

# MAMMALS

3-8 Science Unit Study





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# UNIT INFORMATION

## Science Journal



All The Good and the Beautiful science units include activities in a student journal. Each student should have his or her own student journal, and the parent or teacher will direct the student regarding when to complete the activities in the lessons. The journal can be purchased by going to [goodandbeautiful.com/science](http://goodandbeautiful.com/science) and clicking on the *Mammals* unit link.

## Science Wall



All science units include vocabulary words to be placed on your science wall, which is a wall or trifold presentation board in your learning area on which you can attach the vocabulary words and other images. **Cut out the vocabulary word cards at the beginning of the unit.** The course will indicate when to place them on the wall.

## Lesson Preparation



All science units include easy-to-follow lesson preparation directions at the beginning of each lesson.

## Activities



Many of The Good and the Beautiful science lessons involve hands-on activities. The *Mammals* unit features activities that involve potentially messy and/or harmful materials.

**An adult should always closely supervise children as they participate in the activities to ensure they are following all necessary safety procedures. This unit does not contain any experiments.**

## Unit Videos



Some lessons include videos that were created by The Good and the

Beautiful. Have a device available that is capable of playing the videos from [goodandbeautiful.com/sciencevideos](http://goodandbeautiful.com/sciencevideos) or on the Good and Beautiful Homeschool app.

## Content for Older Children



Some lessons include extra content that is more applicable for older children (grades 7–8). Parents or teachers may choose to skip this content if instructing only younger children.

## Content for Younger Children



Some lessons include extra content that is more applicable for younger children (grades 3–6). Parents or teachers may choose to skip this content if instructing only older children.

## Worldview

The unit takes a general Christian worldview that supports Creationism. The unit does not attempt to define how long it took God to make items in the universe, thus allowing for use by both those who believe in a young earth theory and those who believe in an old earth theory. If parents want to get into more detail on dates and time periods of the universe, they can include the doctrines specific to their own beliefs.

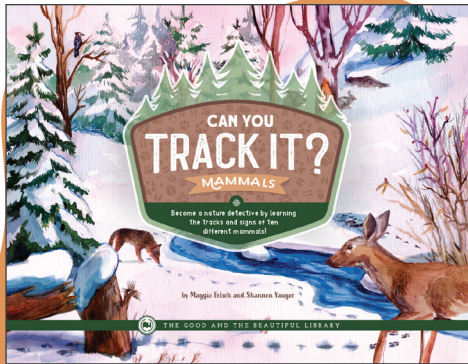
## Versions

New discoveries are being made on an ongoing basis. This course is reviewed and revised periodically to keep information as up to date as possible. This version is the second edition of this unit.

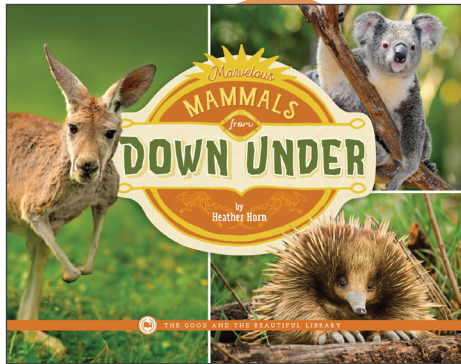


# READ-ALoud BOOK PACK

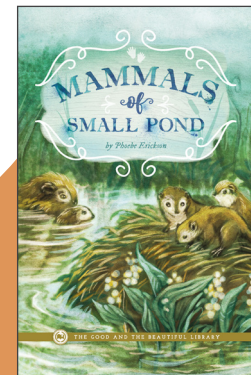
The three books below are optional read-aloud books that complement this unit. These books can be purchased as a book pack by going to [goodandbeautiful.com/science](http://goodandbeautiful.com/science) and clicking on the *Mammals* unit product page.



**Can You Track It? Mammals**  
By Maggie Taylor Enger and Shannen Yauger



**Marvelous Mammals from Down Under**  
By Heather Horn



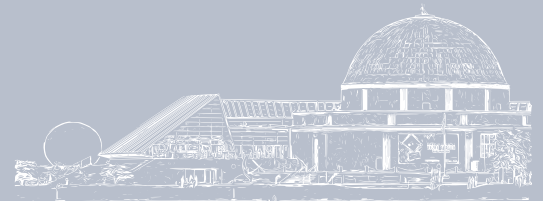
**Mammals of Small Pond**  
By Phoebe Erickson

## CORRELATED BOOKS

The Good and the Beautiful Bookshop has several books that correlate well with the *Mammals* unit. It can be a wonderful experience for children to read books on their levels related to the subjects they are learning in science. The bookshop includes both fiction and nonfiction books that are organized according to reading level. Find these correlated books by going to [goodandbeautiful.com/science](http://goodandbeautiful.com/science) and clicking on the *Mammals* science unit product page.

## FIELD TRIP IDEAS

If possible, consider taking a field trip to a natural history museum while completing this unit. Also, consider taking a field trip to a local farm or zoo.



# LESSON EXTENSIONS

## How the Extensions Work

Each lesson has an optional lesson extension for children in grades 7-8. Complete the lesson with all the children, and then have the older children complete the self-directed lesson extension. These extensions are located in the *Grades 7-8 Student Journal*.

## Answer Key

The answer key for the lesson extensions can be found on the free Good and Beautiful Homeschool app in the science section. Visit [goodandbeautiful.com/apps](http://goodandbeautiful.com/apps) for information on accessing the app. The app can be accessed from a computer, phone, or tablet.

## Flexibility

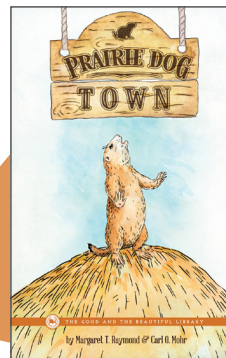
The amount of time it will take to complete each lesson extension will vary for each child. The average time is about 10-15 minutes per extension. Parents, teachers, and children may choose to omit parts of the lesson extension if desired. Encourage the children to stretch their capabilities, but also reduce work if needed.

## Taking Notes

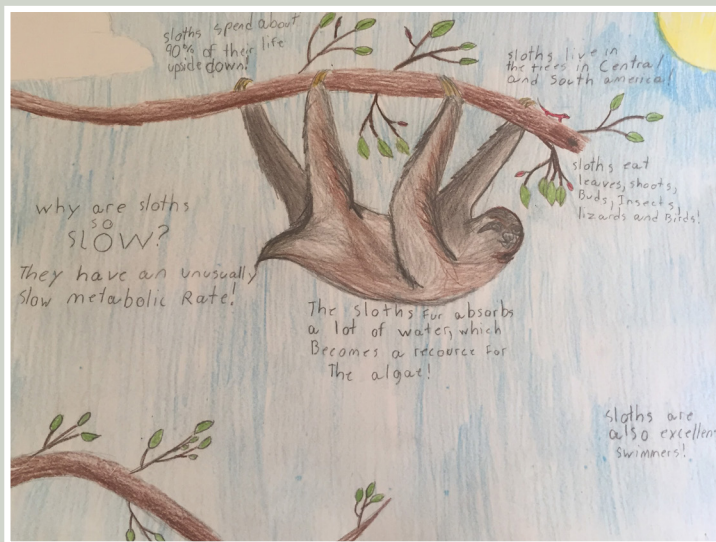
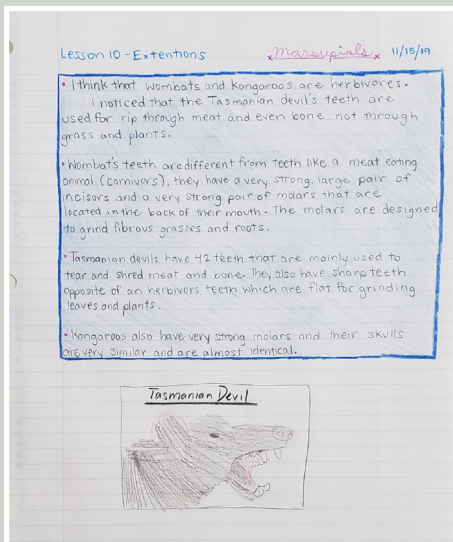
Some of the grades 7-8 lesson extensions have the children summarize the material read. Teach the children to look for key information, summarizing the most important points. Students can also add notes with their thoughts and the facts that are most interesting to them.

## Optional Grades 7-8 Reading Book

We recommend *Prairie Dog Town* by Margaret T. Raymond and Carl O. Mohr as extra reading for students in grades 7-8. This book can be purchased by going to [goodandbeautiful.com/science](http://goodandbeautiful.com/science) and clicking on the *Mammals* unit link.



**Prairie Dog Town**  
By Margaret T. Raymond  
and Carl O. Mohr



# SUPPLIES NEEDED

You will need the following supplies for activities. There are no experiments in this unit.

## Lesson 1

- A piece of fruit or vegetable (or an image of a fruit or a vegetable)
- A piece of meat (or an image of a piece of meat)

## Lesson 2

Optional Activity—Milking a Cow:

- A rubber glove (a thicker glove is preferred)
- Milk (or water mixed with white paint)
- A string or rubber band
- A pin or needle
- A bowl or container to catch the milk (or water)
- A black permanent marker (optional)

Optional Activity—Bursting Milk:

- $\frac{3}{4}$  cup whole milk (lower-fat milk will not work)
- Food coloring (any colors)
- Dish soap
- Cotton swabs
- A shallow dish or pan
- Heavy cream (optional)

## Lesson 3

- A measuring tape
- Something to mark a distance (e.g., sidewalk chalk, a ribbon, etc.)
- A stopwatch

## Lesson 4

- Two small boxes

## Lesson 5

- A glue stick
- A stuffed animal (if doing the actions with the activity “Social Behaviors of Elephants”)

## Lesson 6

*Note: For items with an asterisk (\*), you may choose to provide one per child, or the children may take turns using the items. You only need one of each of the other items.*

- A hand mirror
- A large pair of socks\*
- A pencil\*
- A piece of scrap paper\*
- A soft object to be thrown\*
- A water bottle\*
- Tape

## Lesson 7

- None

## Lesson 8

- A glue stick
- A pair of scissors for each child (or to share)

## Lesson 9

- Colored pencils (optional)
- Tape (optional)
- Scissors for each child
- A glue stick

# SUPPLIES NEEDED

## CONTINUED

### Lesson 10

- A glue stick
- A sample of wool or woollike material (such as a wool sock)
- A sample of water-repellent material (such as a raincoat)

### Lesson 11

- 3–4 random objects that make noise, such as two spoons banging together, a stapler, a book closing, etc. (Keep these items hidden from the children.)
- A small game token for each child
- A six-sided dice
- A pair of scissors for each child
- A glue stick

### Lesson 12

- A marker or a set of five items, such as buttons, beans, etc., to mark off the “Five Senses” cutout

### Lesson 13

- Sunglasses
- Something black
- Some kind of plant

### Lesson 14

- A glue stick
- A pair of scissors for each child
- Colored pencils





# VOCABULARY

**Instructions:** Cut out the vocabulary cards in this section. Place them on your science wall when prompted to do so in the lessons. Review the vocabulary words several times during this unit and, if desired, at various times throughout the school year.

## Mammal

an animal that is an endothermic vertebrate and is distinguished by the ability to produce milk for its young and has fur or hair, a neocortex, three bones in the middle ear, and a single-boned jaw

## Herbivore

an animal that eats plants

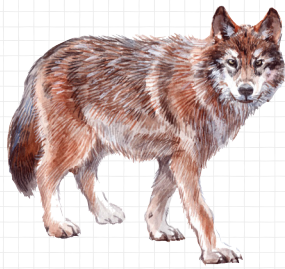


## Carnivore

an animal that eats meat







## Dominant

a lead animal of a pack, held in highest social regard

## Submissive

a pack animal that obeys and follows the dominant animal

## Monotreme



an order of egg-laying mammals found only in New Guinea and Australia that have one exiting tract for reproduction and the elimination of waste

## Marsupial



an order of mammals that give birth to partially developed babies that continue to develop and nurse in the mothers' pouches



# INTRODUCTION TO MAMMALS

## Objective

Help the children review classification, learn mammalian characteristics, and explore food chains.



### Preparation:

- Cut out the “Food Chain Cards and Arrows.”

### Activity Supplies:

- A piece of fruit or vegetable (or an image of a fruit or a vegetable)
- A piece of meat (or an image of a piece of meat)

## Art Observation



**Read to the children:** The Bible teaches about the sixth day of creation: “And God made the beast of the earth after his kind, and cattle after their kind, and every thing

that creepeth upon the earth after his kind: and God saw that it was good” (Genesis 1:25).

Have the children turn to the “Mammals in Art” page in Lesson 1 of their student journals while you read the following: God’s creations are good. Look at these pictures of mammals and try to see the wonder in each creation as I talk about each one.



Imagine that you are high in the mountains when you see a couple of bighorn sheep. Surprised, you suck in a breath of cool fresh air. The sheep leap onto a cliff. You think they will fall at any minute, but they don’t! They make a breathtaking climb with amazing, agile leaps.

Now imagine that you are in a cool, calm forest, gently lit by the setting sun. A bold and stalwart

deer stops near you. He looks powerful and brave, like a guardian of the forest, his majestic antlers reaching toward the sky.

You are now in a beautiful green field with large trees. Horses are grazing—black, brown, and milky white. You watch the white horse, admiring its impressive shape, strong muscles, and stately presence. You wonder if it would give you a ride through the fields with exhilarating speed.

There are many different types of mammals, each with special characteristics. We are going to have a wonderful time exploring the world of mammals in this unit. First, let’s learn what makes a mammal different from other animals.

## Mammals



Watch the video “Mammals” at [goodandbeautiful.com/sciencevideos](http://goodandbeautiful.com/sciencevideos) or on the Good and Beautiful Homeschool app, and then discuss the questions below.

1. What are some characteristics that all mammals have? [mammary glands, hair or fur, neocortex, three bones in the middle ear, single-boned jaw]



**Food Chains**



**Read to the children:** All living things have a home where they can access the things they need to survive, including shelter and food.

These places are called *habitats*. There are several habitats within an ecosystem. An ecosystem includes all the living creatures in a given area that interact with each other and with their environment. In science we call a living creature an organism. If the population (or number) of one organism gets too big or too small, the balance of the entire ecosystem will change. As part of that balancing act, mammals participate in a system known as the food chain.



The food chain is a series of organisms that are related to each other by the food they eat. While a chain is straight, the relationship between living things on the planet is interconnected, more closely resembling a web.

Carnivores depend on an adequate supply of prey animals for them to eat. The prey animals, often herbivores or omnivores, depend on having enough plants to be able to breed and thrive. When the number of plants declines, there are fewer prey animals for the carnivores to eat. When there are plenty of plants, the population of herbivores and omnivores grows, and the carnivores are there to help keep those populations to a sustainable size.

