

KINGDOMS AND CLASSIFICATION

3-8 Science Unit Study



Kingdoms and Classification

CREATED BY THE GOOD AND THE BEAUTIFUL TEAM

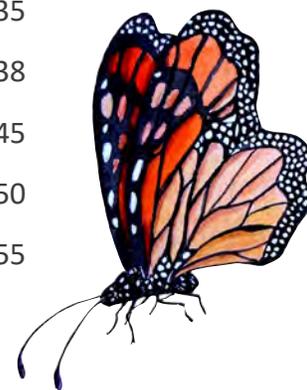
Prerequisite Unit

Most of The Good and the Beautiful science units can be used in any order. However, it is very helpful to complete this unit before *Botany* and *Mammals*.



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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 as directed in the lessons. Science journals can be purchased by going to goodandbeautiful.com/science and clicking on the *Kingdoms and Classification* unit link.

Science Wall



All The Good and the Beautiful science units include vocabulary words to be placed on your science wall, which is a wall or tri-fold presentation board in your learning area to 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 The Good and the Beautiful science units include easy-to-follow lesson preparation directions at the beginning of each lesson.

Activities and Experiments



Many of The Good and the Beautiful science lessons involve hands-on activities and experiments. An adult should always closely supervise children as they participate in the activities and experiments to ensure they are following all necessary safety procedures.

Optional Microscope Activities



This unit introduces the use of microscopes. In this unit there are several microscope activities, beginning with Lesson 2. The microscope greatly enhances the lessons, but if you do not have a microscope, this unit can still be completed by watching the microscope activity videos. Note: For help selecting and using your microscope, see “How to Use a Microscope” at goodandbeautiful.com/sciencevideos.

Experiment Videos



Go to goodandbeautiful.com/sciencevideos and click on the *Kingdoms and Classification* link or use the Good and Beautiful Homeschooling app to see videos of experiments used in this unit. This is a convenient way to watch experiments that may be more complicated. Children often learn best through hands-on experience; therefore, this unit includes a supply list and instructions for all experiments, and you may choose to do as many as you wish.

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 or from the Good and Beautiful Homeschooling 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.

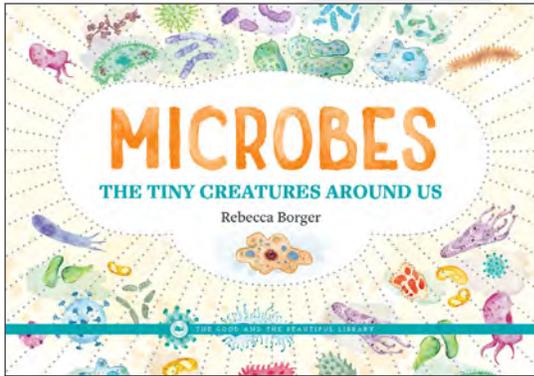
Versions

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

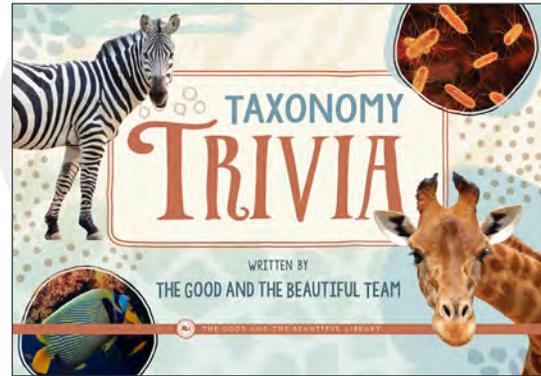


Read-Aloud Book Pack

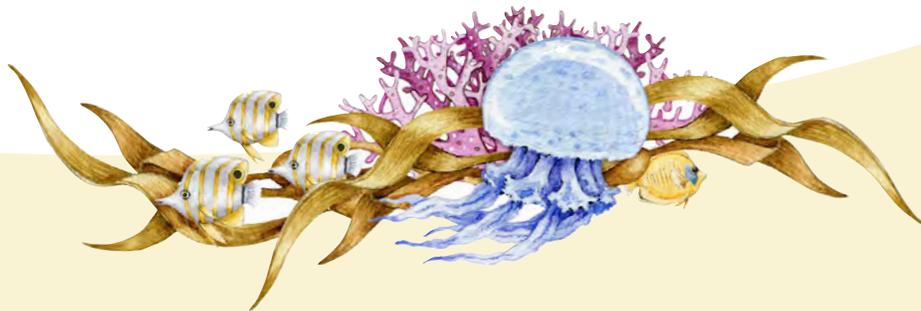
The books below are optional read-aloud books that complement this unit. These books can be purchased as a book pack by going to goodandbeautiful.com/science and clicking on the *Kingdoms and Classification* link.



Microbes: The Tiny Creatures Around Us
by Rebecca Borger



Taxonomy Trivia
by The Good and the Beautiful Team



CORRELATED BOOKS

The Good and the Beautiful Library has several books that correlate well with the *Kingdoms and Classification* 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 library includes both fiction and nonfiction books organized according to reading level. Find these correlated books by going to goodandbeautiful.com and clicking on the *Kingdoms and Classification* science unit product page.



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 Kingdoms and Classification Student Journal*.

Answer Key

The answer key for the lesson extensions can be found by going to goodandbeautiful.com/science and clicking on the *Kingdoms and Classification* unit. From there click on the FAQs, Helps, and Extras page.

Flexibility

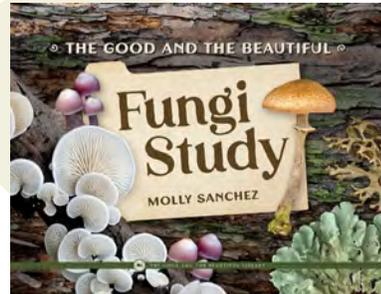
The amount of time it will take to complete each lesson extension will vary for each child. The average time is about 10–15 minutes per extension. Parents/teachers and children may choose to omit parts of the lesson extension if desired. Encourage the children to stretch their capabilities, but also 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 and then to summarize 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 *The Good and the Beautiful Fungi Study* by Molly Sanchez as extra reading for students in grades 7–8. This book can be purchased by going to goodandbeautiful.com/science and clicking on the *Kingdoms and Classification* unit link.



The Good and the Beautiful Fungi Study
by Molly Sanchez



Supplies Needed

o o o

This section is divided into supplies needed for **activities** and supplies needed for **experiments**. If you would prefer to watch the experiments instead of perform them, you can watch all the experiments at [goodandbeautiful.com/sciencevideos](https://www.goodandbeautiful.com/sciencevideos) or on the Good and Beautiful Homeschooling app. The activities, however, are not filmed.

For Optional Use with Lessons 2, 5, 7

- High-quality compound microscope
- Methylene solution
- Glass slides and coverslips
- Toothpicks
- Clear tape
- Eyedropper
- Paper towels
- We have tested and reviewed microscopes. Our top-recommended microscope is AmScope M150C 40x–1000x All-Metal Optical Glass Lenses Cordless LED Student Compound Microscope (monocular). You do not have to use our recommended microscope.

Lesson 1

- Pencil or pen
- Paper clip

Lesson 2

- 2 pieces of thread, yarn, or rope about one foot long per child
- Agar plates purchased online or 5 paper cups, plastic wrap, 5 rubber bands, $\frac{1}{2}$ cup water, 2 tsp sugar, 2 tsp gelatin
- Disposable gloves

Lesson 3

- Permanent marker
- 7 standard-sized disposable cups
- Tape

Lesson 4

- Agar plates prepared in Lesson 2
- 4 cotton swabs

Lesson 5

- 15–20 assorted office or household supplies, such as a paper clip, rubber band, pencil, sticky note, hair elastic, penny, bobby pin, eraser, staples, etc.
- Cup of water from a stagnant pond or lake (optional)

Lesson 6

- 3 empty disposable water bottles
- 3 balloons
- Marker
- 3 portions of $\frac{1}{4}$ c water each—two portions warm and one portion cold
- 3 Tbsp active dry yeast
- 1 Tbsp sugar
- Bowl
- Funnel
- Spoon or whisk
- Game pawn, piece of cereal, or coin

Lesson 7

- Shallow pie pan and tall glass filled with $\frac{1}{2}$ inch of water each
- Dry sponge
- Straw
- Thin layer of onion (optional)

Lesson 8

- None

Lesson 9

- Glue
- 1 M&M® (or similar hard-shelled candy) for each child

Lesson 10

- A pipe cleaner for each child
- 10–15 beads for each child

Lesson 11

- None

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.



