided into two subphyla: plants that produce seeds and plants that do not produce seeds. Seedless plants reproduce using spores. These plants include horsetails, ferns, and club mosses.

Vascular plants with seeds are further divided into two classes: gymnosperms and angiosperms. Gymnosperms are plants that produce seeds that are not enclosed in fruit. These plants primarily reproduce with seeds that form in cones. Angiosperms are plants that produce seeds that are enclosed in fruit.


Thallose liverwort


Ginkgo tree

There are three main groups of gymnosperms. The largest group is the conifers. These plants have needle-like or scaly leaves and have the cones that we are familiar with such as pine cones or spruce cones. The second group of gymnosperms is the cycads (SI-kadz). These plants produce very large cones that grow out of the center of a large circle of palm tree style leaves. There are only a few species of cycads flourishing today, although many species are common in the fossil record. The sago palm is the most commonly cultivated cycad. The third group of gymnosperms is the ginkgoes. Ginkgoes have fleshy cones and unique fan-shaped leaves. Ginkgoes are native to China and are the only gymnosperms that shed their leaves. Ginkgoes are sometimes called living fossils because they were thought to be extinct, only found in the fossil record, until they were rediscovered in China.

Finally, angiosperms are divided into two main sub-classes based on the types of seed that the plant produces. Plants that produce two-part seeds are called dicots. Plants that produce seeds with only one part are called monocots. Angiosperms are the most common types of plants. You will learn much more about these plants in the following lessons.

Now that you have learned about how the plant kingdom is divided up, take the information above and draw a key or chart similar to the dichotomous keys you used in the previous lesson.

Carl Linnaeus

1707–1778
Father of Taxonomy

SPECIAL FEATURE

Carl Linnaeus (also known as Carolus Linnaeus) came into the world on May 23, 1707, in southern Sweden. His father Nils Linnaeus was a Lutheran pastor, as well as an avid gardener and amateur botanist, which tells you where Carl got his love of plants. His father and mother hoped he would follow in his father's footsteps and become a pastor. Carl did follow him—right out to the garden, every chance he got. By the time he was five, his father gave him his own garden to take care of. In school, Carl got the nickname of "Little Botanicus" because of his love of plants.

Carl was originally studying to become a priest, but on the advice of his teachers, Carl got permission to study medicine. At this time, every doctor had to prepare and prescribe drugs derived from plants. This move suited Carl, and in his autobiography he wrote that studying had become as much fun as it was unpleasant before.

Even though he enjoyed his studies, Carl did not go into medicine but instead spent his time giving lectures on botany. Later, he applied to the Royal Science Society in Uppsala, Sweden, and received a grant for a scientific journey to Lapland in northern Sweden. From a natural history point of view, Lapland was still unknown. In May of 1732, Carl went north and studied the plants in Lapland. Carl Linnaeus's journals were so complete that his trip to the north attracted attention from both inside and outside of Sweden.

By this time Linnaeus had started his work on grouping plants together, but not everyone agreed with him. A botanist named Johann Siegesbeck criticized his work. However, Carl

did not let this bother him. He continued his work and he even named a useless European weed *Siegesbeckia* in honor of his critic. It is not certain who got the last laugh as this weed was later found to have medicinal uses.

Through his work, Linnaeus was able to influence several students to travel as far as America in search of new plants. He also worked to find plants or crops that would grow in Sweden that could be exported in order to reduce Sweden's dependency on imports. He also tried to find native plants that could be used for tea, coffee, flour, and fodder (food for livestock), but was unsuccessful in this venture.

Carl's real claim to fame, though, is that he was the first to consistently use the two-Latin-name system (binomial) for classifying plants and animals. The first name defines the

genus, or grouping of similar organisms, and the second part defines the species. For example, a human is classified as *Homo sapiens*; *Homo* meaning primate and *sapiens* meaning humanity (though we know that humans are not related to primates, such as apes).

You may wonder if Carl Linnaeus was a Christian. If you read his writings, you will see that he was. He wrote in the preface to a late edition of *Systema Naturae*, "The earth's creation is the glory of God, as seen from the works of nature by man alone."