**Lay out the “Food Chain Cards and Arrows” in this order from left to right (or top to bottom): plant → beetle → mouse → snake → fox. With the children review the order in which one organism eats the next.**

*Note: The arrows always point from what is being eaten to what does the eating. You can read it like this: “The plant gets eaten by the beetle, which gets eaten by the mouse, which gets eaten by the snake, which gets eaten by the fox.”*

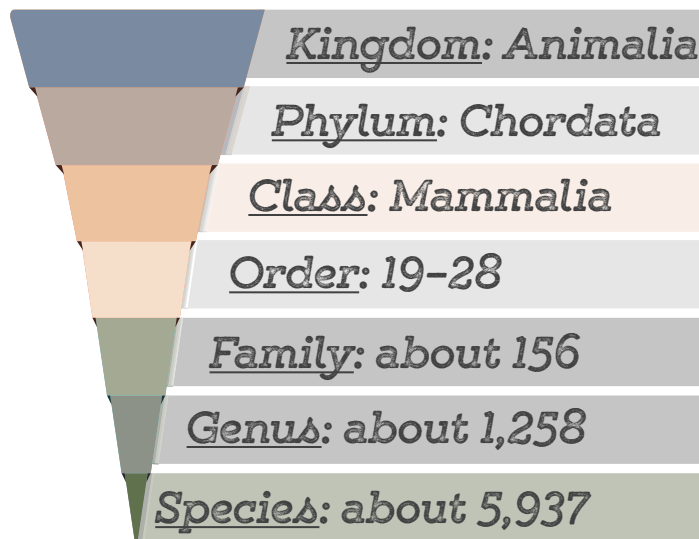
**Mix up the “Food Chain Cards and Arrows” and have the children order them in the way they are eaten in the food chain.** [plant → beetle → mouse → snake → fox]

*Note: Habitats, populations, and more are covered in The Good and the Beautiful Ecosystems science unit.*

**Mammal Classification**

**Read to the children:** In *The Good and the Beautiful Kingdoms and Classification* science unit, we learn about Carl Linnaeus and his methods for organizing life forms. We still use his system as a basis, though there have been quite a few changes since his time. The organization of life goes from very broad to very specific. Think of classification like a funnel. We want to figure out which exact animal or species we are looking for, so we have to figure out which groups they best belong to in order to best classify a specific species.

**Have the children look at the chart below:**



**Point to Kingdom.** Mammals are part of the kingdom Animalia. **Point to Phylum.** Their phylum is called Chordata, meaning they have some type of backbone. **Point to Class.** Their class is Mammalia. **Point to Order.** Scientists do not always agree on how things are classified. Depending on the classification system, there are 19–28 orders of mammals. Here are some of the Latin names of orders for mammals: Carnivora (meat eaters), Chiroptera (bats), and Insectivora (insect eaters).



**Point to Family.** At the time of printing of this unit, there were about 156 families, approximately 1,258 genera (plural form of genus), and around 5,937 recognized living species of mammals. Notice that there are not very many groups of orders but a ton of specific species. This is because classification can give us an exact name for every kind of mammal humans have discovered.

In this unit we will be covering a small handful of interesting and noteworthy mammals out of the thousands of mammals known today.

## **Mammals of the World Map**



Have the children turn to the “Mammals of the World Map” page in the back of their student journals. Read



**to the children:** During this unit we will place stickers on this map to show where certain mammals are commonly found.



## **Musk Ox—Arctic Region**

**Read to the children:** This image is of a musk ox. Since musk oxen are so huge, it might surprise you to learn that musk oxen are herbivores. They live mainly in the frozen Arctic and use their hooves to dig through the snow to reach grass and other plants. In the summer they love to eat flowers. Musk ox babies are amazing! Within a few hours after birth, they are able to keep up with the rest of the herd.

**Have each child place a Musk Ox sticker anywhere in the Arctic Region on his or her map.** *Note: The animal stickers are found on the back cover of the student journal.*

## **Lesson 1 Extension**



Have children grades 7–8 complete the self-directed Lesson 1 extension titled “The Mammalian Ear” in their student journals.

Show the children the image at the bottom of the page.



the name of a mammal, and if you know the name for its babies, jump up. Whoever jumps up first gets to guess the name for the babies first.

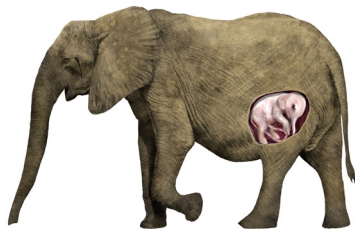
Read a mammal name below and allow the children to jump up if they know the baby name. Let the first child to jump up answer. If he or she is incorrect, allow the next child to guess. Tell the child the answer if he or she needs help.

Mammal	Baby Name	Mammal	Baby Name
Sheep	Lamb	Ape	Baby
Monkey	Infant	Bear	Cub
Ferret	Kit	Deer	Fawn
Giraffe	Calf	Beaver	Kit
Elephant	Calf	Rhinoceros	Calf
Goat	Kid	Mouse	Pinky
Donkey	Foal	Camel	Calf
Zebra	Foal	Koala	Joey
Hippo	Calf	Porcupine	Porcupette

### Gestation and Live Birth

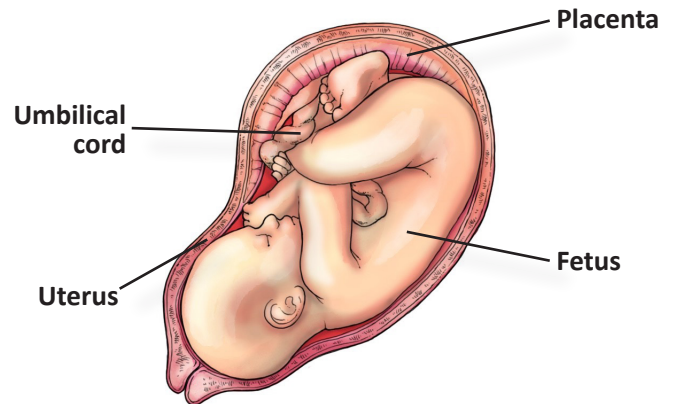
**Read to the children:** When you were born, you did not crack out of an egg—you experienced live birth. Humans and other mammals have babies that grow and develop inside the uteri of their mothers until they are ready to be born. This period of time is called *pregnancy*, or the **gestation** period. Do you see in the diagram in the next column that the uterus holds the baby? As a mammal begins developing inside the uterus, the mammal is called an **embryo**, and after nine weeks the embryo is called a *fetus*. Throughout the pregnancy, it can also be called a baby.

The average gestation period for humans is 38–40 weeks, or nine months. A human mother may think that’s a long time to be pregnant, but imagine being pregnant for almost two years like an elephant mother is!



Because the baby is inside the mother, it relies on her for food, oxygen, and the ability to get rid of waste.

The mother’s body grows a blood-filled organ made of soft tissue called a **placenta**. Point to the placenta on the diagram below.



The baby is attached to the placenta by the umbilical cord, which allows the baby to receive oxygen and nutrients from the mother’s blood and removes the baby’s waste. Where is the umbilical cord on the diagram?

Larger mammals, including humans, cows, polar bears, elk, moose, and hippos, usually have only one baby at a time. Smaller mammals, such as mice, rats, chipmunks, and rabbits, usually face more life-threatening dangers than larger mammals, so their babies are less likely to survive to adulthood. Because of this, they typically are pregnant for a much shorter time and have several babies at a time that form a group called a *litter*. This gives the small animals the ability to have several pregnancies per year and a better chance of at least some of the young surviving to carry on the species. This is an example of God’s loving care for His creations.

Most mammalian babies are born when the muscles of the mother’s uterus begin to contract, or squeeze. This pushes the baby through the birth canal and outside the mother’s body. The placenta is also delivered through the birth canal shortly after the birth of the baby.

After the baby is born, it no longer needs to be attached to the mother through the umbilical cord. Can you guess where your umbilical cord was once attached to you? [belly button]



# AMAZING MILK ACTIVITIES

If desired, choose one or both of these optional activities.



## MILKING A COW

### Items Needed

- A rubber glove (a thicker glove is preferred)
- Milk (or water mixed with white paint)
- A string or rubber band
- A pin or needle
- A bowl or container to catch the milk (or water)
- A black permanent marker (optional)

### Instructions

1. If desired, use the permanent marker to draw black cow spots on your rubber glove.
2. Use the pin or needle to prick a small hole at the tip of the glove's middle finger. It may help to blow air into the glove and then pinch shut the top of the finger you are pricking.
3. Holding your glove over a bowl or container, add the milk (or water mixed with white paint) to the glove until it is filled about halfway up the palm. Tie the top of your glove or tightly wrap a rubber band around the opening to seal it.
4. Using your thumb and first finger, grab the glove's middle finger at the base where it meets the palm part. Pinch your thumb and index finger together to create a seal. Use your other fingers in a wave motion to press the liquid toward the glove's fingertip. It might take some time to figure out the best way to get a squirt, and you may need to slightly enlarge the hole in the fingertip. While you are milking, have a partner guide the glove so the milk (or water) squirts into the bowl. Once you get the hang of it, you can poke a hole in another finger on the glove and try some two-handed milking.

## BURSTING MILK

### Items Needed

- $\frac{3}{4}$  cup whole milk (lower-fat milk will not work)
- Food coloring (any colors)
- Dish soap
- Cotton swabs
- A shallow dish or pan
- Heavy cream (optional)

### Instructions

1. Pour the whole (full-fat) milk into a shallow dish or pan.
2. Place several drops of food coloring in a variety of locations on the surface of the milk.
3. Put a dab of dish soap on the end of a cotton swab. Dip the soap-covered swab into the center of a spot of color and hold it there. Watch the milk burst with the color! Keep moving the soapy cotton swab to different parts of the dish and watch what happens. Add more soap to the swab as needed.
4. Optional: Put a drop of soap directly into a fresh spot of food coloring and watch what happens! When the milk stops moving, dump it in the sink and try again! See what kinds of patterns and designs you can make. Try this same experiment with heavy cream—it has more fat content!

### What is happening?

Milk contains both water and fat. Dish soap breaks up the microscopic chains that hold fats together. When the soap meets the fat in the milk, the fats move around trying to connect to each other. The food coloring allows you to see this movement in action.

# Mother's Milk

Cut along the dotted lines. Read the description once the strip is found.



God gave female mammals the duty and blessing of growing babies. He also gave female mammals the ability to produce milk so they can feed their helpless babies. In fact, it is this distinct characteristic that gives mammals their name! Carl Linnaeus called this class Mammalia after the Latin word *mamma*, which means “breast,” or “teat.” A teat is a nipple on a female’s breast or udder from which young mammals suck milk produced by mammary glands.



All mammals, both male and female, have unique glands in their bodies called mammary glands. These glands are located in different places on different mammals. When females near adulthood, their mammary glands develop and mature to the point where a hormonal spike (caused by pregnancy and birth) can signal their bodies to produce milk. You can see massive blood vessels in this cow’s udder. These blood vessels supply nutrients to the mammary glands to make milk. Amazingly, the blood vessels on cows’ udders are bigger around than an average human thumb!



Mammary glands are where milk is made. Hormones (which are chemicals that send messages from one part of the body to another) stimulate the mammary glands to produce milk for a baby. These glands pull fats, proteins, sugars, minerals, vitamins, antibodies, and other substances out of the mother’s bloodstream and mix these elements with water to make milk. The milk is released when it is sucked or expressed from the mother’s body, most commonly through a nipple or teat.



A mother’s milk is the perfect mixture of everything necessary for her baby’s health, growth, and survival. The “ingredients” in the milk of various mammals can be very different between species. Cow milk has just the right balance of nutrients to grow baby cows. Rhinoceros mothers produce a lot of milk with high fat content that helps their calves grow into huge adult rhinoceroses. While a mammal can often drink milk produced by a different type of mammal, each species truly makes milk that is ideal for its own babies.



There are a few non-mammals that feed their babies milklike substances, but because they do not have mammary glands, they are not considered mammals. There are four species of birds—pigeons, doves, flamingos, and male emperor penguins—that produce what we call “crop milk” to feed their young. Crop milk looks like pale-yellow cottage cheese. Both male and female pigeons start to produce this nutrient-rich substance in their crops (small sacs located below their neck areas) about two days before their eggs hatch. They regurgitate crop milk (that is, they bring it up out of their crops and into their mouths) and feed it to their young.

made of a thick coating of a protein called *keratin*. Metal horseshoes are often placed on the hooves of domesticated horses to protect the hooves from cracking or wearing down too much on hard surfaces.



The horseshoes are nailed into the hooves, but as long as it is done right, it does not hurt the horse.

Rhinoceroses and tapirs have hooves leading to and covering the edge of their toes, but the bottom part of the foot is soft.

In their booklets have the children write or circle the following: “partial” for the tapir, “full” for the horse, and “partial” for the rhinoceros.

All perissodactyls are herbivores. Most of them have a long face and a space between the front teeth and back teeth. The space between teeth is used to strip leaves off branches, and flat molars are used for grinding. Rhinoceroses are the exception—they do not have front teeth.



In their booklets have the children read the section titled “Features of Perissodactyls.”

**Science Wall: Vocabulary Words**



Place the vocabulary cards PERISSODACTYLA and EQUINE on your science wall. Read and discuss the words and their definitions.



**Perissodactyla**

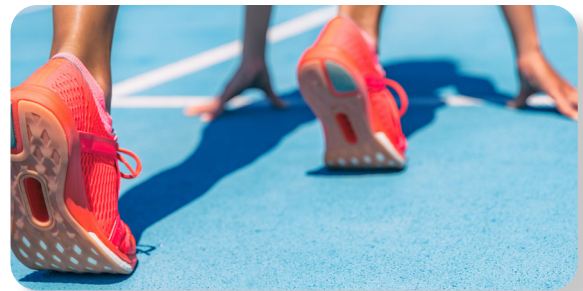


**Equine**

**Ungulate Running**

**Read to the children:** Now that we’ve learned about the different types of ungulate feet, can you guess why God created them with hoofed feet? The answer really depends on the animal because hoofed feet have been specially designed for the needs of each animal. In general, hooves protect the surrounding tissue and bone, especially while walking or running. What happens when you run or walk without your shoes? You may notice that your feet get sore or blistered. The design of ungulate feet also helps them run fast and jump high. Have you noticed that when you sprint, you tend to run on the front part (the ball) of your foot?

Show the children the following image.



People who sprint (or run as fast as they can for short distances) run on the balls of their feet. This gives them more power to push forward. Ungulates don’t have full feet like humans do. Rather, their legs and feet look similar to ours if we’re on our tiptoes. This allows ungulates to quickly gain a burst of speed when running. Let’s see how the running capabilities of human feet match up to those of some ungulates.

**Race an Ungulate Activity**



Go outside and have the children line up in an area that is safe to do a quick sprint. Use the measuring tape to mark off a set distance (for example, 50–100 feet, depending on what is best for the children). Using a stopwatch, time how long it takes the children to sprint the set distance.