Organism

any living thing that can move, grow, and reproduce; most need air, food, and water

Microorganism

an organism so small it can only be viewed with a microscope



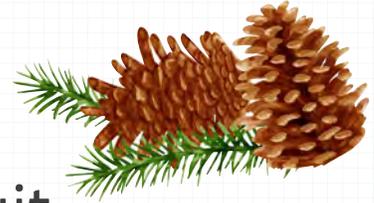
Cell

the small, basic unit of living matter of which all organisms are made



Gymnosperm

a plant without flowers that produces seeds not covered by fruit



Invertebrate

a group of animals without a backbone or spine

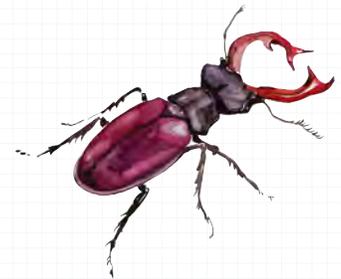
Vertebrate

a group of animals with a backbone or spine



Exoskeleton

a skeleton located on the outside of a creature's body



Introduction to Living Things

Objective

Help the children learn about the wondrous diversity of life as they discover the defining characteristics of all living things on Earth.

Preparation:

- Cut out the “Living Things” cards.
- Cut out the “Characteristics of Life Icons” cards from each child’s student journal.

Activity Supplies:

- Pencil or pen
- Paper clip



Picture Activity



Place the cut-out “Living Things” cards in front of the children.

Read to the children. Point to each

picture as you discuss it: Can you find anything this amoeba, mushroom, tree, red stag, and sea coral have in common? What differences do they have?

Pause for response. It’s probably much easier to find the differences, but they do have one main thing in common—they

are alive! God has created a world that is teeming with life, most of which we can’t even see! **Point to the blob-like gray amoeba.** If you were



to collect a drop of water from a pond, there could be many amoebas within it, too small to see with your eye. This yellow sea coral is something else you can find in the water, but unlike the amoeba, it is actually an animal! God created all of the living beings on the planet with their own characteristics and purposes. In this unit you will learn about what is unique about each life form and what ties them all together. **Save the cards to use later in this lesson.**

Science Wall: Vocabulary Words



Place the vocabulary cards **ORGANISM** and **MICROORGANISM** on your science wall. Read and discuss the words and their definitions.



Characteristics of Life Game



Place the spinner page and each child’s set of cut-out “Characteristics of Life Icons” cards in front of the children. Have each child pick a cut-out “Living Things” picture used in the previous activity to place in front of himself or herself. If there are more than five players, have the children work in teams.

Read to the children: Living things have more in common than you might realize. Some scientists debate over what categorizes something as living vs. nonliving. However, there are eight commonly accepted attributes we will cover in this unit.



We are going to play a game to learn about each one. The goal of the game is to collect all eight characteristics. **Place the “Characteristics of Life Icons” cards near the children. Place the paper clip in the center of the spinner and put the pencil tip through it.** Each of you will take turns spinning the paper clip and collecting the picture of the characteristic you land on. I will read a brief description of each characteristic as it is collected for the first time from the list on this page. If you land on a characteristic that has been read already, you will briefly describe that characteristic. If you have already collected the characteristic you land on, your turn is over. **The first person to collect all eight can be declared the winner, or all players can try to beat a 10-minute timer.**

CHARACTERISTICS:



Living things have DNA. Located within a cell, hereditary DNA is a tiny twisted strand of chemical molecules. It contains the instructions for how an organism looks and functions and is passed down when an organism reproduces. An insect’s DNA tells it to grow wings or six legs, or to have the ability to glow at night.



Living things have cells. All living things have either one or many cells—the building blocks of life. Some *microorganisms*, such as bacteria, fungi, and viruses, are made of one or a few cells. Humans are *organisms* with over 30 trillion cells!



Living things reproduce. Reproduction is the process of living things creating new life. A mother and father cat create new life and pass down their DNA to their baby. This DNA tells the kitten’s body to grow up into an adult cat.



Living things grow and develop. A living thing grows larger and changes as it matures. Consider a frog. The tadpole grows larger and then develops into a frog.



Living things need energy. In order to stay alive, organisms must consume food for energy. This is done in a variety of ways: some organisms eat other organisms, some produce their own food, and others break down dead material for food. A plant’s DNA tells it to convert sunlight into energy so that it can make its own food.



Living things have senses. Although some organisms have very limited senses, all are able to respond to stimuli in an environment. For example, earthworms don’t have eyes, but they are able to sense vibrations and light. They can even taste some flavors through the nerves in their skin.



Living things require homeostasis. As you sit during this lesson, your heart is beating a steady rhythm. You have internal balance or *homeostasis*. If a balloon suddenly popped nearby, it might surprise you, and your heart would beat more rapidly. After a time your heart would return to homeostasis and its steady rhythm. The beating of your heart is one example, but other body functions fluctuate and return to balance, such as body temperature, breathing, hormones, and emotions.



Living things can move. At some stage in their lives, all living things move; flowers open to the sun, cheetahs run across the savanna, and sea sponges float about the ocean as polyps.



Living and Nonliving Hunt Activity



Read to the children: Everything around us is either living or nonliving. To explore this further, we are going to do a scavenger hunt.

Have the children turn to the “Living and Nonliving Hunt” page in Lesson 1 of their student journals.

Depending on the season and weather, this activity may be completed outside or inside.

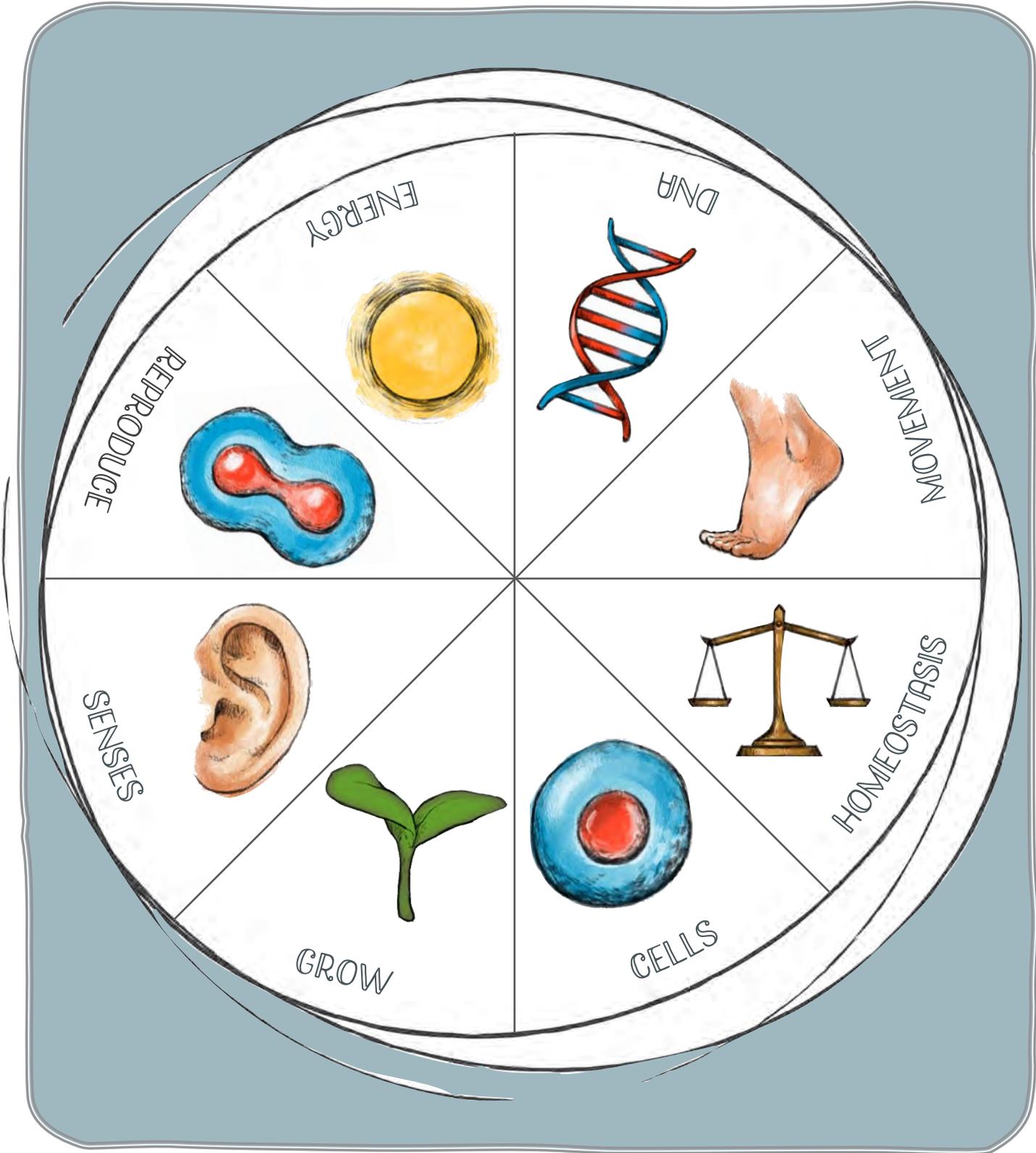
Lesson 1 Extension



Have children grades 7–8 complete the self-directed Lesson 1 extension titled “DNA and Classification” in their student journals.