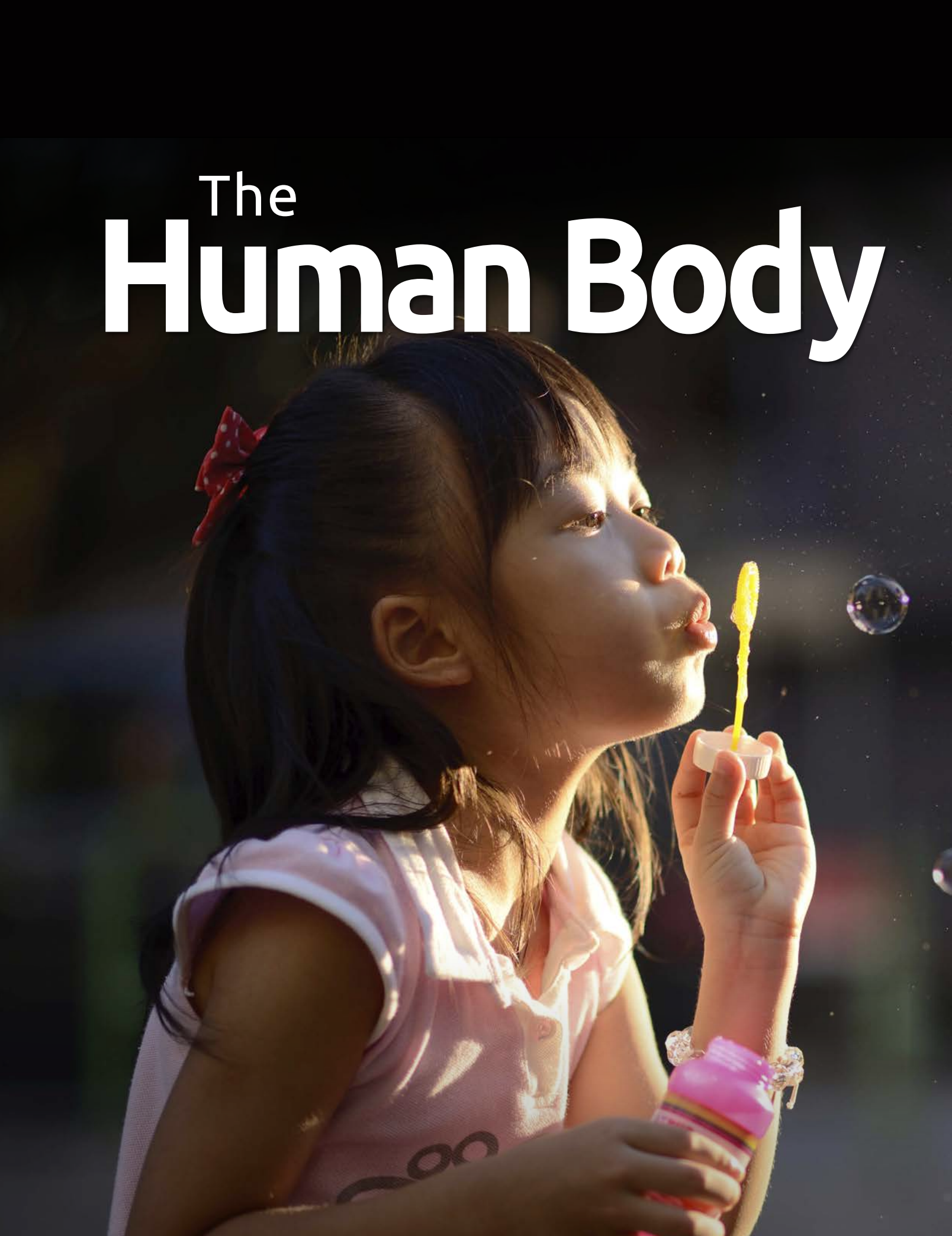
Linnaeus did not believe in evolution. In his early years, he believed that species were unchangeable as he wrote, "The invariability of species is the condition for order in nature." He was saying that the descendants of a deer or woodpecker would be the same as the original animal.

In later years, he abandoned the concept that species were fixed and invariable and suggested that species might alter through the process of acclimatization (or adaptation). In other words, species can change to fit their environment. We see evidence of these kinds of changes. For example, moths that blend in with their environment are not eaten so they survive to reproduce whereas those that did not blend in get eaten. After a few generations, the overall color of the population has changed to fit the environment. This is not a change from one kind of animal to another kind; it is merely a change in the dominant color of the overall population.

Linnaeus did not believe that the process of change was open-ended or unlimited. One kind does not change into another kind. The moths are still moths. They did not change into a frog or some other animal. Whatever changes have occurred within a kind have arisen from the original kind that God created.