Calculate their speed to feet per second (ft/s), and then convert it to miles per hour (mph). Do this by following this example: If it took a child 5 seconds to run 50 feet, you would first find his or her feet per second by calculating  $50 \text{ feet} \div 5 \text{ seconds} = 10 \text{ ft/s}$ .





### Rhinoceroses

Rhinoceroses are native to Asia and Africa, but they are highly endangered, meaning there are only a few remaining rhinoceroses due to poaching (illegal hunting). Being naturally suspicious, rhinoceroses charge when they feel threatened. Their senses of hearing and smell are quite keen; however, their eyesight is somewhat weak. They have been known to charge things like boulders and trees because they felt threatened. Rhinoceroses are the second-largest land animal after elephants and weigh as much as one and a half average-sized cars! Their speed is quite impressive considering how large they are.

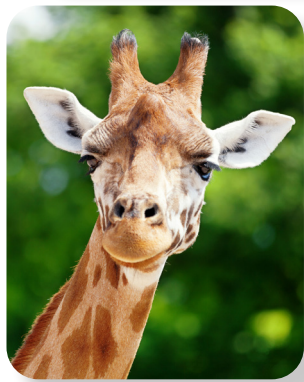


### Tapirs

Tapirs are herbivores that look like a cross between an elephant and a pig. Tapirs have a distinctive muscular nose that lets them eat food that would otherwise be out of reach. Baby tapirs (called calves) have striped or spotted fur, but their coats change to a banded pattern as they grow into adults. They live in the forests of South and Central America as well as Southeast Asia. They love to swim in water or wallow in mud.



horns have a small branch. The outside covering of their horns is made of keratin, and they regrow their horns every year. Look at the horns of this pronghorn. **Point to the image below.**



Now look at the picture of this giraffe. **Point to the image to the left.** It does not have horns or antlers. The protrusions you see on the giraffe’s head are called *ossicones*. They are very similar to horns except that they are made of cartilage instead of bone. Giraffes are born with their ossicones,

but the ossicones lie flat and are not yet attached to the skull. This is so they don’t cause any harm during birth. Later, the ossicones connect to the skull. They remain covered by skin and hair. Male giraffes use their ossicones more, so the skin will often wear off at the top as they get older. Let’s watch a video to learn more about giraffes.

**Giraffes**



Watch the video “Giraffes” at [goodandbeautiful.com/sciencevideos](http://goodandbeautiful.com/sciencevideos) or on the Good and Beautiful Homeschool app.

**Ruminant Animals**



**Read to the children:** Many ungulates are ruminant animals—including the giraffe and cow. Let’s explore the digestive system of a cow to learn what this means. Cows are grazers that have four-compartment stomachs that are built for their constant eating. The largest



compartment can hold up to 189 liters (50 gallons) and is called the *rumen*—hence the name **ruminant digestive system**.

**Have the children turn to the “My Ungulates Booklet” in Lesson 3 of their student journals. On the ruminant digestive system diagram, have the children draw arrows on their diagrams to show how food moves through a cow’s stomach as you read the information below. They could use two different colors for the sets of arrows. An answer key for this activity is included at the end of this lesson.**

As a ruminant animal starts the digestion process, the esophagus takes chewed food from the cow’s mouth to the rumen. The rumen is the largest compartment. This chamber acts as storage and is very good at pulling out nutrients from food. Within the rumen, the food becomes *digesta*. The digesta ferments there for a long time. Microorganisms (like bacteria) live in the rumen and break digesta down into smaller pieces. The rumen muscles swish the digesta around like a washing machine and sometimes push big particles back up the esophagus so that the animal can chew it again, breaking it into smaller particles. The regurgitated food that gets chewed over and over is called **cud**.

**Have the children change the color of their arrows now.** After the food is ready to be fully digested, it moves from the esophagus to the reticulum. The reticulum is a honeycomb-textured pouch. From there the food moves to the omasum, a round pouch with tissue layers like pages of a book. There, the tissue layers absorb water. The final compartment of the stomach is the abomasum, which is known as the “true stomach” and is similar to that of humans and other mammals with only a single-chambered stomach. From there the food travels to the intestine.

**Ruminant Animal Advantages**

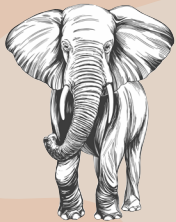
**Read to the children:** The advantage of having a ruminant digestive system is that these animals can efficiently digest high-fiber grasses and be nourished by them. In God’s wisdom He created many grass-eating animals with a system that could digest the grass with which He filled the earth. Ruminant animals are the most efficient digesters on the planet!



# ELEPHANTS

## Objective

Help the children learn about the three species of elephants, their features, and the worldwide efforts being made to protect elephants from danger.



### Preparation:

- Cut out the eight boxes on the bottom of the page “Elephant Species.”
- Cut out the “Elephant Puzzle” pieces in each child’s student journal.
- Cut out the “Elephant Parts” cards.

### Activity Supplies:

- A glue stick
- A stuffed animal (if doing the actions with the activity “Social Behaviors of Elephants”)

## ■ Elephant Species



**Show the children the page titled “Elephants” and read aloud to the children:**

Majestic. Ancient. Strong. Loving. Powerful. Gentle. These words give us a sense of the character of one of God’s most beautiful creations—the elephant. Sadly, elephants are the only living family in their classification order. All other families, and even certain species within the elephant family, such as woolly mammoths, are extinct! That means there are no more alive on Earth. Let’s take a look at the surviving animal species.

**Display the “Elephant Species” images and read to the children:** It’s no surprise that elephants are really big; in fact, the African bush elephant (also called the African savanna elephant) is the biggest land animal. When it is born, it can weigh a whopping 91 kilograms (200 pounds)! Scientists have classified elephants into three different species: the African bush (or savanna) elephant, the African forest elephant, and the Asian elephant. What are some differences you see among these three types of elephants?

**Place the cut-out boxes from the bottom of the “Elephant Species” page on the table. Read to the children:** As I read the different characteristics of the three species of elephants, place the cut-out boxes under the corresponding elephant type. For example, if there was a cut-out box that said “largest elephant,” we would place that under African bush elephant. *Note: As an aid to the parent or teacher, the characteristics in the cut-out boxes are underlined in the text below.*

The African bush elephant is the largest of the three living species of elephants. An average adult male elephant, called a *bull*, can weigh up to 6,350 kilograms (14,000 pounds) and can be 2–4 meters (8–13 feet) tall. As you may have noticed, their ears are also the largest, covering their neck and shoulders, and appear to be shaped like Africa. Both males and females can have tusks, and their tusks are curved. These



# Elephants



Females tend to be driven to protect the young, which is done best in these tight herds, while males are driven to find other females, so they can be seen roaming to and fro.

**Instruct the children to return to their seats.** Elephants have been found to remember other elephants for as long as 50 years after parting. They bond so closely that it is believed that they mourn the loss of a herd member. Elephants are one of the most intelligent creatures on the planet after humans and are comparable to chimpanzees in intelligence.

### **Mammals of the World Map**



Have the children turn to the “Mammals of the World Map” page in the back of their student journals. Have each child place stickers for the following animals on his or her world map on the noted locations.



**African Bush Elephant**—sub-Saharan Africa

**African Forest Elephant**—equatorial Africa

**Asian Elephant**—India or Southeast Asia

**Read to the children:** One final important thing to know is that many good people and organizations around the world are working hard to protect elephants from danger. Currently both African elephant species are classified as vulnerable, the number of elephants is less than it should be, and the Asian elephant is classified as endangered, with its numbers dangerously low.

Habitat loss due to deforestation or the development of land for agriculture is a threat that elephants face because they typically need a lot of land to roam around on.

Another issue they face comes from their beautiful tusks. Ivory is a valuable material made from the tusks of elephants, and the buying and selling of ivory is currently banned. Sadly, illegal hunting hasn't completely stopped; but as we educate ourselves on these issues, we can take a determined stand for what's right and do our part to help protect one of God's most impressive creations.

### **Lesson 5 Extension**



Have children grades 7–8 complete the self-directed Lesson 5 extension titled “The Sloth—Another Marvelous Mammal” in their student journals.



**Ask the children:** What are some differences you notice between these primates and humans?

**Point out any of the following differences if they are not mentioned by the children:** Other primates have more fur (or hair) all over their bodies, they comfortably walk on all four limbs, they naturally use their feet to grasp objects, and some primates have tails.

Because of our similarities, scientists classify humans as primates. However, from the Bible we know that humans were not created the same as other primates. (See Genesis 1:26–27, if desired.) Still, we can delight in the beauty of God’s creations as we see similar characteristics in ourselves and other mammals.

**Science Wall: Vocabulary Word**



Place the vocabulary card PRIMATE on your science wall. Read and discuss the word and its definition.



**More Primate Characteristics**



**Read to the children:** We are going to do a few activities to discover certain characteristics found in primates.

**Hands:** Place the following items on the table: the pair of socks, a pencil, a piece of scrap paper, a soft object to be thrown, and a water bottle. Have the children put the socks on their hands. Ask the children to perform each of these tasks.

1. Lift up the pencil and write your name or draw a picture on the scrap paper.
2. With a partner, toss the soft object to each other a couple of times.
3. Open the lid of the water bottle.

What part of your body did you miss being able to use? Today may be the first day you’ve realized how important your thumb is! All primates have opposable thumbs, which have proven to be very useful when picking up, grasping, climbing, and catching.

**Nails:** Look at the “Mammalian Claws” image to the right. Now look at your hands. What do you notice is different? All primates have flat nails rather than long sharp claws. Flat nails are needed to help us pick up objects and grasp things. Having nails allows primates to perform fine motor tasks, like painting, writing, or picking up things.



Mammalian Claws



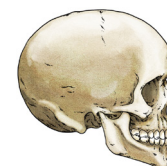
**Get a piece of tape for each child and stick it to the table.** Try to take this piece of tape off the table without using your fingernails—so only use your fingertips. **Once the children have tried a few times, allow them to remove the tape with the use of their fingernails.** What are some other ways your nails are useful to you? This activity helps us realize how grateful we should be for the features God has given us.

**Brain:** Another common characteristic between humans and other primates that we’ll be discussing is the brain. Primates have larger brains relative to the size of their bodies than those of other mammals. Look at this cross section of a giraffe skull. The empty space that the arrow is pointing to is where the brain would be. As you look, consider that an average adult giraffe is about 5 meters (16 feet) tall and weighs 816 kilograms (1,800 pounds). Its brain weight is only around 0.7 kilograms (1.5 pounds)! This means that the brain of a giraffe is 0.08% of its body weight. **Show the children the image to the right.**



Human

Chimpanzee



Compare this to a chimpanzee skull. A chimpanzee weighs about 45 kilograms



(100 pounds)—*much* smaller than a giraffe. Its brain weighs just under 0.5 kilograms (1 pound), so a chimpanzee’s brain is 0.9% of its body weight. Now let’s compare both of these to the human brain. The average human brain is 1.8% of our body weight. Our large brain size and God’s thoughtful creation of the human brain make humans the most intelligent of all mammals.

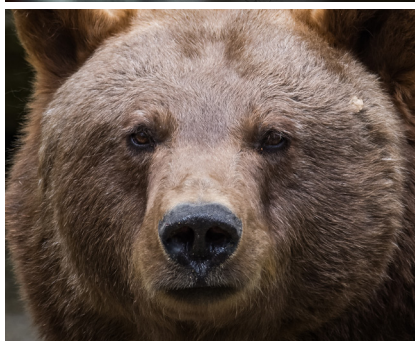
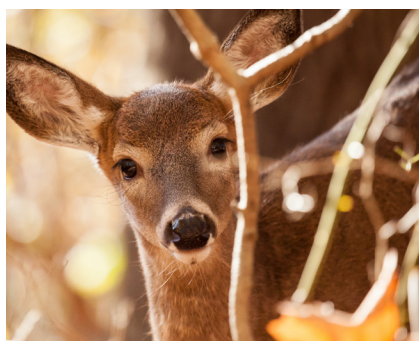
**Eyes:** On the page “Primate Characteristics,” point out to the children that primates’ eyes are on the fronts of their faces. Have the children look at themselves in the mirror again. Where on our faces are our eyes located?

Yes, our eyes are also on the front of our faces. **Show the children the image “Other Mammalian Eyes” at the bottom of this page.** Point to each mammal and tell me if the eyes are located on the front of the face, like a primate, or on the sides of the face.

Notice how the carnivorous mammals (lion, fox, and the bear, which is an omnivore) have eyes in front of their faces, while mammals that are primarily herbivores, such as the chipmunk, cow, and deer, have eyes on the sides of their heads. These animals need to watch for danger, and their eyes on the sides of their heads give them a wider field of vision to protect themselves.

Let’s see how wide our field of vision goes. Extend your arm out directly in front of you. Keep your arm straight, and keep your eyes fixed forward. Do you see your thumb right now? [yes] Keep your eyes and head fixed straight ahead and slowly move your arm out to the side, stopping as soon as you can no longer see your thumb. **Once the children have all stopped their thumbs at the point where they can no longer see them, continue to read to the children:** Now look to see how far your arm went to the side of you. We, like other primates, have a limited amount of *peripheral vision*; we can only see our thumbs (and the surroundings off to the side) for a little while. If your eyes were placed on the sides of your head, you could see a lot more to your sides, and your field of vision would extend to almost behind you!

Forward-facing eyes also allow for better *depth perception*, meaning carnivores can focus on their target prey and perceive how far away the prey is, how quickly the prey is moving, and how far they will need to leap to capture their prey. Along with catching prey, there are other reasons for having vision that is focused in the front. For example, humans and other primates do specialized tasks with their hands and feet, so they need their vision focused in front of them.



Other Mammalian Eyes



# Monkey Mystery

Cut along the dotted lines. Unscramble the letters on the strips to find the answer to the riddle.



Mandrill

A

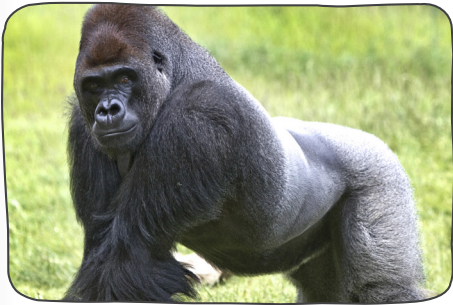
The largest monkey is the Mandrill. Males weigh about 25 kilograms (55 pounds); females weigh around 11 kilograms (25 pounds). Mandrills are colorful with blue and red on the face, which is rare in nature. This coloring is more vibrant on males than females. Mandrills used to be considered baboons, but scientists have reclassified them into their own genus. They are Old World monkeys.



Pygmy Marmoset

L

The pygmy marmoset is the smallest monkey and is a New World monkey. These monkeys weigh only about 0.11 kilograms (4 ounces)—the weight of a small apple!