Spinner



Classification

Objective

Help the children understand and identify the levels of classification and the six kingdoms of life.



Preparation:

- Cut out the “Tiger Taxonomy” squares.
- Write one of the following classification levels on each cup with a permanent marker: kingdom, phylum, class, order, family, genus, species.

Activity Supplies:

- Permanent marker
- 7 standard-sized disposable cups
- Tape

Optional Read Aloud



At any point in the lesson, you may read one of the books from the optional Read-Aloud Book Pack. Longer books may be split into more than one reading session.

Taxonomy Trivia by The Good and the Beautiful Team is suggested with this lesson.

Organization of Living Things

Read to the children: Did you know that new species are discovered every year? A species is a group of animals that all share the same characteristics. Look at the Rice’s blue whale in the picture below. Until recently the Rice’s blue whale was believed to be one of the species of baleen whales. With further study scientists realized that this whale had differences in its skeleton that made it unique from other whales it



had been grouped with. Why do we group animals into species? In this lesson we will discover the answer to that question and see how scientists determine what creatures should be grouped together.

Systems of Organization



Read to the children: Imagine you want to find a certain book at your public library. Would you walk down the aisles and read every single title to find it? No! You would use the library’s system of organization to find the book more quickly. Libraries are organized by sections, such as adult, young adult, youth, nonfiction, and fiction. Within these sections books are given a number that tells you the subject of the



book or are labeled with the author’s last name and put in alphabetical order. The classification system used by libraries narrows down large categories into smaller ones, like the roots of a tree coming from the thick trunk and spreading out into smaller and smaller underground branches.

Your public library holds thousands of books. But did you know there are about 8.7 million different kinds of living things on the earth that we know of, from flowers blooming in the sun to eagles soaring in the skies? Do you think it is important for them to be organized? Why do you think so?



Carl Linnaeus created a system for classifying living things in the 1700s with only two kingdoms: plants and animals. In his time many new organisms were being discovered, and there was not a system for naming or classifying them. This meant that organisms were given

very long names that were difficult to remember, and it was impossible to see how things were related. Thinking back to our library example, it was as if books were being put on shelves in a library randomly. It was difficult to ever find the book, or organism, needed.

Give the children the seven labeled cups. *Kingdom* is the first of seven levels of classification. This level is a large group that includes a variety of creatures. As you move down the levels, they gradually become more specific. *Species* is the last group and includes creatures with the same characteristics that are able to reproduce together. Starting with the cup labeled “Kingdom,” see if you can stack the cups in order according to the diagram below. **Have each child take a turn stacking them in the correct order with Kingdom at the bottom and the other levels of taxonomy inside the Kingdom cup.**

Tape a cut-out “Tiger Taxonomy” card to the outside of each correct cup. Have the children place them in a row in the correct order. Read to the children: Look at all the different creatures included on the cup labeled “Kingdom Animalia.” Move down the row and look at the animals in each picture on the cups. Each classification level narrows down the creatures included until you reach the specific species. **Have the children take turns stacking the cups in order again. If desired, have them try stacking the cups multiple times while being timed to see if they can get faster! If desired, keep the cups to practice with prior to each lesson or every other lesson.**

Read to the children: Now we will see this classification on the “Taxonomy of Life” chart. Find the “Kingdom Animalia” circle. See if you can follow the groupings down the “Taxonomy of Life” chart to find where tigers fit.

Classification Cups Activity



Have the children turn to the “Taxonomy of Life” chart in Lesson 3 of their student journals.



Read to the children: Look at all the different forms of life that God has created! This chart shows the *classification*, or grouping, of just a few organisms based on shared

characteristics, similar to Linnaeus’ system. Point to each of the six circles labeled “Kingdom.” These six kingdoms are the first major grouping of organisms based on their cell and development types. *Note: Some scientists organize creatures into five or seven kingdoms. We will study six kingdoms because that is the system most scientists use.*

HIERARCHY OF BIOLOGICAL CLASSIFICATION



Tiger Taxonomy



Kingdom
Animalia



Phylum
Chordata



Class
Mammalia



Order
Carnivora



Family
Felidae

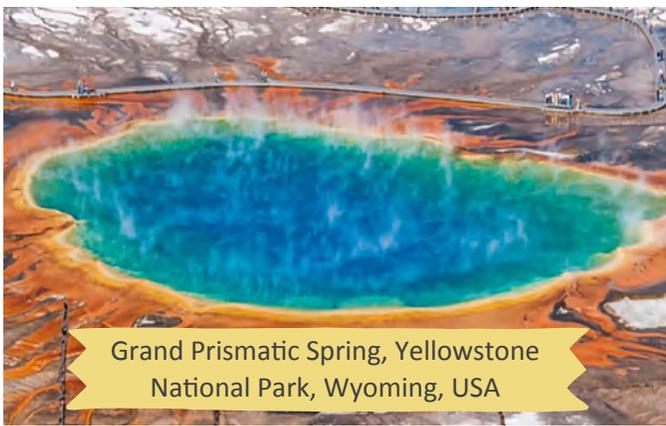


Genus
Panthera



Species
tigris

Bacteria and Where They Are Found



Grand Prismatic Spring, Yellowstone National Park, Wyoming, USA



Eifuku Chimneys "Champagne" hydrothermal vents at Eifuku Seamount Volcano, Pacific Ocean



Shore of Great Salt Lake, Utah, USA



Coastline of Antarctica



Escherichia coli



(Image: Anne Fjelbirkeland), CC BY 2.5, via Wikimedia Commons

Methylococcus capsulatus



Alcanivorax borkumensis



Gloeocapsa magma

1

The Eifuku chimneys are hydrothermal vents found deep in the ocean that pump out water that is 103 °C (217 °F). The bacteria living there enjoy the high temperatures.

FEW

2

Located in Yellowstone National Park in the USA, the Grand Prismatic Spring is 71 °C (160 °F). The color of the pool is a result of the bacteria that live in it.

ER

3

The icy cold terrain of Antarctica is generally below 0 °C (32 °F), but the freezing temperature is no hindrance for the bacteria that call it home.

THAN

4

The shore of the Great Salt Lake is so salty that nothing grows except for the bacteria that eat the salt and give the water its purple color.

ONE

THIS SPECIES

5

uses methane gas to produce energy and converts it into carbon dioxide and water.

DIFFERENCE

Eubacteria live everywhere on Earth.

PER

THIS SPECIES

6

is found in human intestines and helps with digestion. Some strains cause disease.

DIFFERENCE

Archaeobacteria only live in extreme environments.

CENT

THIS SPECIES

7

is commonly seen as black and green stains on rooftops.

DIFFERENCE

Archaeobacteria are simple microorganisms.

THIS SPECIES

8

is often unseen in the ocean until oil is present, then it appears to feed on the oil and reduce the amount in the ocean.

DIFFERENCE

Eubacteria are complex microorganisms.

Marvelous Mushrooms



Bleeding Tooth Fungus

not edible ←



Found primarily in coniferous forests in the Pacific Northwest, this is one of the most unique mushrooms in the world. Dark red liquid oozes from small holes on its cap.



The Giant Puffball

→ edible



The name of this mushroom fits its appearance perfectly. Generally the size of a soccer ball, this white orb-like mushroom can grow to be 1.5 meters (5 feet) wide and weigh 23 kilograms (50 pounds)!



Amanita Mushroom

some are poisonous ←



The traditional storybook mushroom, this red-capped fungus is what many may think of when they picture mushrooms.