Although the system we use today to group plants and animals is somewhat different from what Carl Linnaeus used, his early work laid the foundation for what we use today. Carl Linnaeus helped us develop a way to organize what we see around us and helped direct us to the Creator of that order.

The Human Body



UNIT 1

Body Overview

- **Describe** the function of the major organ systems in the human body.
- **Explain** how cells, tissues, organs, and systems are related.

1

The Creation of Life

God created them male and female.

How is man different from the rest of the creatures God created?

After God created the Earth, plants, sun, moon, stars, and animals, He created man. God spoke the entire universe into existence, but He made man out of the dust of the ground with His own hands and breathed life into his body. God created man to be His companion and friend. The special relationship that man has with God is unique in all of creation.

God also made a woman for man so he would not be alone on the Earth. God made woman from a rib taken from the side of man, and together He charged them with caring for the world He had created.

Fun Fact

There are over 7 billion people alive on the Earth and each one of them is unique and created in God's image.

God gave man and woman wonderful bodies. It has taken scientists thousands of years to even begin to understand the complexity of the human body. Even today, with all of the technology available to us, we have only a small understanding of how everything in the human body really works.

As you study the lessons in this book and learn more about how your body was designed and how it works, remember that God made you special. God wants you to have a relationship with Him.

What did we learn?

- On which day of creation did God make man?
- In whose image did God create man?
- According to Genesis 1:26, over what were man and woman to rule?

Taking it further

- Since we are created in God's image, how should we treat our bodies?

Self-portrait

Read Genesis 1–2. Discuss how God created humans and why He created them. Then read Psalm 139:13–18. Discuss how God knew each of us even before we were born. Remember that He loves us and has a plan for each of our lives.

Write the words "God Made Me Special" at the top of a sheet of drawing paper. Then using a mirror, try and draw a self portrait.

Body systems

There are eleven recognized systems in the human body. We will be studying eight of those systems in some detail in this book and will briefly look at the other three. On a piece of paper, list as many of the body's systems as you can. Then write a short description of what each system does. Which system do you know the most about? Which system do you know the least about? Which system is the most interesting to you?

2

Overview of the Human Body

We are fearfully and wonderfully made!

What systems did God give the body to help it accomplish all of the tasks it must perform?

Challenge words:

endocrine system
hormone
excretory system
kidneys
reproductive system
uterus

Perhaps the most amazing of all of God's creations is the human body. It is a complex set of systems all working together. The human body includes systems to move, breathe, eat, think, and feel. These are all wonders of creation. But most animals also have these systems working in their bodies. So what makes people different from animals?

The Bible says that we are created in God's image. We have souls that can relate to God. As we study the wonder of God's creation, remember that we are His handiwork. God designed humans to be very creative like Him. We have been given the ability to think and reason far beyond anything an animal can do. We resemble our Creator and we are separate from the animals.

Some of the remarkable systems that God created for the human body include:

- Skeletal and muscular systems for strength and movement
- Respiratory system for breathing
- Circulatory system for transporting nutrients
- Digestive system for eating
- Nervous system for thinking and feeling
- Skin for protection
- Immune system to fight against disease and other "intruders"

As you learn more about each of these systems, you will marvel at God's creative genius in putting our bodies together.

What did we learn?

- Name as many of the body's systems as you can and describe what each system does.

Taking it further

- Which body systems are used when you walk across a room?

Body wheel

Color each section of the "Body Wheel." Then cut out both circles and connect them with a paper fastener in the center. Turn the top wheel and read the description of each system of the body.

Other systems

Look at the list you made from lesson 1. Did you include all eight of the body systems mentioned in this lesson? If not, add any you missed to your list. You are probably somewhat familiar with these body systems, and we will study each system in more detail throughout the remaining lessons in this book. However, there are three other systems that are also important to your body that you might not be as familiar with. We will look at these three systems briefly here. If you want to learn more about these systems, you can study an anatomy book or look in a high school biology book

First is the endocrine system. The **endocrine system** produces chemical messengers called **hormones**. These chemicals are produced in special glands and are then secreted into the blood. Hormones control many functions in your body including growth, heart rate, the rate of digestion, waking, and sleeping. You don't have to think about these things. God designed your body to automatically regulate these functions by producing the necessary chemicals.