Gorilla

P

Gorillas, like all other apes, do not have tails. They have strong arms for moving through the trees but mostly stay on the ground. Gorillas can walk on two legs, but most often they walk as a quadruped (on four legs) with the knuckles of their hands turned under. They can weigh up to 218 kilograms (480 pounds), and their arms can extend 2.6 meters (8.5 feet) wide!



Vervet

I

Vervets come from sub-Saharan Africa and are omnivorous Old World monkeys. Due to their small size, they make perfect prey for many other animals, so they travel and live in groups called *troops*. They are very vocal and communicate with one another so the members of the troop know where predators are coming from. Vervets walk using their arms and legs and are comfortable both on the ground and in trees.



Slow Loris

R

When a slow loris moves, it looks like it's slithering like a snake. This is because slow lorises have more spinal vertebrae than other primates. Slow lorises have incredibly strong grips. They can hang onto branches for a very long time with either their hands or feet. They may have cute faces, but one bite could make someone seriously sick or even die! The slow loris is a New World monkey with a decreasing population and is classified as vulnerable.



# FELINES

## Objective

Help the children learn about the feline family of mammals: their behaviors, characteristics, and habitats.



### Preparation:

- Cut out the “Parts of a Cat” fact cards.
- Cut out each of the five felines and the five feline habitats on the “Habitat Mystery Game” pages.

### Activity Supplies:

- None

## ■ Felines and Domestication

**Read to the children:** *Feline* is what we call members of the Felidae [FEE-la-day] (or cat) family. In the United States, cats are the second most popular pet. These pets are the only tamed species of the Felidae family and are kept by humans for their endearing and silly personalities and for their ability to hunt mice and other rodents that are pests. These “house cats” are also called domestic cats. Recall that to be a domestic animal means that the animal is able to live with and be influenced by humans. Domestic cats are related to the other wild cat species found around the world, so they share many similar features.

## ■ Science Wall: Vocabulary Word



Place the vocabulary card **FELINE** on your science wall. Read and discuss the word and its definition.



**Feline**

## ■ How Do Cats Move?

**Read to the children:** Why do you think cats creep around so quietly and slowly sometimes? Why do you think that at other times they run or jump very fast?

### Show the children the page “How Do Cats Move?”

**Read to the children:** Look at these cat pictures and think of the cats you know. What are some ways they move their bodies?

Because cats are carnivores, they prey on live animals. This means they need to be very careful about the way they move so they don't scare their dinner away. Most cats are able to leap at least six to ten times their height, so they walk very quietly until they are close enough to their prey, and then they pounce on their food and kill it. House cats mimic this behavior when playing with toys, and while it can be cute and funny, the cat takes it seriously.



**Parts of a Cat**



Place the “Parts of a Cat” cards facedown in front of the children. Have them take turns choosing a card and reading what is remarkable about each part of a cat’s body.

**Ferocious Felines**



Have the children turn to the “Ferocious Felines” page in Lesson 7 of their student journals and complete the pages. An answer key for this activity is included at the end of this lesson.

**Habitat Mystery Game**



Place on the table the pictures of the habitats and the five felines you cut out during the preparation section. Read the clues for each habitat (below) and have the children place each feline image on its corresponding habitat. If desired, have the children read the clues. Answers are included at the bottom of this page.

**Mammals of the World Map**



Have the children turn to the “Mammals of the World Map” page in the back of their student journals. Have each child place the stickers for the following animals on his or her world map on the noted locations. Optional: Have the children review the animals already placed on their maps.



**Cheetah—Africa**

**Jaguar—South America**

**Lesson 7 Extension**



Have children grades 7–8 complete the self-directed Lesson 7 extension titled “Meerkat vs. Mongoose” and “Hyenas” in their student journals.

**HABITAT MYSTERY GAME**

*Which Cat Lives Here?*

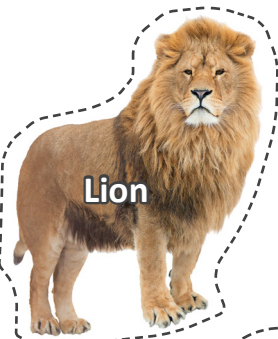


1. This beautiful rock cave in sub-Saharan Africa belongs to a pride of about 30 cats. As the males rest in the cave, the females are on the hunt for food to feed their families.
2. In the dry African savanna, we find the home of Earth’s fastest mammal. Sprinting at a speedy 113 kilometers per hour (70 miles per hour), he captures his wildebeest prey and settles down for a nice meal.
3. In the swampy woodlands of South America, this spotted cat prowls in his search for food. It’s not long before he detects an unsuspecting crocodile and brings it home for a feast.
4. Atop the canopy of a shady tree, this large cat overlooks the African grasslands as he finishes off the baboon that he brought home for lunch. While others of his kind are surely nearby, he prefers to eat and live alone.
5. In the depths of this lush Asian rainforest lurks a 300-kilogram (660-pound) male cat. The pattern of his coat makes it easy for him to hide in the tall grass. As he waits for his next meal to cross his path, he cools off in the small pond nearby.

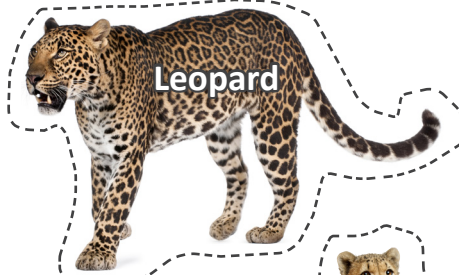
*Answers: 1. Lion 2. Cheetah 3. Jaguar 4. Leopard 5. Tiger*



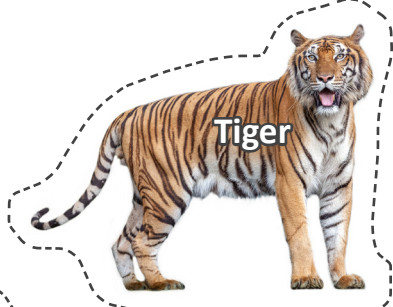
Habitat Mystery Game



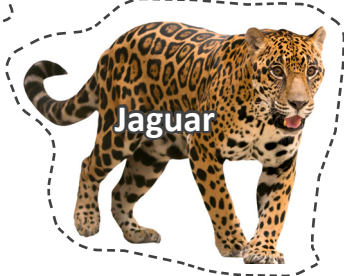
Lion



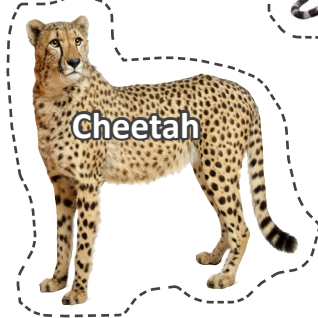
Leopard



Tiger



Jaguar



Cheetah

# Animal Tracks



# Animal Tracks



6

# MONOTREMES

## Objective

Help the children learn about monotremes, a mammalian oddity.



### Preparation:

- Cut out the boxes on the “Echidna” page.

### Activity Supplies:

- Colored pencils (optional)
- Tape (optional)
- Scissors for each child
- A glue stick

## ■ Optional Read Aloud



At any point in the lesson, you may read one of the books from the optional Read-Aloud Book Pack. *Marvelous Mammals from Down Under* by Heather Horn is suggested with this lesson.

## ■ Introduction to Monotremes

**Read to the children:** Several lessons ago, we learned that there is a name given to a group of mammals that develop within their mothers’ wombs for a period of time. Do you remember what they’re called? [placental] *Monotremes* are an order of mammals that also



develop within their mothers’ wombs, but they are in eggs! When the eggs are laid, the babies continue to develop, and even when they hatch out of their eggs, they are still not fully developed.

## ■ Science Wall: Vocabulary Word



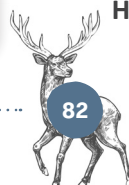
Place the vocabulary card **MONOTREME** on your science wall. Read and discuss the word and its definition.



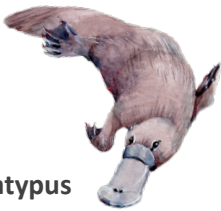
## ■ Monotreme Characteristics

**Read to the children:** There are only five species of monotremes left on Earth, and they are only found in Australia and New Guinea! There is the platypus species, which is in a family by itself, and four species in the echidna [uh-KID-nuh] family, sometimes called “spiny anteaters.” So what exactly are monotremes?

**Have the children read the characteristics below, or you may read them if help is needed.**



1. Monotremes are mammals, and the females reproduce by laying eggs, incubating the eggs, and producing milk for their young.
2. Monotremes are similar to birds and reptiles in these two ways: First, they lay eggs. Second, their digestive, reproductive, and urinary systems all share the same tract that leaves their bodies.
3. Unlike reptiles and birds, monotremes produce milk, have hair, and are endothermic (sometimes called warm blooded), so they are classified as mammals.



Platypus



Echidna

### Mixed-up Animal Creations



Have the children turn to the “Mixed-up Animal Creations” page in Lesson 9 of their student journals and color the animals.



Then have each child cut out his or her animals and shuffle the cards into three piles—one pile for heads, one pile for bodies, and one pile for tails. Have the

children pick one card from each pile. (They will likely pick body parts that don’t match.) Have them glue their funny animal creations onto the provided page in their student journals.

**Read to the children:** Just like the funny animals you created, when some European scientists were first shown a platypus in the 1700s, they thought it was a trick! They thought someone had pieced together different parts of animals. Can you see why these scientists would have thought that? **Pause for responses. Point to the image of the platypus above if needed.** Platypuses appear to have the tail of a beaver, the body of an otter, and the bill of a duck. The equally strange echidnas have sharp spines like porcupines, beaks like birds, and pouches like kangaroos. **Point to the image of the echidna in the next column if needed.** Let’s discover more about these curious creatures!



### Fact or Fiction



Remove the “Fact or Fiction” page from the lesson. Read a statement from either the fact or fiction column and have the children indicate if they believe what you read was fact with a thumbs up or fiction with a thumbs down. Have the children turn to the “Monotremes” page in Lesson 9 of their student journals and follow the instructions to complete the page.



**Read to the children:** Was it difficult for you to determine if a statement was fact or fiction? Just like the scientists of the 1700s found it difficult to believe that accounts of the platypus were true, some of the statements you heard might have seemed like fiction. Monotremes are very unique creatures!

### Echidna Puzzle



Place the “Echidna” cutouts facedown on the table. Have a child pick one of the cutouts and tell you the number in the corner of the image. Read (or have a child read) the text below that corresponds with the number on the image. Have the children assemble the puzzle as you read the descriptions of each number.

1. Like their fellow monotreme, the platypus, echidnas are egg-laying mammals. Developing echidnas grow inside their mothers for about two weeks, after which a mother will usually lay only one leathery egg. The egg sits in its mother’s pouch for about 10 days, keeping warm as the tiny creature grows until it’s ready to hatch. When the baby hatches, it is called a puggle.
2. A young echidna will mature within its mother’s pouch until it has developed its spines. At that point the echidna moves to a nursery, called a burrow,



## Platypus

### Fact

1. Grows to about 43–50 centimeters (17–20 inches) in length
2. Weighs about 1–2.26 kilograms (2–5 pounds)
3. Can swim up to 35 kilometers per hour (22 miles per hour)
4. Is carnivorous and eats insects, shellfish, and worms
5. Lives in freshwater streams, rivers, and lakes in Australia
6. Lives for about 17 years
7. Uses its beak to help it sense electrical impulses (like the heartbeats) in its prey

### Fiction

1. Grows to about 13 centimeters (5 inches) in length
2. Weighs about 9 kilograms (20 pounds)
3. Can swim up to 161 kilometers per hour (100 miles per hour)
4. Is an herbivore and eats aquatic plants
5. Lives in deserts in Africa
6. Lives for about 30 years
7. Uses its beak to dig for roots to eat

## Echidna

### Fact

1. Grows to about 30–76 centimeters (12–30 inches) in length
2. Weighs about 3–9 kilograms (7–20 pounds)
3. Can run up to 29 kilometers per hour (18 miles per hour)
4. Is carnivorous and eats insects such as ants and termites
5. Lives in arid forests and grasslands in Australia and New Guinea
6. Lives for about 14–16 years
7. Its short snout digs, eats, senses, and breathes.

### Fiction

1. Grows to about 1.5 meters (5 feet) in length
2. Weighs about 22.6 kilograms (50 pounds)
3. Can run up to 1.6 kilometers per hour (1 mile per hour)
4. Is an herbivore
5. Lives in jungles in South America
6. Lives for about 5 years
7. Its beak is full of venom to protect it from predators.



# Australian Safari



# BATS

## Objective

Help the children learn about bat characteristics, echolocation, and nocturnal life.



### Preparation:

- Cut out the images found on the page titled “Bats.”

### Activity Supplies:

- 3–4 random objects that make noise, such as two spoons banging together, a stapler, a book closing, etc. (Keep these items hidden from the children.)
- A small game token for each child
- A six-sided dice
- A pair of scissors for each child
- A glue stick

## ■ Be Still and Listen

**Read to the children:** In the Bible we read, “Be still, and know that I am God” (Psalm 46:10). We are going to practice being still for a few minutes to learn about one of God’s stunning creatures—bats. **Have the children close their eyes while you make a noise using one of the random objects you collected before the lesson began. Have the children try to guess what object made the noise. Repeat for all objects. The children may now open their eyes.**

**Read to the children:** Was it hard to discern what object made each noise when you had your eyes closed? Bats have a reputation for poor eyesight, which is not entirely true. Some bat species do have poor

eyesight, but some see just as well as humans. All bats, however, have a keener sense of hearing than humans. Let’s discover how bats being *still* benefits them.

## ■ Bats Video



**Watch the video “Bats” at [goodandbeautiful.com/sciencevideos](https://www.goodandbeautiful.com/sciencevideos) or on the Good and Beautiful Homeschool app.**

## ■ Echolocation



**Read to the children:** Some bats use **echolocation** to “see” with sound. They do this with sonar, which stands for Sound Navigation and Ranging. Bats produce sound in the same way humans make sound—by using the larynx (voice box). Air passes from the lungs through special tissues in the larynx that vibrate to make sounds, such as clicks or chirps. Sometimes bats make sound waves that human ears cannot hear but bats can hear. The sound waves bounce off objects, and bats can sense the vibrations and determine where objects are, even in the dark. Some bats can even detect objects as small as a human hair. The size and shape of the ears of each species of bat play a role in echolocation.



## Science Wall: Vocabulary Word



Place the vocabulary card **ECHOLOCATION** on your science wall. Read and discuss the word and its definition.



**Echolocation**

## Bat Body Parts



Have the children turn to the “Bat Body Parts” page in Lesson 11 of their student journals. Help the younger children cut out the words at the bottom of the page. As you read the following information to the children, have the younger children glue each name onto the correct box, pointing to



that bat body part, and have the older children write each name in the appropriate box. An answer key for this activity is included at the end of this lesson.

### Wings and Fingers

A bat’s wings are formed from long skinny bones that are actually its fingers. Skin is stretched over and under the fingers and arms and is called the *wing membrane*. Bats have a little nub along the top edge of the wing that works like a thumb and is used for climbing or handling food. Can you imagine what it would be like to have fingers longer than your body? Well, bat fingers are! That is like your fingers being longer than your legs!