Honey Mushroom

→ edible



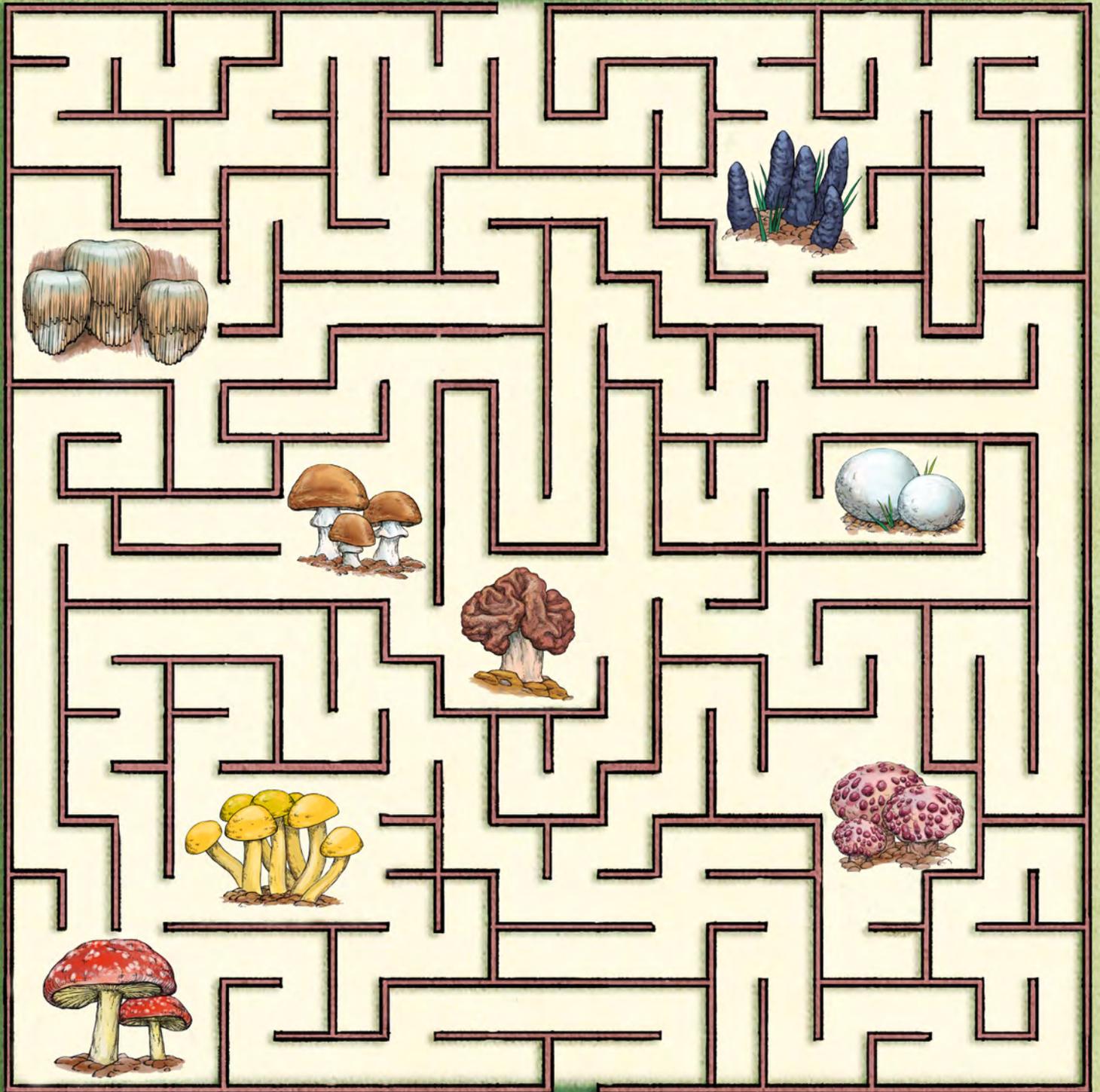
The largest organism in the world is a specimen of honey mushroom that is 2,385 acres in area, which is about 1,350 soccer fields! The mushrooms you see above ground are only part of the organism. Underground is a vast network of root-like structures called mycelia. This mushroom is also interesting because bioluminescent bacteria living on its surface cause it to glow!

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Marvelous Mushroom Maze



START



FINISH



Plantae Kingdom: Gymnosperm and Angiosperm

Objective

Help the children understand the differences between angiosperm and gymnosperm plants of the Plantae kingdom.



Preparation:

- Cut out the numbers at the bottom of the “Seed Stories” page.

Activity Supplies:

- None

Art Observation



Have the children observe the painting by Carl Frederik Aagaard included in this lesson.

Read to the children: Can you find the plants growing on the rock? Would these plants be vascular or nonvascular? [nonvascular] Do you see the green trees and beautiful flowers? Would these plants be vascular or nonvascular? [vascular] Vascular plants are able to grow much taller than nonvascular plants. Why is this? [Vascular plants contain xylems inside their stems that transport water throughout the plants.] God created a variety of plants that bring great beauty and bounty to our world. Vascular plants are divided into two types known as *angiosperms* and *gymnosperms*.



Angiosperm vs. Gymnosperm

Read to the children: Have you ever bitten into a juicy grape and been surprised to find a seed inside? The grape plant is an angiosperm, which is a plant that has flowers and produces seeds inside a fruit. Gymnosperms, on the other hand, do not grow flowers, and their seeds are not encased in a fruit but open to the air. The seeds of the Norway spruce conifer tree can be found nestled between the *scales*, or the rounded, spiky parts that stick out and give the pine cone its shape.

Science Wall: Vocabulary Words



Place the vocabulary cards **ANGIOSPERM** and **GYMNOSPERM** on your science wall. Read and discuss the words and their definitions.



Angiosperm



Gymnosperm



Creature Spotlight: Redwood



Read to the children:

In a foggy forest on the coast of California, USA, grow trees so

wide you can drive a car through their trunks. These coastal redwoods are also very tall. One in particular, given the name “Hyperion,” reaches an astounding 116 m (380 ft) in the air and is the tallest tree in the world.

Its exact location is kept a secret to protect it from too much attention. To reach their skyscraping heights, redwoods can grow 1–3 m (3–10 ft) every year for the first 100 years of their lives. As the longest living organisms on Earth, they can live for over 2,000 years! Are redwoods gymnosperms or angiosperms? Why? [Gymnosperms; they produce cones, not flowers.] **Have the children turn to the “Taxonomy of Life” chart in Lesson 3 of their student journals and follow the path from Plantae Kingdom to the species called *Sequoia sempervirens*, the scientific name for the coastal redwood.**



the furry squirrel opens the protective cone, and the seed falls out onto soft ground in a sunny meadow, where it begins to grow into a new tree. [3, 1, 4, 2; gymnosperm]



2 A large seed with a thin covering falls from a ginkgo tree with fan-shaped leaves. It falls onto a sidewalk and rolls into a shallow crack. It tries to sprout and grow its roots, but there is not enough soil, and it is too hot on the sidewalk. The seed is not able to grow into a ginkgo tree. [4, 2, 1, 3; gymnosperm]

3 A beautiful apple blossom blooms and is visited by a busy bee. Pollen on the bee’s fuzzy legs rubs off on the apple blossom. The fertilized flower grows into an apple that falls to the ground when it is ripe. A bird comes and eats the apple before the seeds are able to sprout. [2, 4, 1, 3; angiosperm]



4 A field of wheat ripples in the wind. A kernel is blown from its head and carried on the wind. It lands in a deserted patch of land full of weeds and thorns. When it begins to sprout, it is unable to grow because the surrounding weeds take all the water and block the sunlight from reaching the seed. [3, 2, 4, 1; angiosperm]



Seed Stories



Give the children the cut-out numbers. Remove the Seed Stories page and place it in front of the children.

Read to the children: As you listen to each story below, place numbers 1–4 on the pictures on the “Seed Stories” page to put the story in order. When I finish each story, you will tell me if the seed I described is from a plant that is an angiosperm or gymnosperm.

1 A pine cone containing a hidden seed falls from the top of a great evergreen tree to the forest floor. A squirrel comes along and grabs the cone, carrying it to its hidden stash. When it gets hungry,

Good Soil

Read to the children: Did you notice that in the stories one of the seeds was able to sprout, and the others were not? Which seed was able to sprout? Whether a seed is an angiosperm or a gymnosperm, it needs the right soil conditions to sprout. The passage below from the 13th chapter of Matthew illustrates different types of soil. The seed represents the Word of God. This passage not only teaches us about good soil for plants, but it is also a parable for the soil of our hearts. **Have the children take turns reading the verses, and then discuss the questions at the end of the section.**

- 3: Behold, a sower went forth to sow;
 4: And when he sowed, some seeds fell by the way side, and the fowls came and devoured them up:
 5: Some fell upon stony places, where they had not much earth: and forthwith they sprung up, because they had no deepness of earth:
 6: And when the sun was up, they were scorched; and because they had no root, they withered away.
 7: And some fell among thorns; and the thorns sprung up, and choked them:
 8: But other fell into good ground, and brought forth fruit . . .

MATTHEW 13:3-8

1. What are the four different types of seed conditions listed in the verses? [way side, stony places, thorns, and good ground]
2. What do you think would be considered good ground for a seed? [fertile soil, plenty of water, sunny location, etc.]
3. How can we make our hearts a good place for the Word of God to take root?

Sorting Seeds



Read to the children: All vascular plants reproduce using seeds. However, the pollination process and type of seed created differs between angiosperms and gymnosperms.

Angiosperms produce flowers that are pollinated primarily by insects. The seed develops enclosed in fruit.