The second system is the **excretory system**. This system was designed to remove wastes from the body. Without this system, poisonous substances would build up in your body and eventually kill you. But God designed our bodies to efficiently remove and eliminate unneeded and harmful substances. The main organs of the excretory system are the **kidneys**, which remove waste substances from the blood, producing urine, which is then eliminated from the body.

Finally, every person has a **reproductive system**. One of the first commands God gave to Adam and Eve was to be fruitful and multiply. God loves children and designed the human body to be able to create new life. A man's body is designed so that he can become a father. A woman's body is designed to carry the developing child in her womb, called the **uterus**, until it is ready to be born and then to nourish the new baby with milk from her body. The creation of a new life is a miraculous process designed by God.

Did you include these systems on your list? These are systems that you might not have thought about. Add these systems to your list and include a brief description of each. Every system of your body is necessary and amazing. Enjoy your study of each system and thank God for His wonderful creation.

Leonardo da Vinci

1452–1519

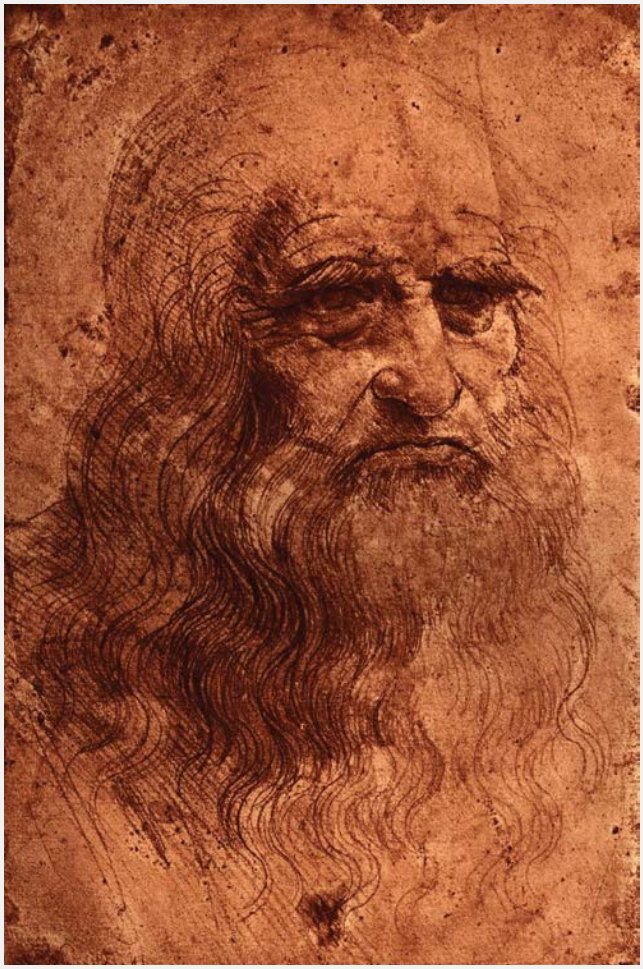
SPECIAL FEATURE

Artist, inventor, engineer, genius—which was Leonardo? He was all of these. He was born on April 15, 1452, to Ser Piero da Vinci, a young lawyer, and Caterina, a peasant girl. His name meant "Leonardo, from Vinci." It is believed he was a vegetarian throughout his life. In fact, there are stories that he loved animals so much that he would buy caged animals only to let them go. He studied at home, learning reading, writing, and arithmetic.

When Leonardo was young, his father asked him to paint a round shield. The story goes that Leonardo thought it would be neat to paint a really creepy scene on the shield. He examined all sorts of vermin such as lizards, maggots, and bats to use in the painting. When he showed the shield to his father, his father was so impressed with the realism of the animals, that he knew his son could only be an artist.

Leonardo was successful at nearly everything he did. He was reported to be strikingly handsome with great strength. He also had a fine singing voice. He quickly learned to play the lyre, and he would sing and beautifully improvise with it. But good looks, strength, and musical talent were just the beginning. He was most gifted in art and science.

In 1469, at the age of 17, Leonardo and his father moved to Florence, Italy where he worked under the master artist, Verrocchio. It soon became apparent that his skills surpassed that of his teacher's. In 1472 Leonardo joined the painter's guild of Florence where he had contact with many other great Florentine artists. At this time, Leonardo started working for himself. Not only was he doing paintings, he was also sketching water pumps, military weapons, and other machines. One of the more unusual characteristics about Leonardo was that he was not only left-handed, which is not too uncommon, but he wrote many of his papers and works from right to left and backwards. Many of his notes can only be read in a mirror.