Bats use their wings for flying and wrapping around fruits and insects. Bats are the only flying mammal that flap their wings like birds to truly fly.

### Teeth and Tongue

Bat teeth are very sharp, so they can pierce through animal skin and fruit. Bats that eat nectar have very long tongues that are also useful for pollination. These long tongues are connected to their breast bones. The majority of bat species eat fruit or insects.

### Body

Like all mammals, bats are endothermic. A bat’s body is covered entirely with fur, which helps bats that hibernate through winter and bats that hunt at night to stay warm. A bat uses its body to sleep in a unique way. It wraps its wings around its body and uses its short, strong legs and claws for hanging upside down when going to sleep.

### Nose

You would never guess a nose so small would have such a great sense of smell, but it does! Most species of bats use echolocation by creating clicking noises that come from their mouths. The Bourret’s horseshoe bat uses its long nose to create a concentrated sound wave (called a sonar beam) to bounce off objects for echolocation.

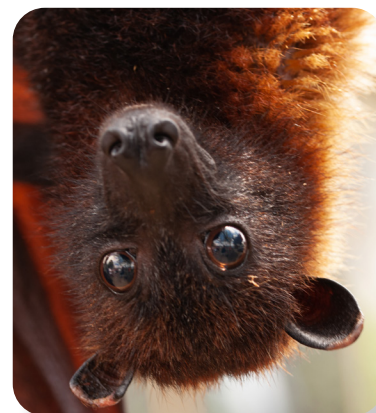
### Ears

Did you know that bats have the best hearing of all the land mammals? Since most bats use their ears to find their prey through echolocation, they often have large ears compared to the rest of their bodies. Bats constantly move their ears and open and close them to follow sonar signals.



### Eyes

God designed bats to use their senses to find food. Microbats do not see very well, so they use echolocation to help them find prey. Nectar bats have good vision and can see well enough to find fruit and nectar during the daytime. In fact, they have specialized cells in their eyes to see ultraviolet (UV) colors on flowers!





# ENDANGERED ANIMALS

## Objective

Help the children learn what causes mammals to become endangered or extinct and what people can do to practice conservation.



### Preparation:

■ Cut out the boxes on the “Mammal Conservationists Booklets Covers” and “Mammal Conservationists Booklets Page 1” pages in each student journal. (Do not cut out the boxes on the “Mammal Conservationists—Booklets Page 2” page.)

### Activity Supplies:

- A glue stick
- Colored pencils
- A pair of scissors for each child

*Note: Information presented in this lesson on the conservation level of certain animals, the current population of these animals, and conservation efforts being made are based on available data as of the time of publication.*

## ■ Endangered Animals

**Have the children close their eyes and listen carefully as you read to them:** Imagine you are overlooking the beautiful scenery of the African savanna. The sun is starting to set, casting a reddish glow across the land. The lush, golden grass ripples as the soft wind blows through. Off in the distance, your eyes spot a crouching cheetah stalking its prey. Its speckled coat blends in with the grass deceptively well. Your eyes move forward as if you're flying above the land, and you spot a herd of elephants encircling a mother giving birth. The elephants' trumpeting calls bellow from their trunks as if to signal the arrival of new life. A matriarchal elephant shakes her head, and her big ears flap like flags meeting a gust of wind. As the sun continues to lower behind the vast plains, you see the silhouettes of a few giraffes nibbling the leaves of an acacia tree. **Ask the children to open their eyes.** What are some feelings you have as you think about God's magnificent creations?

In Lesson 1 we read a verse taken from the account of the creation of the earth. A few verses later, in Genesis 1:31, it says, “And God saw every thing that he had made, and, behold, it was very good.” We know that God was pleased with His work of creation, and we also learn from the Bible that God has given us the responsibility to take care of the earth. We depend on the bounty of the earth for food, clothing, shelter, and many other things. Since Earth is our home, we feel a yearning to protect it.

## ■ Endangered Species

### Read to the children:

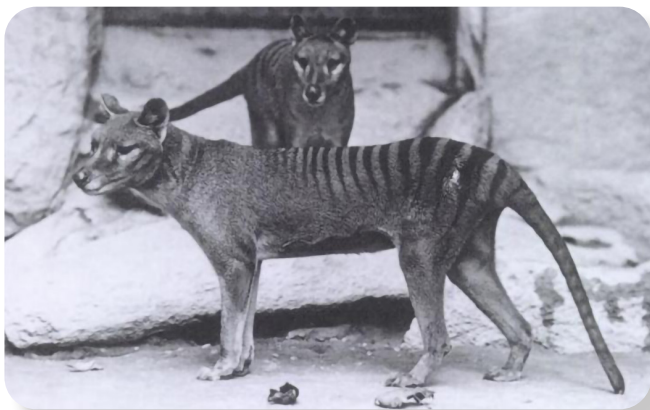
Organisms that are at serious risk for extinction are marked as **endangered**. There are agencies that monitor species around the world to keep track of their numbers and living conditions. The International Union for Conservation of Nature (IUCN) keeps a “Red List of Threatened Species.” This has seven levels of conservation: Least Concern, Near Threatened, Vulnerable, Endangered, Critically Endangered, Extinct In The Wild, and Extinct.



Do you remember which of the mammals you learned about that are threatened, vulnerable, or endangered? [elephants, rhinoceroses, wolves, gorillas, some bats, slow loris, and some bears] All the big cats and the great apes are also endangered.

The West African black rhinoceros was once heavily hunted, and though efforts were made to preserve them, their population declined. They were considered critically endangered in 2008, and by 2011 they were declared **extinct**. There are other species of black rhinoceroses that are endangered, but their numbers are being restored because of the efforts people are making to protect them.

A species native to Australia called the Tasmanian tiger (or Tasmanian wolf) went extinct in 1936 due to overhunting, disease, and habitat loss. The Tasmanian tiger looked like a zebra-striped dog, and it was a carnivorous marsupial. While some have said they have spotted these marsupials, these claims have remained unproven. **Show the children the image of a pair of Tasmanian tigers below.**



**Conservation and Discussion**

**Read to the children:** Both natural causes and human interference can threaten the existence of a species. For example, changes in the weather, natural disasters (like forest fires, floods, droughts, and hurricanes), disease, and non-native species that invade the area are natural causes. In our lesson on elephants, we learned about the serious consequences of poaching (illegal hunting). In addition, using land for human development is one of the biggest threats to natural habitats. Cutting down trees that are homes to animals, building homes in grazing areas, and misusing chemicals that are

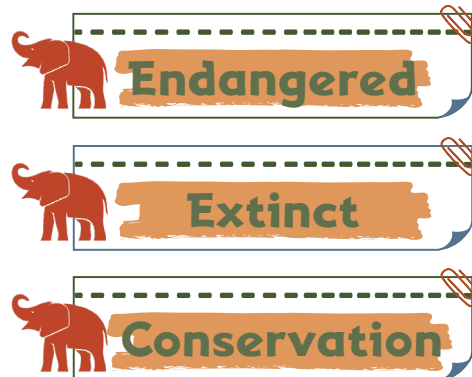
harmful to the environment are some ways organisms can become endangered through human causes. While it is essential for humans to use the land, it should be done in wisdom and balance.

As more people have become aware of potential dangers to other species, many good men and women are striving to raise awareness of how our actions can impact the environment, and they are working to make a difference. As individuals, we can find ways to practice **conservation**, which means to be less wasteful of resources.

**Science Wall: Vocabulary Words**



Place the vocabulary cards **ENDANGERED**, **EXTINCT**, and **CONSERVATION** on your science wall. Read and discuss the words and their definitions.



**Mammal Conservationists**



**Read to the children:** The Maasai Mara National Reserve lies in the Great Rift Valley in Kenya. It is a reserve protected by the Kenyan government where wild animals are free to roam naturally. Maasai Mara contains a variety of large mammals. The land varies from sandy soil and thick grasslands to plains and plateaus. The Great Migration takes place each July through September. More than one million wildebeest, zebras, gazelles, and antelope migrate from the Serengeti to Maasai Mara searching for food and water. The herds remain until November, and then they return to the Serengeti, about 201 kilometers (125 miles) south of Maasai Mara. During this time, it is popular for tourists to “migrate” here, too. Establishing a



reserve is one way to protect the ecological balance of an environment.

We are going to learn of some other interesting ways people are striving to preserve wildlife and maintain this balance.

Have the children turn to the “Mammal Conservationists” pages in Lesson 14 of their student journals and have them follow these instructions to assemble a booklet page:

1. **DO NOT** cut out the page titled “Mammal Conservationists Booklets Page 2.” Cut out **ONLY** the four boxes on the pages titled “Mammal Conservationists Booklets Covers” and “Mammal Conservationists Booklets Page 1.”
2. Glue the four boxes of text onto the corresponding four boxes on the page “Mammal Conservationists Booklets Page 2.”
3. Glue the four boxes of “Mammal Conservationists Booklets Covers” onto the corresponding previous four boxes.

Once the assembly of the booklet page is complete, have each child read one of the booklet text pages and illustrate a cover for that booklet. Repeat until all four are illustrated and complete.

**Mammals of the World Map**



Have the children turn to the “Mammals of the World Map” page in the back of their student journals. Have each child place the stickers of the final animals on his or her world map on the noted locations. Take a few minutes



to discuss the stickers placed on the map throughout the unit.

**Amur Leopard—Eastern Russia**

**American Bison—United States**

**Lesson 14 Extension**



Have children grades 7–8 complete the self-directed Lesson 14 extension titled “Marine Mammals” in their student journals.



# MAMMALS

Grades 3-6

# STUDENT JOURNAL

This journal belongs to:



THE GOOD AND THE BEAUTIFUL

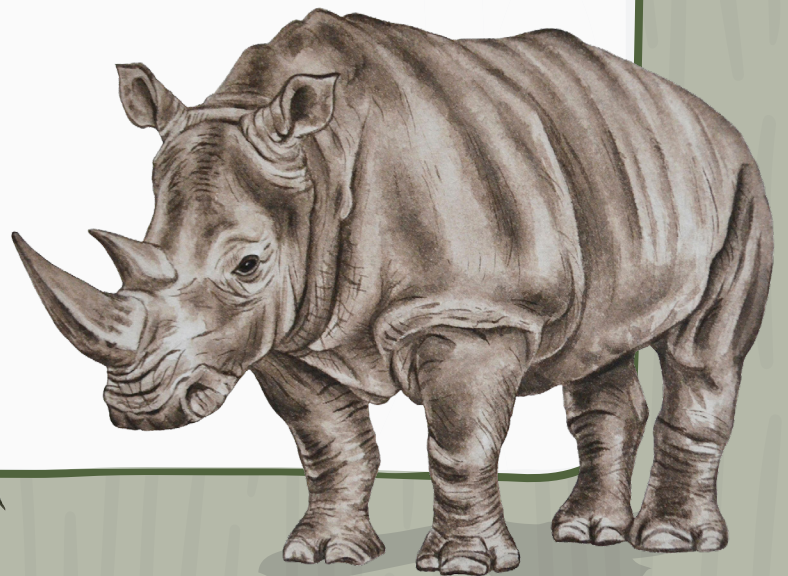




## INSTRUCTIONS

This student journal accompanies *The Good and the Beautiful Mammals* science unit. It contains all the worksheets and journal pages that are needed to complete the unit. Each student will need his or her own copy of the science journal.

Have each student take his or her time to create high-quality work as the activities and worksheets are completed. Students may enjoy looking back on their past discoveries when they've finished.



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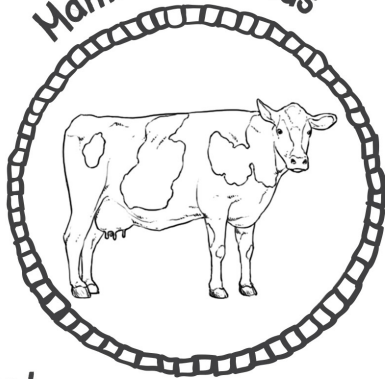


# MAMMAL CHARACTERISTICS

**NOTE:**

Repeat each characteristic aloud three times as you color this page.

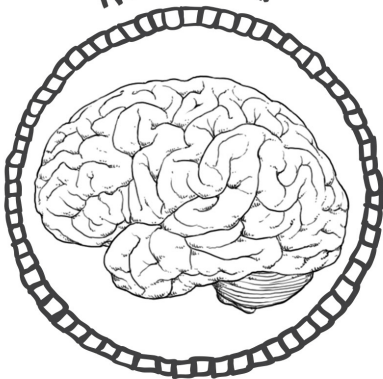
Mammary Glands



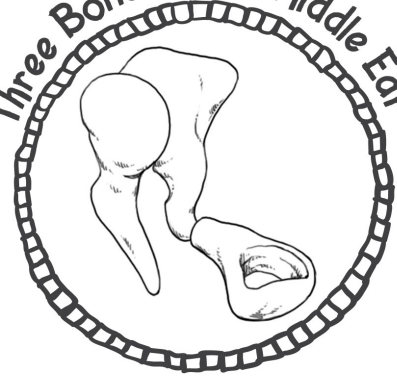
Hair or Fur



Neocortex



Three Bones in the Middle Ear



Single-Boned Jaw



# My Ungulates BOOKLET



## PERISSODACTYLA: Odd-Toed Mammals

### Features of Perissodactyls

- ➔ They bear their weight on one toe.
- ➔ They are herbivores.
- ➔ They have hooves.
- ➔ They have long faces.

TAPIR



Number of Toes Per Foot  
4 front 3 hind 5 1  
Partial or Full Hoof

HORSE



Number of Toes Per Foot  
2 5 3 1  
Partial or Full Hoof

RHINOCEROS



Number of Toes Per Foot  
7 5 3 2  
Partial or Full Hoof

# UNGULATE RUNNING

Fill in the information on the chart below as you complete the running challenge.