Gymnosperms produce seeds that are pollinated primarily by the wind. The seed develops without a covering.

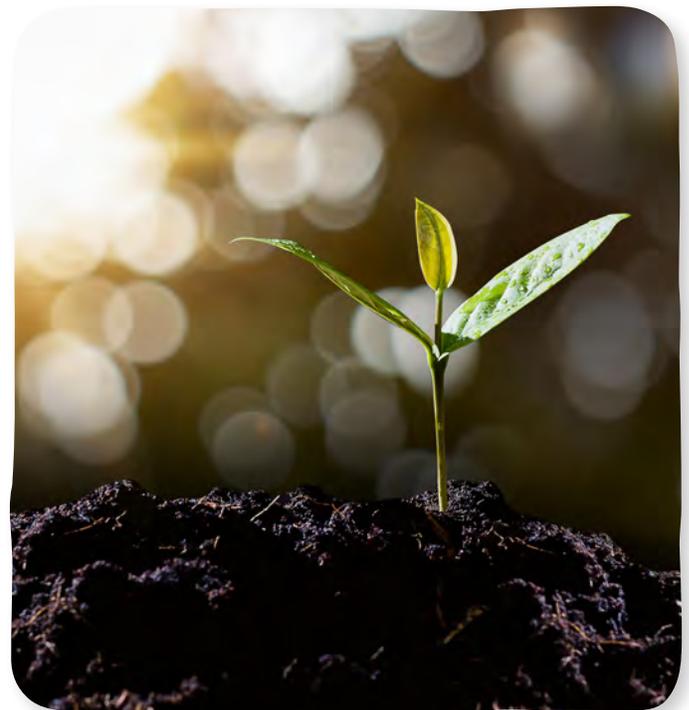
Have the children turn to the “Sorting Seeds” page in Lesson 8 of their student journals and follow the instructions.



Lesson 8 Extension



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





"Wildflowers by a Cornfield" by Carl Frederik Aagaard (1833–1895), date unknown

Seed Stories



1	2	3	4
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Animal Kingdom: Vertebrates

Objective

Help the children understand the characteristics of vertebrates in the Animalia kingdom.



Preparation:

- Cut out the “Animal Field Journal: Vertebrates” cards from each child’s science journal.
- Write the words “endothermic” and “ectothermic” on two separate slips of paper, one set for each child.

Activity Supplies:

- A pipe cleaner for each child
- 10–15 beads for each child

Complex Creatures

Read to the children: In this unit we have seen a variety of living things, from basic, unicellular bacteria to towering trees. We have gradually learned about the simple to the complex. This wide range of complexity gives our earth diversity and connection. Each species is unique and needed, just like every person.

Humans have the distinction of being the most complex living things on our planet. Unlike protists, we are able to learn and remember. Because we have a backbone and an endoskeleton that holds us up and helps move our muscles, we can run, jump, and dance, whereas a snail moves slowly across the ground. God has created all things to serve a unique purpose. Think of the unique talents that you have. What is something you do that benefits your family or community? **Discuss this question with the children.**



Watch the video titled “Vertebrates: Complex Creatures” at goodandbeautiful.com/sciencevideos or from the Good and Beautiful Homeschooling app. Discuss the following questions:



1. Animals display an astounding variety of abilities—jumping, flying, swimming, changing color, regrowing limbs, etc. If you could have any of these abilities, which would you choose?
2. Why do you think variety is important?

Backbone Beads



Give each child a pipe cleaner and 10–15 beads.



Read to the children: Stand up and place your hands on your back. Can you feel your backbone? Bend over and move side to side. Your backbone gives your body structure and allows you flexibility. **Have the children place the beads on their pipe cleaner.**

A backbone is made up of two parts. The first is the spinal cord, which is represented by the pipe cleaner. This cord carries nerves that send important messages to and from your brain. It is important and needs to



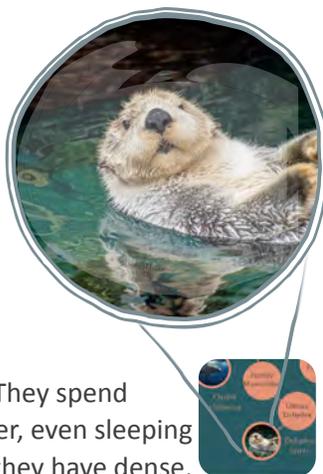
be protected by the second part of your backbone, the vertebrae bones, which are represented by the beads. Humans have 33 vertebrae stacked on top of each other like the beads on the pipe cleaner. Each bone is connected to muscle that allows it to twist and turn. **Have the children move the pipe cleaner in different directions to show the flexibility of the backbone.**

☐ Creature Spotlight: Southern Sea Otter



Read to the children: Off the coast of California, USA,

you might spot some of these marine vertebrates swimming, floating, or playing in the Pacific Ocean. They spend most of their time in the water, even sleeping while floating. To stay warm they have dense, waterproof fur that protects their bodies from the cold water. **Have the children turn to the “Taxonomy of Life” chart in Lesson 3 of their student journals and follow the path from Kingdom Animalia to the species *Enhydra lutris*, the scientific name for the sea otter.**



vertebrates: birds, mammals, reptiles, amphibians, and fish. While they all share the characteristic backbone, each class is unique and is either **ectothermic** or **endothermic**. Sea otters are endothermic because they are able to maintain their body temperature with thick protective fur. As I read about each class of vertebrates below, raise your ectothermic or endothermic card to show how you believe their body regulates heat. **Review the vocabulary cards as needed.**

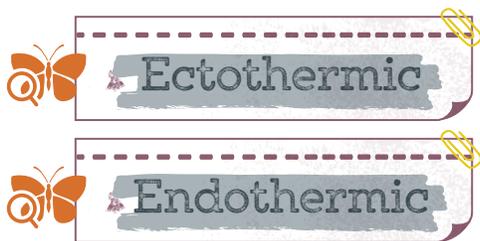
Birds: Covered in feathers that help maintain their body heat, birds are most distinct for their ability to fly. They are found on every continent of the world and include varieties like the penguin, ostrich, eagle, and hummingbird. [endothermic]



☐ Science Wall: Vocabulary Words



Place the vocabulary cards ECTOTHERMIC and ENDOTHERMIC on your science wall. Read and discuss the words and their definitions.



☐ Vertebrate Diversity



Place one set of the previously written words “ectothermic” and “endothermic” in front of each child.

Mammals: Characterized primarily by the fact that they give birth to live young who feed on the mother’s milk, these animals are found throughout the world. It may surprise you to learn that there are only about 5,000 species in this class. Some have fur to help them maintain their body heat, while others have large amounts of fat or even blubber. [endothermic]



Read to the children: There are five classes of

Animal Field Journal Key

<i>Animalia</i>
<i>Arthropoda</i>
<i>Insecta</i>
<i>Coleoptera</i>
<i>Lampyridae</i>
<i>Photinus</i>

While many underwater creatures can produce their own light through bioluminescence, these small beetles are one of few on land to do so. On a summer night in warm climates, they will use these lights, created by a chemical reaction, to find a mate.



Firefly
Photinus pyralis

<i>Animalia</i>
<i>Cnidaria</i>
<i>Scyphozoa</i>
<i>Semaeostomeae</i>
<i>Cyaneidae</i>
<i>Cyanea</i>

Glowing in the ocean is a creature with over a thousand tentacles that can grow to be up to 37 meters (120 feet) long! It lives in cold waters near the surface and dangles its tentacles below to catch its prey. Like others in its phylum, it has stinging barbs that can kill unsuspecting fish that swim too close.



Lion's Mane Jellyfish
Cyanea capillata

<i>Animalia</i>
<i>Mollusca</i>
<i>Gastropoda</i>
<i>Stylommatophora</i>
<i>Helicidae</i>
<i>Helix</i>

A trail of slime follows in its wake as this invertebrate moves through the forest. Commonly called escargot, these small mollusks live in forests and feed on fungi and decaying plants. Snails create their shells in a spiral shape that gradually grows as the snail does.



Snail
Helix pomatia

<i>Animalia</i>
<i>Porifera</i>
<i>Demospongiae</i>
<i>Haplosclerida</i>
<i>Petrosiidae</i>
<i>Xestospongia</i>

This creature is called home to many animals and looks more like a rock than an animal. It eats by pumping the water around it through its walls and filtering out nutrients. With a width up to 2 meters (6.5 feet) across, these giants are capable of pumping, filtering, and cleaning a lot of water.



Giant Barrel Sponge
Xestospongia testudinaria

<i>Animalia</i>
<i>Echinodermata</i>
<i>Echinoidea</i>
<i>Echinoida</i>
<i>Strongylocentrotidae</i>
<i>Strongylocentrotus</i>

These spiny relatives of sea stars live in rocky, shallow water near the shore. Eating primarily algae and the base of kelp, these tiny creatures can have a big impact on water ecosystems. These invertebrates can eat away the bases of an entire kelp forest, but predators keep their population in check.