In 1482 the Duke of Milan hired Leonardo as a painter and engineer. During his 17 years under the duke, he completed six paintings and worked as an adviser on architecture, fortifications, military matters, hydraulics, and mechanical engineering. In 1489 Leonardo did some of his earliest drawings of human anatomy, and even though most of his drawings were completely wrong, he produced extremely accurate cross-sectional representations of the skull. By 1495 Leonardo felt he had achieved his goal in understanding the human anatomy and he abandoned his work in this area for eight years.

During his time with the duke, Leonardo spent many hours studying geometry. This took time away from his painting. But he wrote a book on the elementary theory of mechanics. It was also during his time under the duke that he started exploring the possibility of constructing a telescope, looked into flying machines, designed advanced weapons, including tanks and other vehicles for war, and designed submarines. During this period, Leonardo achieved new heights of scientific thought.

When the Duke of Milan died, his son wanted Leonardo to make a bronze sculpture of his father on horseback. The sculpture was to be four times bigger than life size and weigh about 80 tons. But this task proved too challenging even for Leonardo. Leonardo studied for years, developing new casting methods, but when the French invaded, he had only been successful in building a 22-foot clay model. He left Florence in 1499 when the French soldiers used the model for target practice.

Leonardo spent the next few years traveling through southern Europe. From 1502 to 1503 he worked as a military engineer for Cesare Borgia. After this, he returned to Florence for three years. It was during this time he painted what is perhaps his most famous work, the "Mona Lisa." In 1504, Leonardo received word of his father's death. His father's estate went to his half brothers and sisters, so he left Florence for Milan only to return the following year to fight for his uncle's estate, which he eventually inherited.

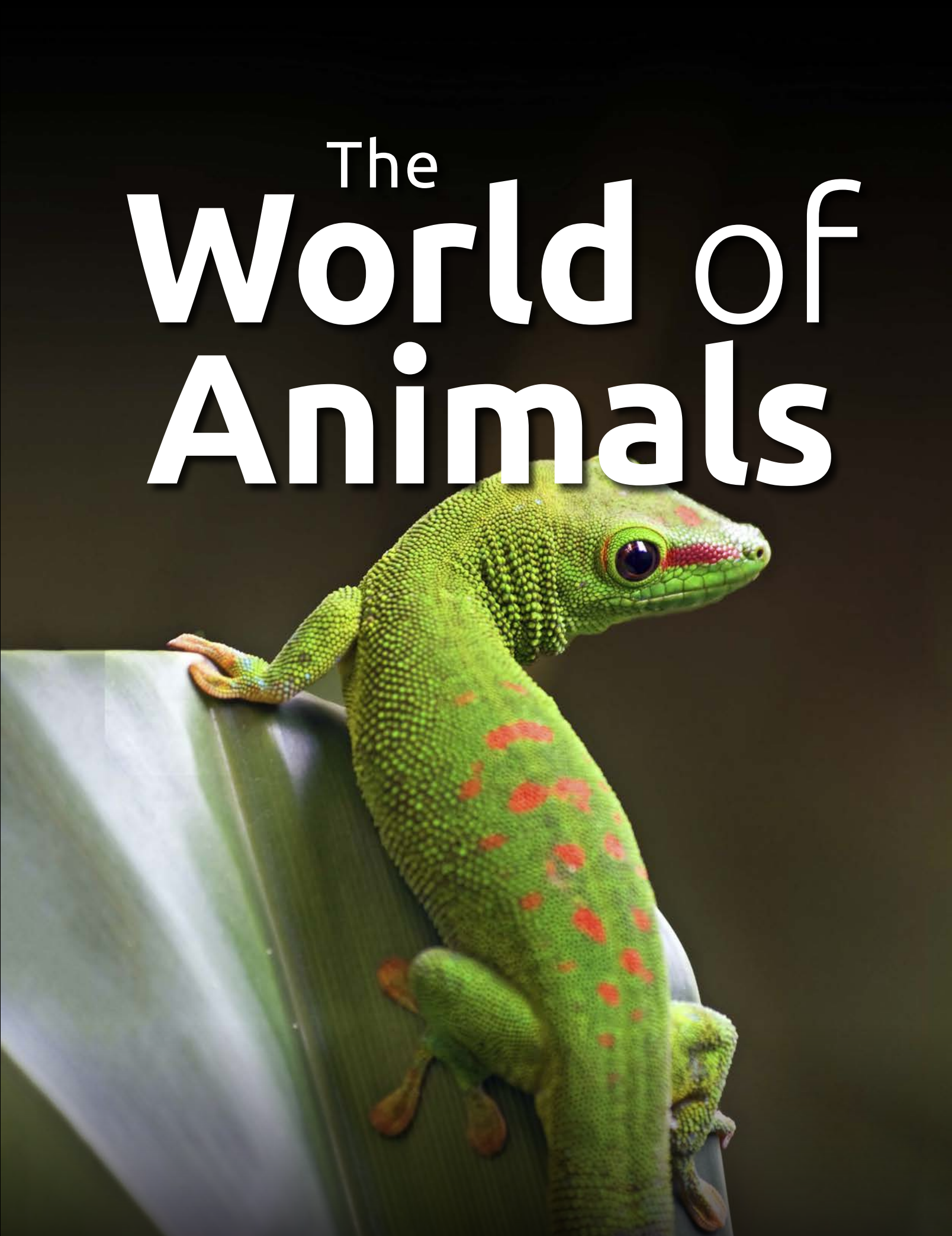
In the winter of 1507–1508 his interest in the human anatomy was revived when he witnessed an old man die. The man claimed to be one hundred years old. The old man told Leonardo before dying that he felt fine, only weaker. Leonardo wanted to know how this man could have such a peaceful death, so he studied this man's anatomy and found an absence of fat. This study allowed Leonardo to complete the most detailed records of a single subject. During his lifetime, Leonardo made hundreds of sketches of the human body.