Name	Time	Distance Run	Speed (feet per second) Calculate: Distance Run ÷ Child's Time	Speed (miles per hour) Calculate: Speed (Feet per Second) x 0.68
Example	5 seconds	50 feet	50 feet ÷ 5 seconds = 10 ft/s	10 ft/s x 0.68 = 6.8 mph

# HORSE BREEDS



Friesian

Clydesdale

Appaloosa

Shetland

American Quarter  
Horse

# ARTIODACTYLA: Even-Toed Mammals

## Features of Artiodactyls

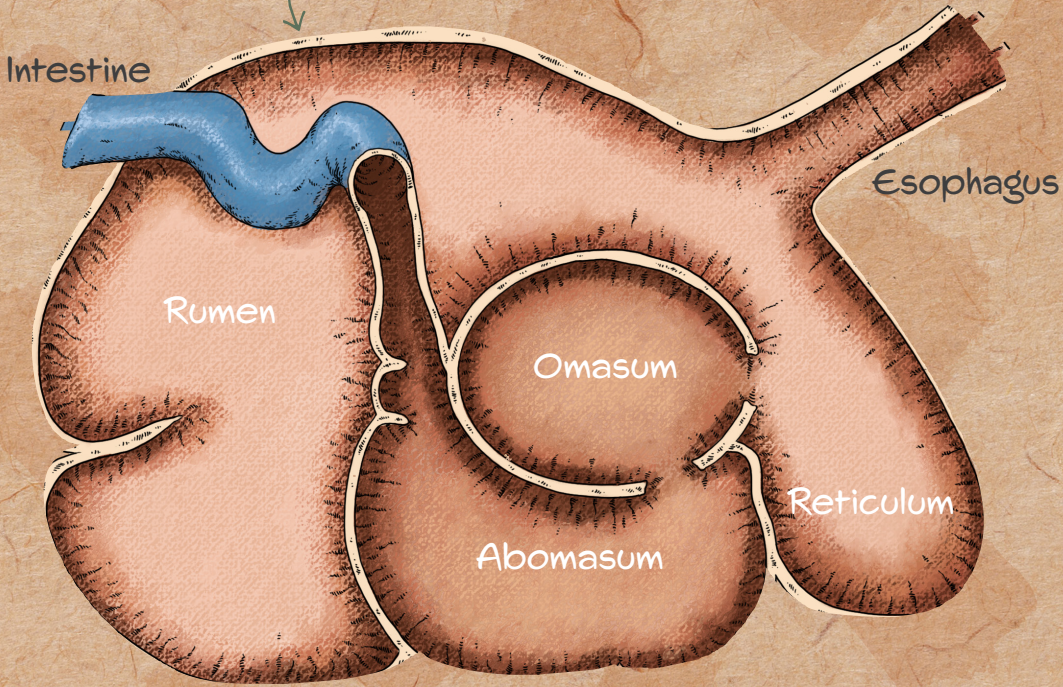
- ➔ They bear their weight evenly between two main toes.
- ➔ They are herbivores.
- ➔ They have hooves.
- ➔ Most of them have four-chambered stomachs.
- ➔ Most of them have powerful, elongated legs.
- ➔ Many families in this order have horns, antlers, or tusks.



branch	do not branch
fall off	do not fall off
replaceable	not replaceable
velvet covering	never covered with velvet

branch	do not branch
fall off	do not fall off
replaceable	not replaceable
velvet covering	never covered with velvet

## RUMINANT DIGESTIVE SYSTEM



# FEROCIOUS FELINES





ART STUDY

"Tropical Forest with Monkeys"  
by Henri Rousseau (1844–1910), 1910



# MONKEY MYSTERY



Draw a line from each primate to the category it belongs to.

**NEW WORLD MONKEY**

- comes from the Americas
- has a prehensile tail
- spends most of its time in trees

**OLD WORLD MONKEY**

- comes from Africa and Asia
- has a tail, but not a prehensile one
- spends most of its time on the ground

**APE**

- comes from Africa and Asia
- does not have a tail
- spends most of its time on the ground
- is not considered a monkey



Mandrill



Gorilla



Vervet



Slow Loris



Pygmy Marmoset

What is a primate's favorite month?

○ ○ e - ○ ○ ○



# FEROCIOUS FELINES

## 5 SNOW LEOPARD

- Just as other cats were created with traits that help them to survive the heat in sub-Saharan areas of Africa, snow leopards were created to survive the cold in the mountainous areas of Asia using their thick fur coats.
- Their small ears are designed to lose less heat, and their long tail can wrap around them for extra warmth.
- They are very difficult to see because they are perfectly camouflaged in their snowy, mountainous habitats. This makes them hard to study.

## 6 DOMESTIC CATS

- Recent studies have linked the DNA roots of cat domestication to the Fertile Crescent and Egypt. Cat domestication may have begun with cats taming themselves rather than humans caging and taming them.
- As farming practices increased, there became a surplus of grains to store and trade on ships. This invited unwelcome rodents. Cats are natural predators of rodents.
- It wasn't until the 18th century, when selective breeding began, that cats became a more prevalent house pet. Scientists study changes in behavioral patterns and the color, pattern, and length of cat coats to determine the history of breeding over the years.

## 7 MOUNTAIN LION

- Also called pumas or panthers, these wild cats are found throughout the Americas, generally wherever deer are found.
- They inhabit deserts, woodlands, and rocky mountains.
- They are the largest American wild cat; adult males can be more than 2.44 meters (8 feet) long.

## 8 BOBCAT

- Not as large as mountain lions, these fierce predators generally prey on rabbits, birds, or rodents, but they are capable of taking down prey that is up to eight times bigger than they are.
- Females raise their young, known as kittens, in a secluded den for up to 12 months. Domesticated cats have been known to care for orphaned bobcat kittens.
- The bobcat gets its name from its short "bobbed" tail.

# WOLF VS. DOG IMAGES

Read the characteristics of the gray wolf and the husky dog on the "Wolf vs. Dog" page. On this page, cut out the two images under the first category (coat) and choose which of the two images best fits the wolf or the dog. Paste the images onto the worksheet. Repeat this for the remaining categories.

COAT



FACE & EARS



SOUND



TRACKS



# MONOTREMES

Circle the fact you found most interesting from the activity.

## Platypus

### Scientific Name:

*Ornithorhynchus anatinus*

**Size:** 43–51 centimeters (17–20 inches)

**Weight:** 0.90–2.27 kilograms (2–5 pounds)

### Top Swimming Speed:

About 35 kilometers per hour  
(22 miles per hour)

**Diet:** Carnivorous; insects, shellfish, and worms  
(They are bottom-feeders.)

**Habitat:** Australia; in freshwater streams, rivers, and lakes

**Life Expectancy:** 17 years

**Fun Fact:** They use their beaks to help them sense electrical impulses (like the heartbeats) in their prey.



## Echidna

**Scientific Name:** *Tachyglossidae*

**Size:** About 30–76 centimeters (12–30 inches), depending on the species

**Weight:** 3–9 kilograms (7–20 pounds)

**Top Speed:** About 29 kilometers per hour (18 miles per hour)

**Diet:** Carnivorous; insects like ants and termites

**Habitat:** Australia and New Guinea; in arid forests and grasslands

**Life Expectancy:** 14–16 years

**Fun Fact:** Their short snout digs, eats, senses, and breathes.



# POSSUM VS. OPOSSUM



They are native to Australia. They appear very soft and have large ears and bushy tails. Their fur is gold, brown, black, and gray.



They are native to North America and appear to be fierce. They have sharp teeth, coarse hair, and bare tails. Their fur is white and gray.



Using their strong teeth, they feed mostly on eucalyptus leaves, buds, flowers, and fruits. They can also eat insects and small animals. Close to suburban areas, they'll eat almost anything.



They eat grass, nuts, and fruit, and they hunt small animals like mice, birds, insects, and worms. Known for being scavengers, they may raid garbage cans. By eating ticks, they help reduce the spread of Lyme disease in humans, since some ticks carry the disease.



Females will give birth to only one baby at a time, which will nurse in the mother's pouch and eventually ride on her back.



Females give birth to many young at a time, and they are as small as bees! They nurse in their mother's pouch and will ride on her back while she hunts.



They are solitary (live alone) but can be very noisy during breeding season! They make clicking, chattering, hissing, and grunting sounds. They can also make piercing screeches.



These creatures are known for the phrase "playing possum." They pretend they are dead when they feel threatened by a predator, hoping the predator will pass them by, giving them a chance to escape!

# ART STUDY



"Dormice"  
by Archibald Thorburn (1860–1935), 1903

# BEAR SPECIES

Match each bear picture to the correct species name.



American Black Bear  
*Ursus americanus*



Brown Bear  
*Ursus arctos*



Giant Panda  
*Ailuropoda melanoleuca*



Polar Bear  
*Ursus maritimus*



Sun Bear  
*Helarctos malayanus*



Spectacled Bear  
*Remarctos ornatus*

# MAMMAL CONSERVATIONISTS BOOKLETS PAGE 1

glue here

## Chimpanzee of Gombe

Current population in the wild: 170,000 to 300,000

Jane Goodall grew up in England. She developed a love for animals while reading books about a naturalist veterinarian, and she gained a love of Africa while reading fiction stories that took place on that amazing continent. She has been living with, studying, and teaching about the chimpanzees of Gombe for many decades! It began when she saw a male chimpanzee in the rainforest reserve looking for food. He used a twig to spoon termites out of their mound and into his mouth. She found it fascinating that he made a tool and used it like a human would. She also observed the chimpanzees showing affection for one another as humans do, and interestingly, she also saw them fighting a war! This occurred between two tribes of chimps and lasted about three years.

glue here

## Bison of the American West

Current population in the wild: about 500,000

About 30–60 million bison once roamed North America. When American settlers pushed farther west in the 1800s, American bison were pushed out. By 1889, the bison numbers plummeted to a mere 1,091. How did this happen? Native Americans understood the land and had burned the grasses of the prairies to keep the trees from overtaking the bison range. However, farming settlers didn't know this, and their ways of farming left the soil depleted, affecting the balance of the prairie's ecosystem. The bison were also hunted by the millions during this time. In 1908, President Theodore Roosevelt passed legislation to establish the National Bison Range, and land was purchased for it. The American Society of Bison bought the first 34–40 bison for the bison range, and by 1910 there were 11 calves. While this allowed the bison to graze freely again, care for the land and the species is still needed to ensure their survival.

glue here

## Chiru of Chang Tang, Tibet

Current population in the wild: 100,000 to 150,000

The chiru is a Tibetan antelope. The chiru's wool is very fine—one-fifth the thickness of human hair! It is used to make shahtoosh wedding shawls, and it takes four chiru to make one shawl. The demand was so great that it pushed the species near to extinction. George B. Schaller grew up in Germany reading books about Tibet. As an adult in the 1900s, he traveled there to study the wildlife. He found thousands of chiru carcasses lying in waste, so he decided to do something about it. He studied the herd and found the secret place where the chiru gave birth each year, away from hunters. He helped to make the buying and selling of the shahtoosh illegal. The number of chiru has been increasing in recent years because of conservation efforts.

glue here

## Amur Leopard of Eastern Russia

Current population in the wild: greater than 103

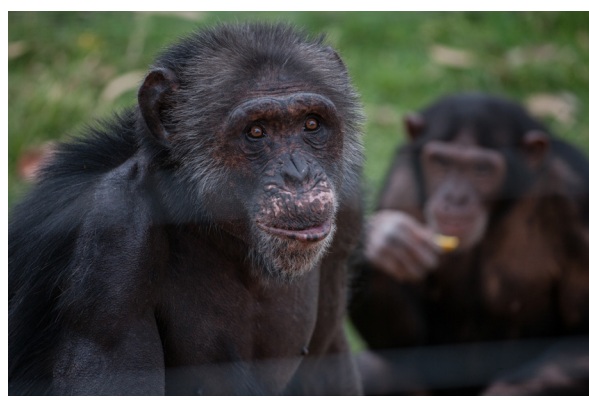
One critically endangered species is the Amur leopard found in Eastern Russia (also home to the rare Amur tiger). Surrounded by agriculture and villages, the leopard's forests are being threatened, as well as its prey. Because of its highly admired pelt, poaching is also a major threat to this beautiful species. Land of the Leopard National Park was founded by the Russian government in 2012 to help protect the world's rarest feline species. There are 400 cameras installed all over the park to harmlessly capture these leopards on camera for people to see their movements.





# MAMMAL CONSERVATIONISTS BOOKLETS PAGE 2

Chimpanzee of Gombe



glue here

Bison of the American West



glue here

Chiru of Chang Tang, Tibet



glue here

Amur Leopard of Eastern Russia



glue here



**NORTH AMERICA**

United States

Rocky Mtns

CENTRAL AMERICA

**SOUTH AMERICA**

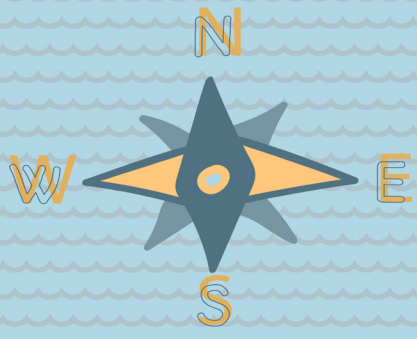
Equator

United Kingdom

**EUR**

Sahara De

**AFR**



Mammals of the World Map

ic REGION

EOPE

esert

ICA

Russia

ASIA

China

India

SOUTHEAST ASIA

Borneo

Madagascar

AUSTRALIA

Tasmania

ANTARCTICA



# MAMMALS

Grades 7-8

# STUDENT JOURNAL

This journal belongs to:



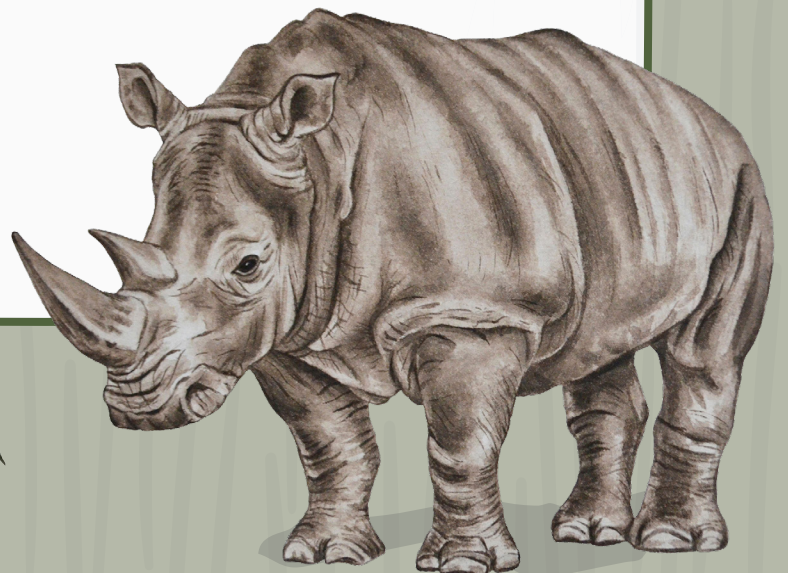


## INSTRUCTIONS

This student journal accompanies *The Good and the Beautiful Mammals* science unit. It contains all the worksheets and journal pages that are needed to complete the unit. Each student will need his or her own copy of the science journal.

The lesson extensions are also found here. These extensions are optional for older students (grades 7–8) to complete on their own. Each extension is accompanied by lined paper so the student can keep his or her work in one place.

Have each student take his or her time to create high-quality work as the activities and worksheets are completed. Students may enjoy looking back on their past discoveries when they've finished.