Purple Urchin
Strongylocentrotus purpuratus

<i>Animalia</i>
<i>Annelida</i>
<i>Clitellata</i>
<i>Haplotaxida</i>
<i>Lumbricidae</i>
<i>Lumbricus</i>

Earthworms may be small, but they are one of the major contributors to the health of Earth's soil. As they move underground, they eat buried waste and recycle it into the soil as nutrients for plants and other organisms. There are over 7,000 different species of earthworms and they can be found on every continent except Antarctica.



Earthworm
Lumbricus terrestris

Invertebrates

Invertebrates

Invertebrates

■ World of Diversity

Let all things be done decently
and in order.

1 CORINTHIANS 14:40

Read the verse above to the children. Then read the following to the children: God created a world full of diversity to give it beauty and prosperity. We have been able to learn from the amazing creations to which He gave life and have preserved the vital natural systems around us by classifying, organizing, and ordering the living things on this planet. Not only are amazing scientific advances being made to benefit humans, but the beauty and diversity of the organisms around us lead to joy and wonder. By tracking and caring for our planet and its inhabitants, we will continue to enjoy the blessing of all God's creations into the future.

Note: There is no grades 7–8 Lesson Extension for this lesson.



KINGDOMS AND CLASSIFICATION

Grades 3-6

STUDENT JOURNAL

This journal belongs to:



INSTRUCTIONS

This student journal accompanies *The Good and the Beautiful Kingdoms and Classification* 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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Animal Field Journal21



LIVING AND NONLIVING HUNT

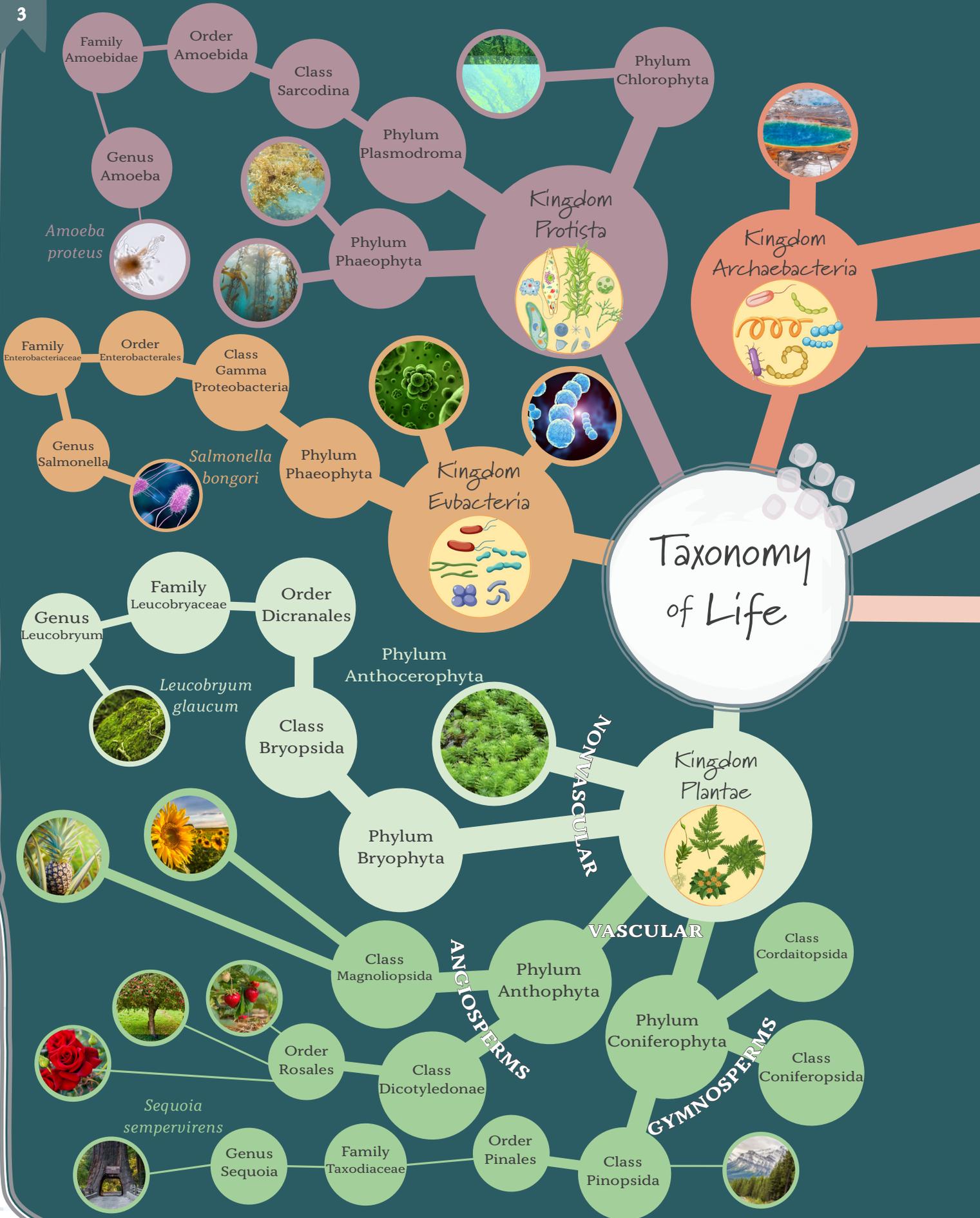
*Can be completed outdoors or indoors (looking for items inside or through a window)

Find at least five of the items listed below and write or draw them in the column under "Item." Observe each item and put an X in each box that applies to the item. More spaces are included if you would like to find more items. In the final box, draw an X if the item is living.

- ◇ rock
- ◇ ant
- ◇ fence
- ◇ house
- ◇ grass
- ◇ dirt
- ◇ worm
- ◇ pet
- ◇ tree
- ◇ flower
- ◇ window
- ◇ book
- ◇ cement
- ◇ bird
- ◇ plant
- ◇ spider

Item	 Needs Energy	 Grows & Develops	 Has Cells	 Has Senses	 Can Move on Its Own	 DNA	 Reproduces	 Homeostasis	 Living
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									





SCIENTIFIC NAME SEARCH

Referencing the chart below, draw lines from each bird's common name to each part of its scientific name.