In 1509 Leonardo returned to Milan and spent time on other scientific studies including a project to change the course of the Abba River. From 1510 to 1513 he concentrated on the study of human

anatomy and developed a new way to do science. The old way was to interpret everything with what you already knew; the new method was to first observe and then see if it fit with what you understood. During this time, Leonardo did some of his most famous anatomical drawings—one of them being the "Embryo in the Womb," which is still found in some medical textbooks today.

In 1513 Leonardo went to Rome under the protection of Giuliano de Medici, the brother of Pope Leo X. He had a workshop and undertook a variety of projects for the Pope. He was also able to continue his studies in human anatomy. However, the Pope would not allow him to dissect any cadavers.

Following the death of Giuliano de Medici, Francis I of France offered Leonardo the position of Premier Painter, Engineer, and Architect of the King. Leonardo accepted the position and went to work for the king of France where he lived in a house near the royal chateau at Amboise. He worked for King Francis until his death, and legend has it that when he died in 1519, King Francis was at his side, cradling Leonardo's head in his arms. Leonardo da Vinci was buried in the cloister of San Fiorentino in Amboise, France. The world will remember him as a painter, architect, engineer, and scientist with one of the brightest minds of the Middle Ages.


The
World of
Animals

UNIT 1

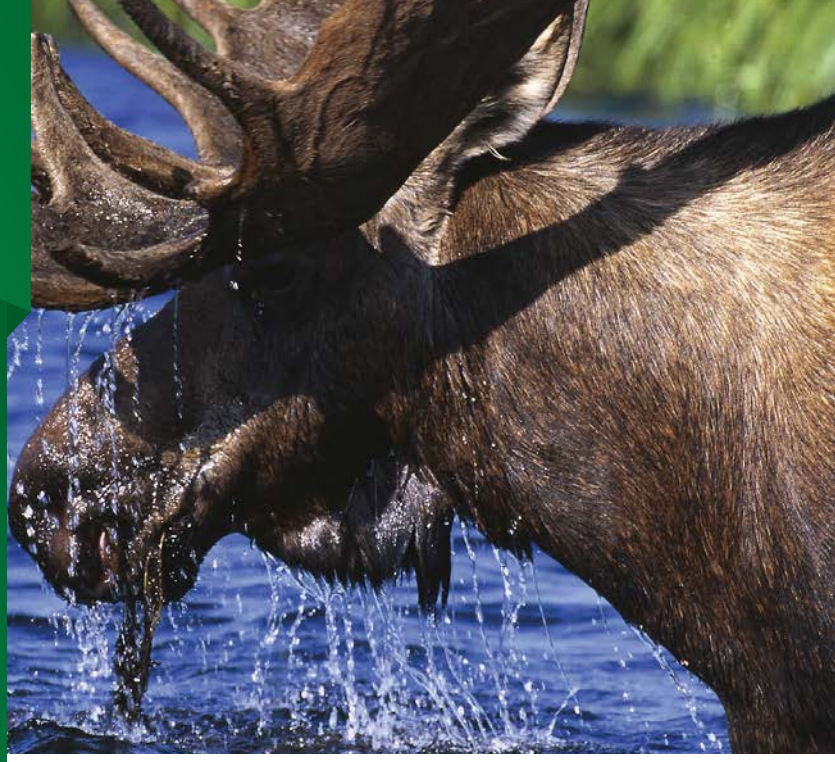
Mammals

- **Distinguish** between vertebrates and invertebrates.
- **Identify** the five characteristics of mammals.
- **Distinguish** between apes and monkeys.
- **Distinguish** between marsupials and other mammals.

1

The World of Animals

Is it a mouse or a moose?



What is the difference between vertebrates and invertebrates?

Words to know:

vertebrates invertebrates

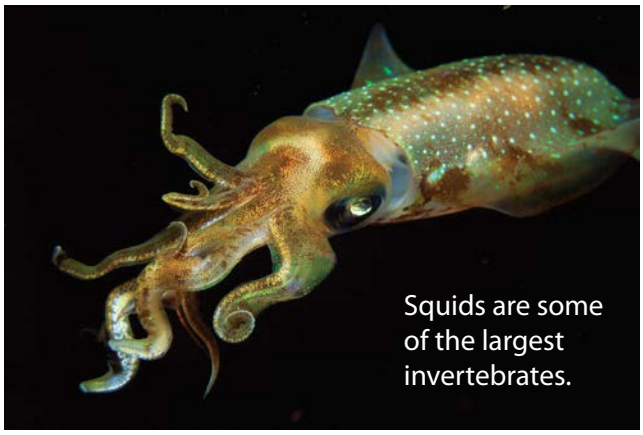
Animals and plants are the two largest and most familiar groups of living things. The most distinguishing difference between plants and animals is that plants can make their own food and animals cannot. Animals (and man) were originally created to eat plants to obtain energy (Genesis 1:28–30). Since the Fall of man in the Garden of Eden, many animals still eat plants but others eat animals to obtain energy. Because animals must obtain their own food, they are mobile. They can move about to find plants or other animals to eat.