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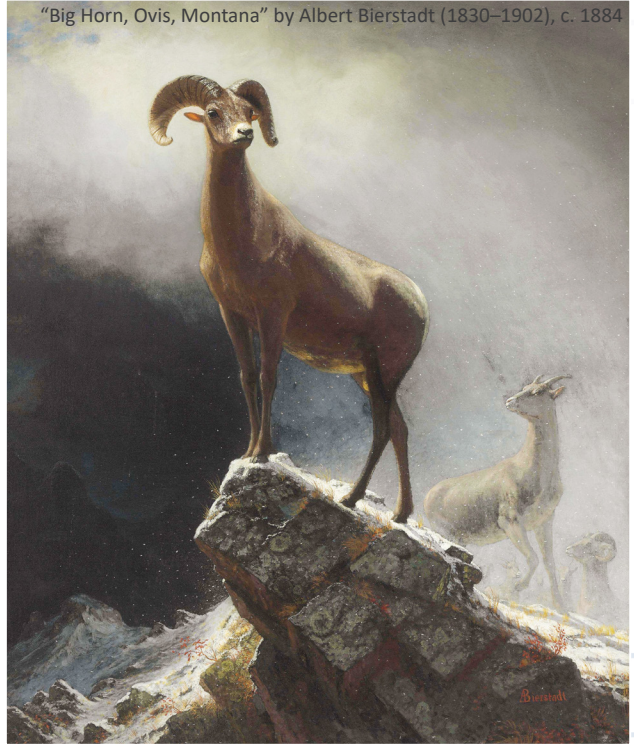


# MAMMALS IN ART

"Deer in Forest Landscape" by Sándor Brodsky (1819–1901), 1876



"Big Horn, Ovis, Montana" by Albert Bierstadt (1830–1902), c. 1884



"White Horse in Pasture" by Jacques-Laurent Agasse (1767–1849), c. 1806



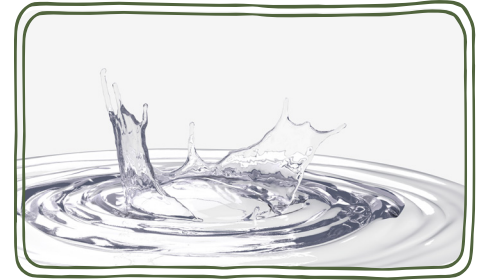
## Instructions:

1. Read each section and study the diagram of the ear.
2. Write a paragraph explaining how sound is transferred through the ear, using the vocabulary words (which are in bold italics). In your paragraph underline the vocabulary words.

## EXTENSION

## The Mammalian Ear

One of the unique characteristics of the mammalian ear is that it contains three bones in the middle ear. Just as waves ripple through the water, sound waves move through the ear, hitting these three bones. These bones act like links in a chain, transmitting the waves that enter the ear to the inner part of the ear. So how does this process work, and how does this translate into sound?



## 1. External Ear

The **external ear** (outer ear) is composed of the fleshy part on the outside of your body and the **ear canal** (the passageway leading to the inside of the ear). As sound waves hit the external ear, they travel through the ear canal until they meet the **eardrum** (also called the tympanic membrane). The eardrum divides the external and middle ear.

## 2. Middle Ear

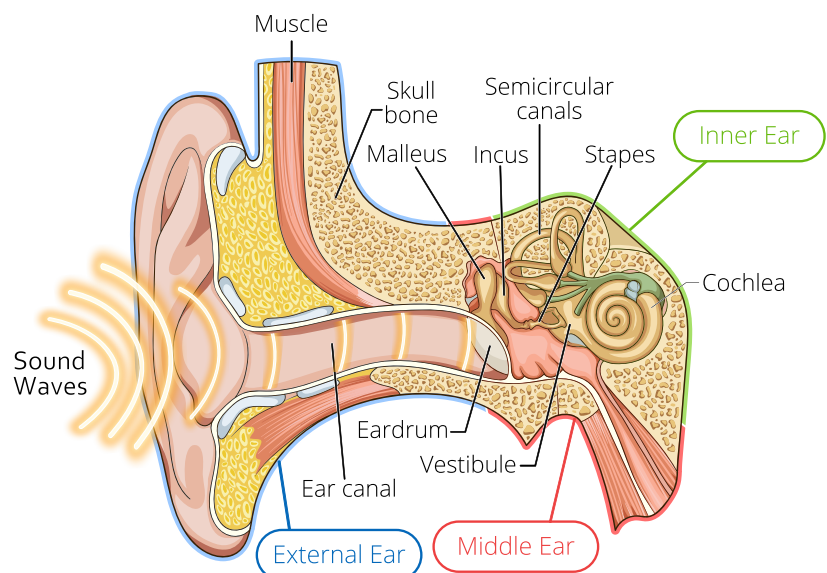
When sound hits the eardrum, this thin piece of tissue vibrates, passing the sound waves to the three ossicles (which literally means “tiny bones”). These three **middle ear** bones are the smallest bones in the body, and vibrations hit these bones in this order: the **malleus**, the **incus**, and then the **stapes**. The function of these bones is to conduct (or pass on) the sound to the inner ear.

## 3. Inner Ear

Sound waves move to the **inner ear**, which contains a snail-shaped organ called the **cochlea**. This organ is filled with liquid and has nerves for hearing. The nerves sense inner-ear vibrations and convert them to electrical impulses that our brains can interpret as sound. Two other organs found in the inner ear are the oval-shaped **vestibule** and the **semicircular canals**; these both help with balance.

## Did you know?

World-famous musical composer and pianist Ludwig van Beethoven suffered damage to his inner ear, and yet he was still able to compose music during the time when his hearing dwindled. How was this possible? One factor was his mastery of understanding how instruments and voices blend together. Second, it was said that Beethoven would place a pencil in his mouth and touch the other end of the pencil to the piano to feel the vibration of the note as he played it. The well-known song “Ode to Joy” was Beethoven’s last symphony, written after complete hearing loss.





# My Ungulates BOOKLET



## PERISSODACTYLA: Odd-Toed Mammals

### Features of Perissodactyls

- They bear their weight on one toe.
- They are herbivores.
- They have hooves.
- They have long faces.

TAPIR



Number of Toes Per Foot

Partial or Full Hoof

HORSE



Number of Toes Per Foot

Partial or Full Hoof

RHINOCEROS



Number of Toes Per Foot

Partial or Full Hoof

# ARTIODACTYLA: Even-Toed Mammals

## Features of Artiodactyls

They bear their weight evenly between two main toes.

They are herbivores.

They have hooves.

Most of them have four-chambered stomachs.

Most of them have powerful, elongated legs.

Many families in this order have horns, antlers, or tusks.

HORNS



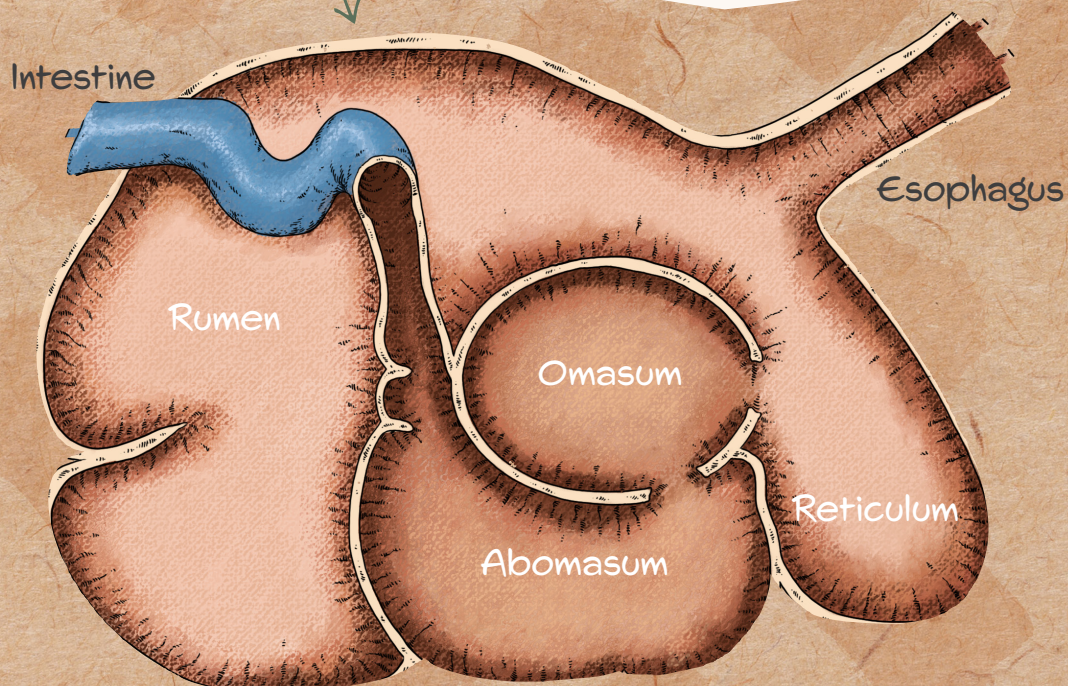
ANTLERS



branch	do not branch
fall off	do not fall off
replaceable	not replaceable
velvet covering	never covered with velvet

branch	do not branch
fall off	do not fall off
replaceable	not replaceable
velvet covering	never covered with velvet

## RUMINANT DIGESTIVE SYSTEM



## Instructions:

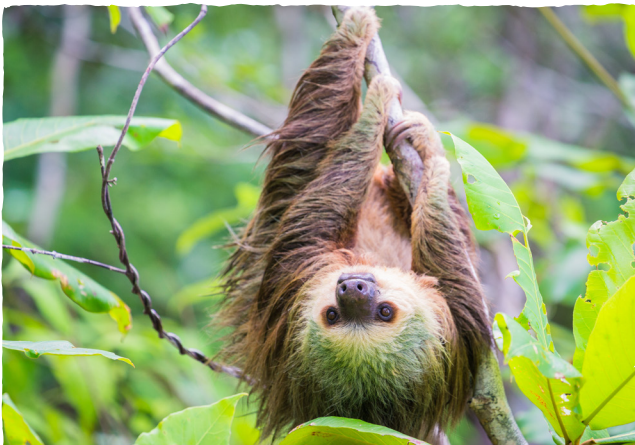
1. Read the information below.
2. List 5–7 facts about sloths that you found most interesting.
3. Present what you learned to a family member or draw a picture based on one of the scenes from the text.

## EXTENSION

## The Sloth—Another Marvelous Mammal

In this lesson you learned about elephants—one of God’s incredible creations. In this extension we will highlight another marvelous mammal—the sloth. You may already be familiar with the sloth’s reputation of being sluggish and hanging around in a carefree manner, and there is a lot of truth to that. Sloths are the slowest-moving mammal in the world, typically traveling only about 38 meters (125 feet) per day. So why are they so slow? Sloths have an unusually low **metabolic rate** (the rate at which energy is used over time), so they move slowly to conserve energy. Aside from their sleepy, sluggish demeanor, there are many characteristics of sloths that make them truly marvelous.

Sloths make their homes in the trees of the tropical rainforests of Central and South America. A sloth will spend its day creeping along the branches of trees, munching on the buds, leaves, and shoots. Since sloths are omnivores, they will sometimes snack on insects, lizards, and birds. Occasionally, they’ll drop from these branches and crawl along the ground, and when they do so, their rate of movement decreases even more—to only about one foot per minute. This could partly be because their claws are so long that walking on land is difficult. Can you guess one other place a sloth is found aside from in trees or on land? Sloths can also be found in water—swimming. Not only are they good swimmers, but they also move up to three times faster in water.



Just as sloths have made the forest their home, they themselves are the home to an organism—algae. Sloths have a **symbiotic relationship** with algae. This means that algae and sloths coexist. Algae benefit from living on sloths because sloths provide the algae with water and a home. The sloths’ fur absorbs a lot of water, which becomes a resource for the algae. In exchange, the algae benefit sloths by providing nutrients and giving sloths a tint of camouflage—hiding them from predators. (After all, algae are green, and sloths live in green forests.)



When we said that sloths “hang around,” we meant this literally—they spend about 90% of their lives hanging upside down. If we tried doing this, we’d probably get dizzy or find it hard to breathe after a while. Sloths can handle an upside-down life because their organs are attached to their rib cage, so their organs don’t weigh on their lungs and have no impact on their breathing.

Sloths are important to the ecosystem of the rainforests, and their survival depends on us preserving their habitat. Without trees, they become more prone to predators that live on the forest floor. Some species of sloths are endangered, so communities and organizations are working hard to promote sustainable forestry.

## Instructions:

1. Read the information below.
2. It's impossible to know what animals are thinking, so scientists carefully design experiments to determine how much animals understand. Imagine you are studying one of the primates below. Describe an experiment you would do to test how much your chosen primate knows.

## EXTENSION

## Intelligent Primates

**Gorillas:** The idea of being able to communicate with animals has always intrigued humans. People have attempted to teach animals to talk to us, and one of the most successful experiments has been with a western lowland gorilla named Koko.

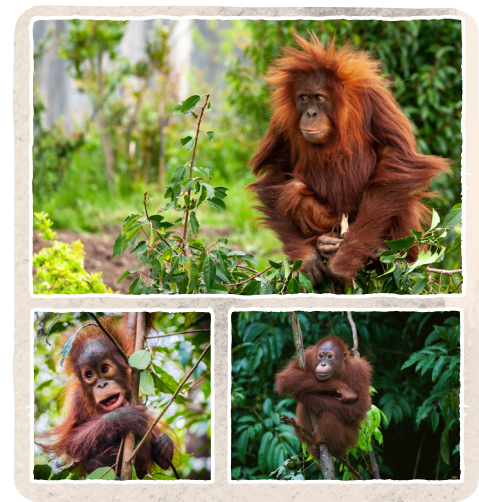
Koko was born in a San Francisco zoo and attracted the attention of researcher Francine Patterson, who noticed that the young gorilla seemed to have picked up a few gestures on her own. Patterson began working with Koko to teach her a modified version of American Sign Language. Eventually, Koko had a vocabulary of about 1,000 words, comparable to that of a three-year-old human.

Koko helped scientists understand more about what gorillas are capable of learning. Koko even appeared to comprehend abstract concepts, such as “death” and “birthday.” Koko expressed sadness when looking at pictures of her kitten that had died and draped herself with fabric to dress up for her birthday party. Koko’s abilities were impressive but not unique. Researchers have now observed both captive and wild gorillas using gestures to communicate with each other.



**Orangutans:** If you go to the island of Sumatra and watch orangutans on the west side of the Alas River, you will see them using sticks to poke logs, looking for honey, and then removing it. Researchers call this activity “honey-dipping.” However, if you are watching orangutans on the east side of the Alas River, you won’t see this behavior. Why? Orangutans are social learners—scientists believe an orangutan from the west side of the river figured out how to use a stick to extract honey, and then the group passed this behavior on to each other and their young.

Researchers gained more evidence for this theory when they took young, orphaned orangutans from both sides of the river and gave them two tasks to do with sticks. All the orangutans used sticks to rake food into their enclosures, but the west-side orphans also easily used the sticks to dip honey, while fewer of the east-side orphans figured this out. Scientists believe the west-side orphans had learned the behavior by watching their mothers and other adults. Learning by watching is a sign of high intelligence.