COMMON NAME

SCIENTIFIC NAME



MOUNTAIN
BLUEBIRD

TURDUS

FORSTERI



EMPEROR
PENGUIN

APTENODYTES

CURRUCOIDES



SONG THRUSH

MICRATHENE

PHILOMELOS



AMERICAN
ROBIN

SIALIA

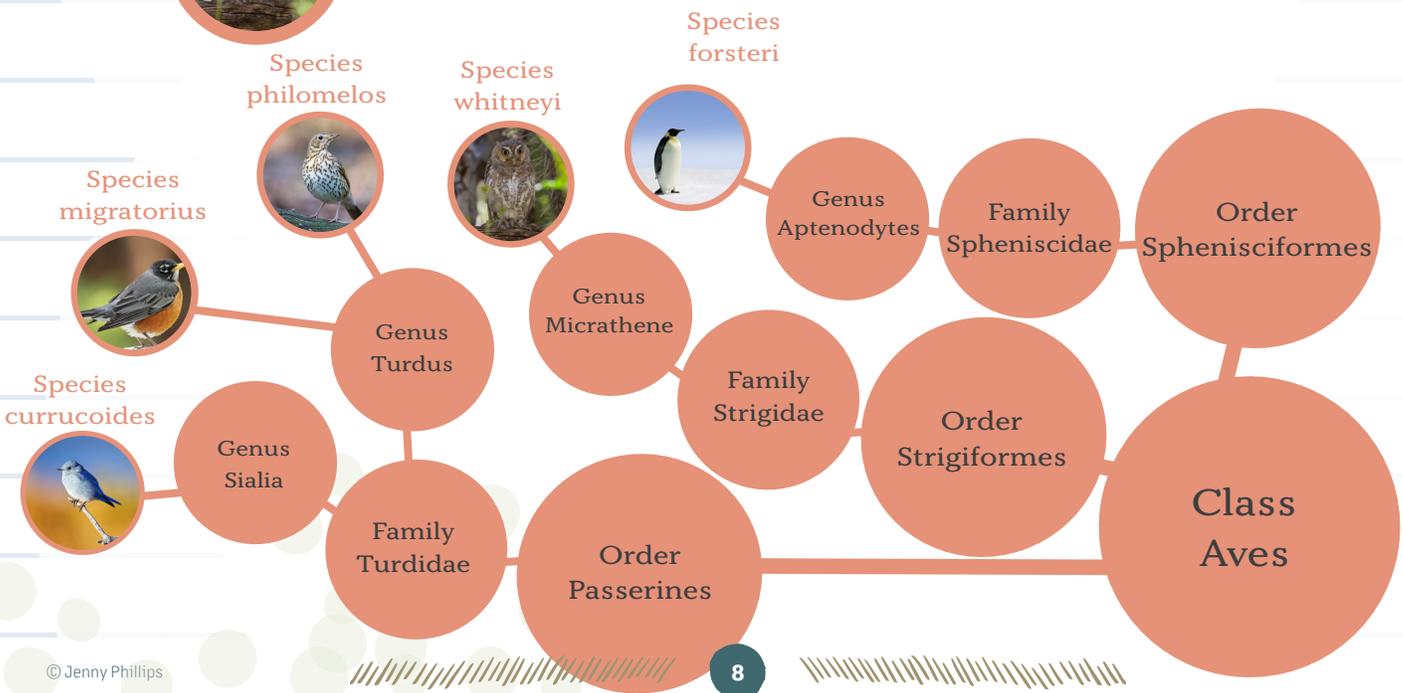
MIGRATORIUS



ELF OWL

TURDUS

WHITNEYI



YEAST EXPERIMENT RECORDING SHEET

DATE COLLECTED _____

My Predictions:

Cold Water	Warm Water	Warm Water + Sugar

My Results:

Cold Water	Warm Water	Warm Water + Sugar

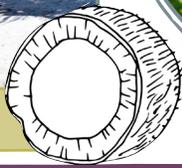


SORTING SEEDS

Write an "A" for angiosperm or "G" for gymnosperm in the seed next to each plant.



COCONUT



FIR



GINKGO



APRICOT



PINE



PUMPKIN



BEANS

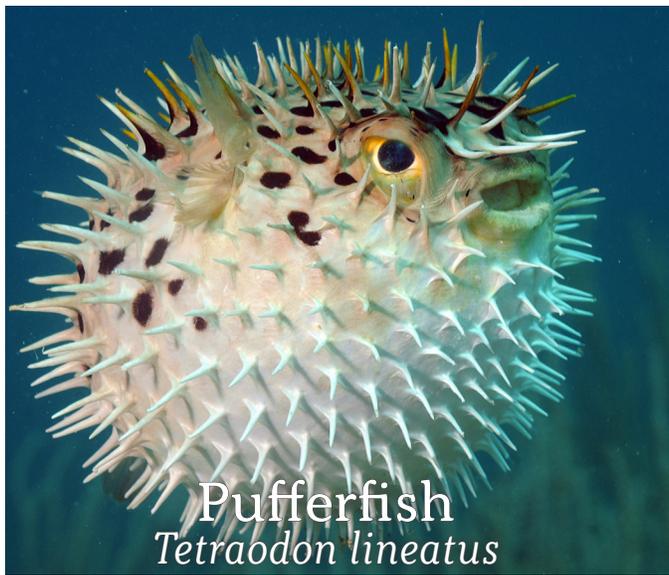


CYCAD



WALNUT





Pufferfish
Tetraodon lineatus



Poison Dart Frog
Oophaga pumilio



Chameleon
Chamaeleo chamaeleon



Ruby-Throated Hummingbird
Archilochus colubris



Dusky Leaf Monkey
Trachypithecus obscurus



Bottlenose Dolphin
Tursiops truncatus



KINGDOM ANIMALIA

- Read the story by replacing the pictures with the words in the key at the bottom.
- Then review the vocabulary cards ECTOTHERM, ENDOTHERM, VERTEBRATE, and INVERTEBRATE.



ran to the door. He was so happy to see the animals. The first thing

he wanted to see was the  . He loved how most  have fur to

keep them warm. Next, he went to see the  with their smooth,

scaly skin. His favorite was a  that had skin that could change

colors to camouflage, and right next to it was an  that could jump

really far!  remembered looking for  at a pond near his house.

Flying overhead were  in many different colors. He loved hearing

their songs.  sometimes wished that he could fly like a  . As he

walked by a large glass tank, he could see  swimming in the water.

These  came from rivers, and one was really big!  was sad

when it was time to go but glad that he could see so many amazing animals.

Sam



Reptile/s



Mammals



Amphibian/s

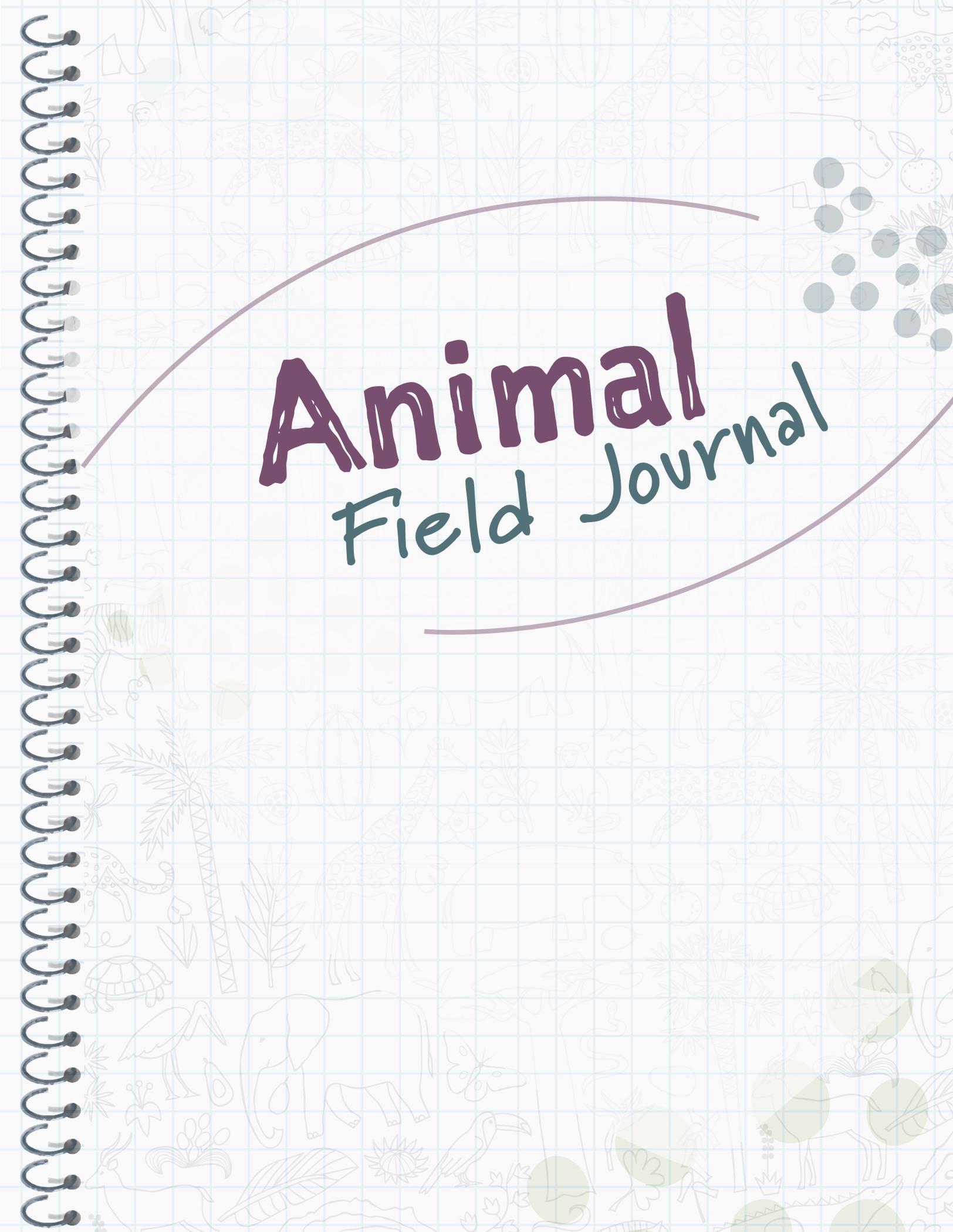


Bird/s



Fish





Animal Field Journal

- Animalia***
- Chordata***
- Mammalia***
- Primate***
- Cercopithecidae***
- Trachypithecus***

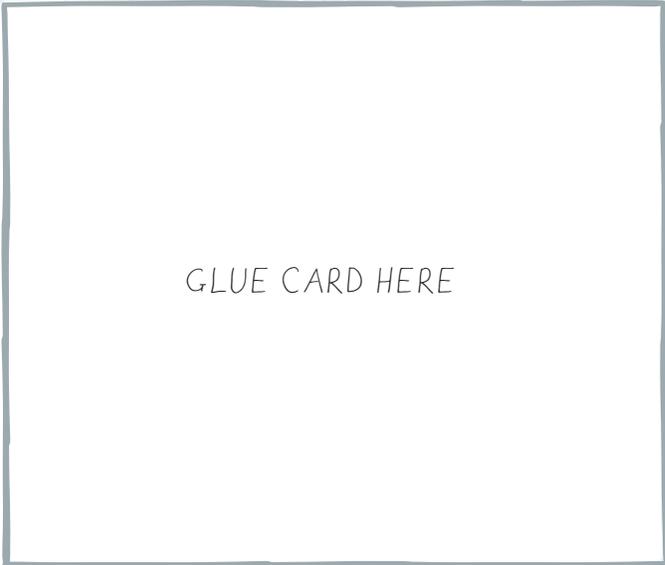
This monkey, with rings around its eyes that look much like glasses, spends its days playing and eating high in the trees. Like other primates, it has a prehensile tail, hands, and feet that are able to grab fast to branches. Given their small size, these monkeys eat a surprising amount of food each day, about one-third of their body weight!