Animals come in all shapes and sizes. Some are so tiny you can only see them with a microscope. Others are as huge as a car or even a house. God originally created various animal kinds, like the cat kind, horse kind, and elephant kind. Since the Flood of Noah's day, these animal kinds have spread around the world and have adapted to different environments, so that today there are many different species of animals within each kind. Scientists have classified over 1 million different species of animals, and there may be millions more that have not been classified.

In order to study so many different types of animals it is convenient to group them together by their similar characteristics. The first grouping that scientists make is to divide animals by whether they have backbones or not. Animals with backbones are called **vertebrates**. Animals without backbones are called **invertebrates**.

Although only 3% of all animals are vertebrates, they are the animals we are most familiar

The African elephant is the largest living land animal.



Squids are some of the largest invertebrates.

with. Vertebrates are the animals we see around us every day. Every vertebrate has a backbone. The backbone protects the spinal cord that passes through it. Vertebrates have the same major systems that humans have, including skin, skeletal, muscular, nervous, respiratory, and digestive systems. Although all of these systems occur in all vertebrates, they vary considerably among the different kinds of animals.

Vertebrates are divided into five different groups: mammals, birds, fish, amphibians, and reptiles. We will explore each of these groups in more detail.

Invertebrates are animals without spinal cords. They are very diverse and account for nearly 97% of all animals. Invertebrates do not have internal skeletons. Invertebrates include sponges, jellyfish, worms, insects, and many more creatures. We will also study each group of invertebrates in more detail.

What did we learn?

- What are the two major divisions of animals?
- What are two similarities among all animals?

Taking it further

- When did God create the different animal kinds?
- How is man different from animals?

Animal charades

This can be a fun family game. Pretend to be an animal and have everyone else guess what animal you are. Whoever guesses the animal correctly gets to be the next animal. Choose animals other than mammals, with which you are most familiar.

Unusual animals

There are many animals that you are familiar with. But with over a million different species, there are bound to be many that you are unfamiliar with as well. Below is a list of unusual animals. See what you can find out about each of these animals from an animal encyclopedia or other source, and prepare a short report to share with your class or family.

Three of them are shown below. Can you identify them?