**Monkeys:** Did you know that monkeys can do math? Scientists have done experiments with rhesus macaques, Old World monkeys from Asia. Researchers taught the monkeys numbers and tested them. The monkeys demonstrated that they understood which numbers were larger by choosing the one that would give them more treats.

The monkeys were even able to add—they would choose a sum that added to a bigger number over a single, smaller number. Monkeys may not be able to help you with your algebra, but scientists hope that learning how their brains process numbers will help them understand human brains better, including what causes learning disabilities like dyscalculia.



# FEROCIOUS FELINES

Match the descriptions on the next two pages with the pictures on the third page by writing the number by each name in the correct circle. If desired, write or draw an interesting fact about each species on the fourth page.

## 1 LIONS

- Lions live with about 30 others in a group called a *pride*, with about four lionesses for every male lion.
- The size of a pride is determined by food and water availability; where there is more food and water, there are more lions.
- The small, agile adult lionesses hunt for dinner while the larger male leaders stay behind to protect their young and territory.
- A lion's thick mane protects its neck from attack.

## 2 TIGERS

- The tiger is the largest feline, with Siberian tigers weighing around 300 kilograms (660 pounds).
- Their long hind legs for making great leaps and padded feet for sneaking up on prey help them hunt.
- A tiger can single-handedly kill a young elephant and eat more than 36 kilograms (80 pounds) in one sitting.
- A tiger's stripes are on its fur and its skin.
- White tigers are not albino or a separate species, but have a rare genetic anomaly known as *leucism*. Genes from both parents cause them to have pigmentation only in their eyes, not their hair or skin.

## 3 CHEETAHS

- A cheetah's paw pads are like football cleats, rough with semi-retractable claws for traction.
- Their eyes are outlined with black to reflect the sun's glare so they can zero in on their prey.
- Going from 0 to 113 kilometers per hour (0 to 70 miles per hour) in just three seconds, or three paces, the cheetah is well known as the fastest mammal on Earth.
- A small head, a sleek body, low weight, and a flat rib cage make a cheetah's body aerodynamic.
- Long legs and powerful muscles allow a cheetah to take strides of 7.62 meters (25 feet) at a time.

## 4 LEOPARDS

- Found in Africa, the Middle East, and Asia, leopards are not fussy about their habitat as long as they live alone.
- They love to rest in trees and will even drag their prey (including gazelles, baboons, and antelope) up into the tree with them.
- Most leopards can live for 12–17 years.
- When leopards are calm and happy, they can be heard purring like a house cat, but you don't want to get too close and upset a leopard. When they are angry, they have a loud roar.

## Instructions:

1. Read the information below.
2. In a paragraph at least three to five sentences long, describe some of the ways canines can help humans. If desired, you could also include some information about a canine in your own life.

## EXTENSION

## Training Canines

The Canidae [CAN–uh–dee] family has 34 species, including the fox, wolf, coyote, and domesticated dog. Within the dog species are a vast variety of breeds, which you might have assumed were different species based on their great differences. However, the species *Canis familiaris*, commonly called dog, is one species that has been bred by humans to serve many purposes and therefore displays many unique features, sizes, and abilities. One thing all dogs and other canines have in common is their intelligence. **Read through the boxes at the bottom.**

Wild canines use their intelligence to survive, hunt, and protect their young. Domesticated canines have been trained to be useful at home and on the job. It is estimated that up to 47% of people in the United States have a dog as a pet. We are going to learn about just a few of their trained abilities.

In a home setting, dogs can be trained to fetch, detect medical emergencies, provide emotional support, do tricks, and much more. A border collie named Chaser has set the record for learning the most words or commands. Through careful training, Chaser has learned to respond correctly to 1,000 words or commands. Other dogs such as the golden retriever Copper have learned to communicate with their

owners through sound buttons. Each button says a different word, such as “outside” or “hungry,” and the dog can press a button to communicate what it wants or needs. Service dogs are trained to guide those who are blind, detect smells that mean a person is about to have a seizure, or even give an alarm to those with diabetes that their blood sugar is too high or too low through the dog’s amazing sense of smell.

Dogs can even be found in a variety of work settings ranging from mountain search and rescue to Hollywood movie sets. St. Bernard dogs can find people trapped in avalanches, smelling them up to 4.5 meters (15 feet) under the snow! Police dogs such as German Shepherds, often called K9s, are used to detect explosives, illegal drugs, and alcohol. On the farm many dogs have been trained to herd sheep and cattle. The Great Pyrenees breed is not only smart enough to care for a herd of sheep on its own, leading them to green pastures, but it is also large and strong enough to protect the herd from bears!



It is easy to see how these amazing and loyal creatures are often called “man’s best friend.” Their abilities make them useful, if not invaluable, to humans around the world.



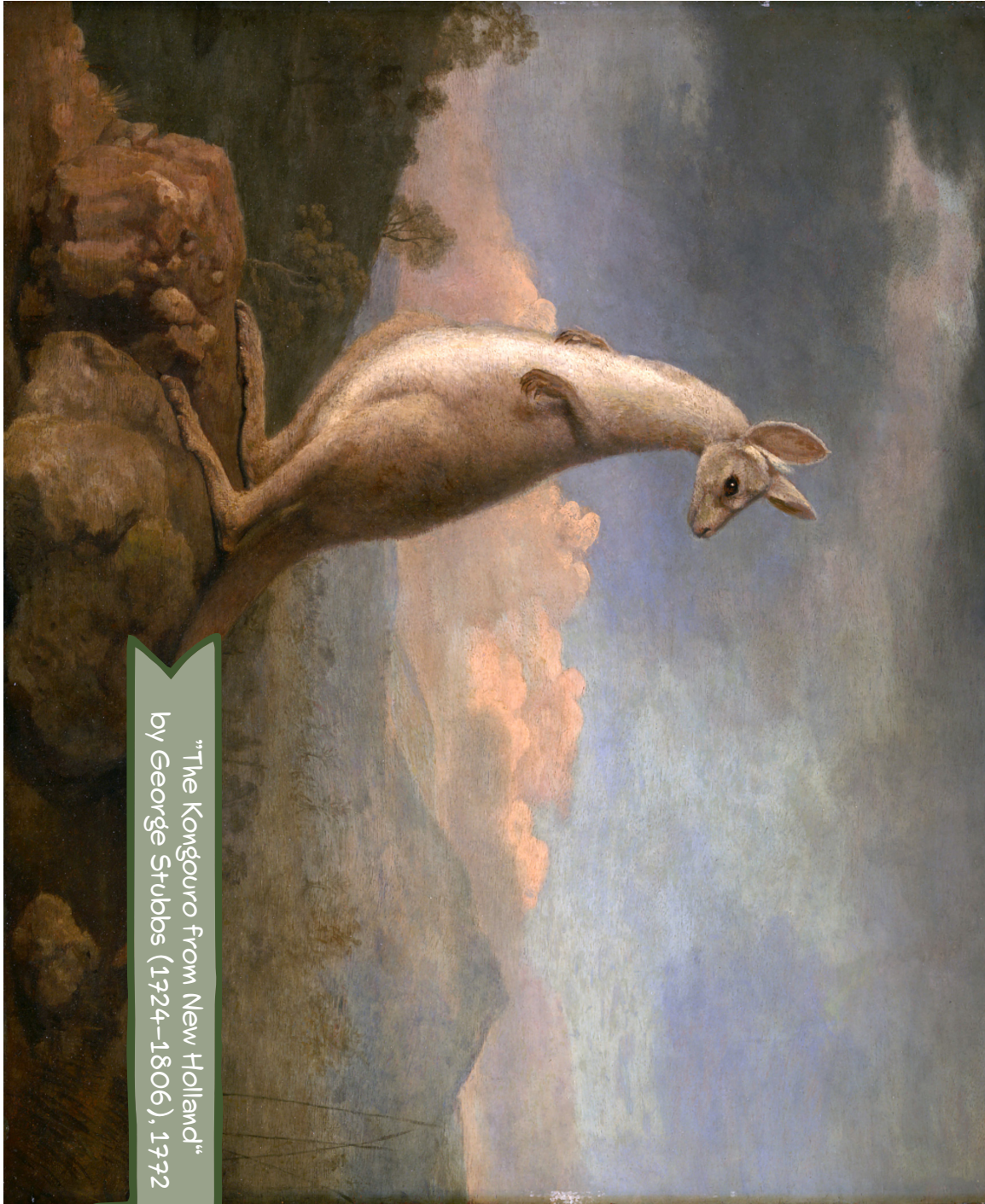
The black-backed jackal (*Canis mesomelas*) can only be found in Africa and is often seen scavenging in the dry savanna. Careful and crafty, they are able to steal food from lions and keep predators away. Families tend to stay together, but jackals may hunt with others in large packs.



You may have heard the saying “cunning as a fox.” This is because foxes are very intelligent; they are good at outsmarting their prey and protecting their young. With a watchful eye, they will wait and sneak in to snatch prey. They will often steal food from hunters’ traps.



The coyote (*Canis latrans*) derives its name from the Aztecs, implying a crafty and tricky demeanor. Coyotes generally are smaller, smarter, and have bushier tails than wolves. Coyotes consume almost anything and are adept at capturing prey; they will dig tunnels to trap, leap into the air or trees, and even scale six-foot walls.



“The Kongourou from New Holland”  
by George Stubbs (1724–1806), 1772

ART STUDY

## Instructions:

1. Read each section and the case study.
2. Do one or both of the following assignments:
  - a. List 5–7 interesting facts about marine mammals.
  - b. Briefly summarize how rescue teams are able to disentangle a trapped whale, based on what you read in the case study.

## EXTENSION

## Marine Mammals

Throughout this unit, you explored the fascinating features of land mammals, but did you know there are mammals that live in the ocean too? If you completed *The Good and the Beautiful Marine Biology* science unit, then you have already learned about marine mammals. Marine mammals live in aquatic environments. In this lesson extension, we're going to learn the basic characteristics of marine mammals, how they are classified, how their ecosystems are being threatened, and what is being done to help God's creations that live in the ocean.

## Characteristics

To be classified as a marine mammal, scientists look for the characteristics that are shared with land mammals—the characteristics that you learned about in this unit. At least at some point in their lives, they also have hair, and they, too, produce milk to nurse their young. They also give birth to live young and have the distinguishing three bones in the middle ear. Unlike other oceanic creatures, marine mammals are endothermic, which is commonly referred to as warm blooded. With that in mind, you may be wondering how these mammals survive the frigid temperatures of the ocean. Most marine mammals have blubber to help them keep warm. Their bodies are so incredibly fascinating because they must survive extreme changes in temperature, pressure, depths, and light availability.

How do these mammals live underwater if they, like other mammals, have lungs instead of gills? Marine mammals have the ability to hold their breath for a really long time! When they dive down, they can slow their heart rate in order to consume

less oxygen. A reserve of oxygen is kept in their blood and muscles, and they can control where their blood goes. For example, they can send their blood to main organs (like their hearts and lungs) to ensure there is oxygen in these body parts. These features enable them to stay underwater for quite some time, but eventually, they do have to return to the surface to breathe again.



## Classification

Aquatic mammals live in the water permanently, and semiaquatic mammals spend time on land and in the ocean. There are four main taxonomical groups of marine mammals. See below.

## CETACEANS

whales. dolphins. porpoises



## PINNIPEDS

seals. sea lions. walrus



## SIRENIANS

manatees. dugongs



## MARINE FISSIPEDS

polar bears. sea otters





## Marine Ecosystems & Protection

Marine animals are vital to oceanic ecosystems. All of Earth's water is connected through the water cycle. As precipitation (through rain, snow, etc.) falls to the ground and collects in oceans, lakes, streams, and on land, it moves, cycling this precious life-giving asset. Within the ocean, animals fulfill different ecological roles—herbivores (such as the manatee), filter feeders (such as the baleen whale), and top predators (such as the killer whale) are all essential. People have begun to realize the importance of caring for our environment, and we can go forward making better efforts to keep our water clean and protect life in the water.

Within the United States, there are laws such as the MMPA (Marine Mammal Protection Act) that protect marine life. Internationally, treaties have been formed to ensure the safety of these beautiful and important creatures. Many marine animals (not just mammals) are endangered because of poaching, trapping, pollution, climate change, harassment, accidents, and habitat loss. One organization that is working to help marine animals is NOAA, which stands for National Oceanic and Atmospheric Administration. Let's take a look at some of the things that NOAA, pronounced "NOAH," does to help these amazing animals.



### Case Study

Unlike humans, marine mammals do not have opposable thumbs. So when they get stuck in something, they cannot just pull the thing off and free themselves. This poses quite the problem when they get entangled in fishing gear.

Organizations like NOAA have people that work to find animals trapped in fishing gear and to free them. However, this isn't an easy task. In this case study, you'll see how rescuers disentangle a humpback whale.

An average humpback whale has remarkable strength and measures about 15 meters (50 feet) long and can weigh 40 tons! When one gets entangled in fishing gear, it becomes panicked and stressed.

Since rescuers do not want to harm themselves or cause further harm to the whale, they will not get into the water with the whale. Instead, they follow behind in a boat, and they use a grappling hook to catch and hold on to the tangled-up fishing lines. Next, they attach a series of buoys to try to keep the whale at the surface (to prevent it from diving down) and to help it slow down.

The rescue team will get into a small inflatable boat to try to catch up with the entangled whale. This isn't easy

because the powerful whale is still moving, but eventually it tires from swimming and slows down.

At this opportune moment, the disentanglement team will use a special tool that is attached to a pole. This tool is designed to cut away at rope without harming the whale. Once the team is able to cut away the rope and all associated fishing gear, the whale is free. Afterward, the team will clean up any remains of rope so it won't entangle another sea creature.

The Hawaiian Islands Humpback Whale National Marine Sanctuary has seen around 100 cases of entangled whales since 2002—and these are only the cases that people reported, so there could be more! While organizations make efforts to rescue, prevention is one of the best ways to protect these amazing sea creatures. Raising awareness of potential dangers and using safe, responsible fishing methods are just two ways that harm can be prevented, and in these ways, we can be better stewards of the earth.





**NORTH AMERICA**

United States

Rocky Mtns

CENTRAL AMERICA

Equator

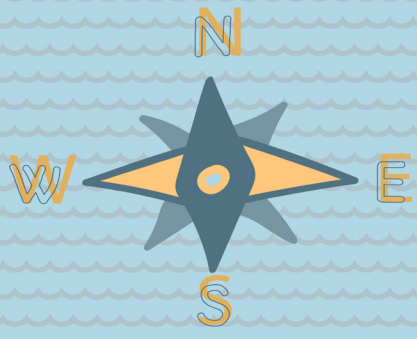
**SOUTH AMERICA**

United Kingdom

**EUR**

Sahara D

**AFR**



Mammals of the World Map

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COPE

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ICA

Russia

ASIA

China

India

SOUTHEAST ASIA

Borneo

Madagascar

AUSTRALIA

Tasmania

ANTARCTICA