- Pangolin
- Common snipe
- Echidna
- Queen Alexandra's Birdwing
- Grouper
- Liver fluke
- Common whelk

2

Vertebrates

Does it have a backbone?

What makes a vertebrate a vertebrate?

Words to know:

vertebrae

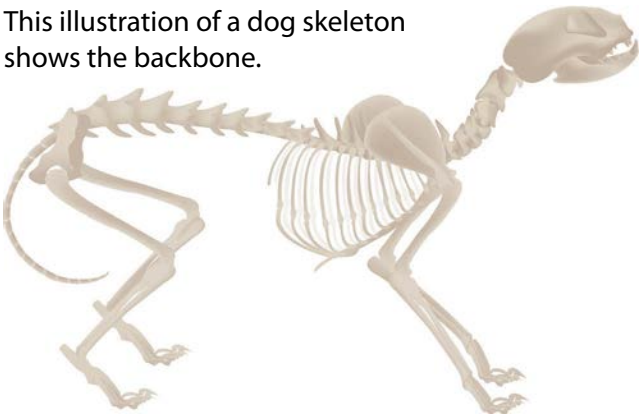
The animals we are most familiar with are vertebrates. A vertebrate is an animal that has a backbone. The backbone protects the spinal cord that runs inside of it. Vertebrates can be classified into five categories: mammals, birds, fish, amphibians, and reptiles. These are the animals we notice most around us because, in general, they are the largest animals. Although each of these groups of animals has unique characteristics, they have some common characteristics as well.

All vertebrates have spinal cords and brains. These are the major parts of each vertebrate's nervous system. The spinal cord is protected by a backbone, which is really a series of smaller bones called **vertebrae**, hence the name vertebrates. Messages travel from the animal's brain down the spinal cord to the various parts of the body to tell the animal how to move and what to do. Messages also travel from the various parts of the body along the spinal cord to the animal's brain. Vertebrates have some of the most complex nervous systems of all the animals.

Another common trait that is unique to vertebrates is an internal skeleton. This skeleton is what allows vertebrates to be much larger than most other animals. God gave vertebrates the internal structure needed to support the weight of a large body. Not all vertebrates are large, but nearly all large animals are vertebrates. A few exceptions are the octopus and giant squid. These creatures can be large without an internal skeleton because the water in which they live helps to support their weight. For the most part, vertebrates also have more complex muscular, digestive, and respiratory systems than invertebrates.

Dogs are mammals; they are warm-blooded and nurse their young.

This illustration of a dog skeleton shows the backbone.



We will discuss each group of vertebrates in more detail in the following lessons, but here is a quick overview of the major types of vertebrates. Mammals are vertebrates with hair or fur. They are warm-blooded, and they nurse their young. Birds are warm-blooded animals with feathers. The other vertebrates are all cold-blooded animals. Amphibians are unique because they begin life in the water and as they mature their bodies change and they begin to breathe air through lungs. Reptiles are animals that have scales and breathe air. And fish are aquatic animals that have gills that extract oxygen from the water in which they live. Vertebrates are easy to find and fun to study. Enjoy learning more about God's wonderful creatures.

What did we learn?

- What are the two major divisions of the animal kingdom?
- What characteristics define an animal as a vertebrate?
- What are the five groups of vertebrates?

Taking it further

- Think about pictures you have seen of dinosaur skeletons. Do you think dinosaurs were vertebrates or invertebrates? Why do you think that?

Animal notebook

As you study the world of animals you will be making a notebook that will include your projects. Today, start your notebook by making dividers for each part of the animals we will study. Use the dividers with tabs that are designed for three ring binders. Make labels for each tab in the notebook. Tabs should be labeled as follows:

Mammals, Birds, Fish, Amphibians, Reptiles, Arthropods, Mollusks, Cnidarians, Echinoderms, Sponges, Worms, Protists, and Monerans (you may combine Protists and Monerans if you wish).

These are the various parts of the world of animals that you will be studying. Name as many animals in each category above as possible. Some, like mammals, will be very easy, but you may have no idea what animals belong in some of the other categories. As you go through the lessons in the book you can include anything in your notebook that you wish. Some ideas include the projects from this book, photos of projects or activities that you do, photos from field trips, photos cut from magazines, or coloring books and drawings. Use your imagination.

Notebook title page

Use your artistic, computer, and literary skills to create a title page for each section of your animal notebook. If you don't know what kinds of animals belong in some of the sections, look them up in an encyclopedia or on the Internet