Vertebrates

- Animalia***
- Chordata***
- Mammalia***
- Cetacea***
- Delphinidae***
- Tursiops***

Although they live in the water, these interesting animals are mammals and not fish. They give birth to live young and nurse their babies with milk from their bodies. They do not have gills and must go to the surface to breathe. Being highly intelligent, they can learn tricks and communicate with others in their group.



- Animalia***
- Chordata***
- Reptilia***
- Squamata***
- Chamaeleonidae***
- Chamaeleo***

These scaly ectothermic creatures are best known for their unique method of blending in with their surroundings by changing colors. Like monkeys, they have prehensile tails they can wrap around branches for greater stability. Their eyes can see in a full circle around them and can even look in two directions at once.



Vertebrates

- Animalia***
- Chordata***
- Actinopterygii***
- Tetraodontiformes***
- Tetraodontidae***
- Tetraodon***

When threatened, these unique animals quickly suck air into their stomachs and become three times larger in less than 15 seconds! Their expanded bodies are covered with dangerous spikes that are also full of some of the most toxic poison on Earth. The ability to puff up is made possible because of their lack of ribs.



KINGDOMS AND CLASSIFICATION

Grades 7-8

STUDENT JOURNAL

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INSTRUCTIONS

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The *Kingdoms and Classification* 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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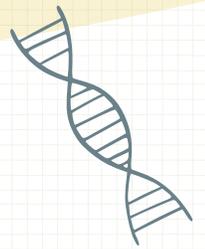
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EXTENSION

Instructions:

1. Read the information below.
2. With the help of DNA, scientists are better able to classify animals. Write two or three sentences explaining to someone who hasn't studied DNA and classification why it is important to distinguish differences between animals.

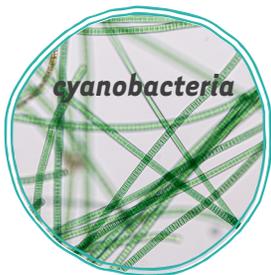


DNA and Classification

In the 18th century, scientists began using a system of organism classification developed by Carl Linnaeus. At that time classification was based primarily on the appearance of organisms or their ecological locations. Since that time new developments in science, primarily in DNA, have made it possible to determine even more accurately the relationship between certain organisms.

Changing Classification

All living organisms contain DNA. Scientists can now utilize the process of DNA sequencing to see the relationship between organisms. The more closely related organisms are, the more sequences they have in common. Even more importantly, sequencing helps scientists determine distinctively when a new species has been discovered. Due to these newer developments, classifications of some organisms have changed. An example of changing a classification and the discovery of new classifications is found in cyanobacteria. Previously



thought to be blue-green algae, **cyanobacteria** are single-celled microscopic organisms found naturally in all types of water. Like plants, they use sunlight to make their food. DNA sequencing allowed biologists to definitively classify this organism more accurately.

DNA Barcode

With an established database of DNA sequences in place, scientists have been able to create what is known as a DNA barcode for each species. Similar to the barcode a grocery clerk scans to add the price of an item to your total automatically, DNA barcodes are a short section of DNA sequence for a given species that allows scientists to quickly identify and determine the taxonomy of a species without evaluating its entire genetic code.

Giraffes

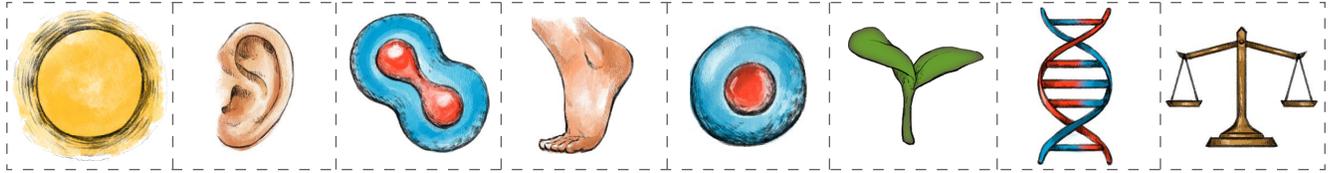
A giraffe is another organism that has been reclassified due to DNA findings. Prior to 2016 all giraffes were believed to be one species. Giraffes had not been extensively studied before this time. In 2016, through DNA analysis, scientists discovered that giraffes actually comprise four very different species.

This discovery was made by taking skin samples from more than 100 giraffes in Africa. DNA was extracted from each sample. After a comparative analysis, scientists were able to classify giraffes into four new groups: *Giraffa giraffa*, *Giraffa tippelskirchi*, *Giraffa reticulata*, and *Giraffa camelopardalis* (commonly named southern, Masai, reticulated, and northern giraffe respectively). This discovery has had a great impact on the preservation of these threatened species. Because these groups are so genetically diverse, they are not able to mate with one another. Conservationists now understand that they must have giraffes with the same DNA barcode together. DNA sequencing is a remarkable tool for correctly classifying living things and seeing the connections between them.

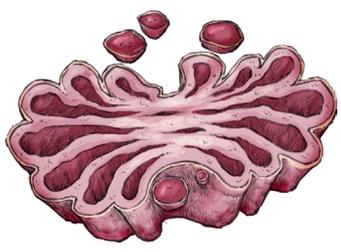
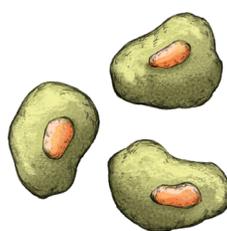
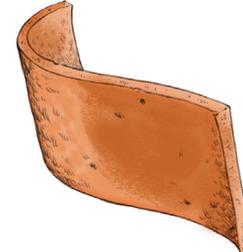
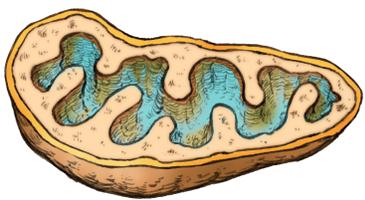
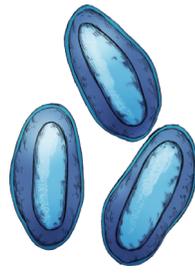
Can you “spot” any differences?



CHARACTERISTICS OF LIFE ICONS



PARTS OF A CELL

PROKARYOTE	EUKARYOTE	EUKARYOTE
		
		
		





EXTENSION

Instructions:

1. Read the information below.
2. Imagine you are a taxonomist who studies amphibians. Create an hourly schedule for your day starting at 8:00 AM and ending at 5:00 PM.



A Day in the Life of a Taxonomist

What do you think the day of a taxonomist would be like? Do you think they sit in a museum looking at specimens under a microscope? Perhaps they spend a lot of time writing about what they have found. Actually, in a given day they may do all of these things or one of these things. Each day is different but filled with study and discovery!

The purpose of taxonomists is to organize and classify the world around them. Most will choose a specific area to focus on, such as fish or parasites. Much of the life on Earth has been organized, but sometimes corrections to groupings need to be made and new species are found and need to be classified. The first step for a taxonomist is to find organisms to study.

To begin his or her day, a taxonomist may go out in the field to collect organisms. For example, parasite taxonomists gather small mammals, from which they can collect parasites. As with other scientists, specimens are collected during a field expedition where taxonomists spend days, or even weeks, in a specific area, collecting what they can to bring back to a laboratory for storage.

Once study material has been collected, either from the field or from storage, taxonomists work to identify the organisms. Taxonomists must be like detectives and ask questions like “How is this organism different than other similar organisms?” “How does this organism live?” “Where did it come from?” and “Does its DNA match an existing species?” To find the answers to these questions, taxonomists will look at the organism’s appearance, anatomy, DNA, and cells (under a microscope) and will consider where it came from. With all this information, they can identify the species as one already classified or give the new species a name and classify it.

At this point they will continue to evaluate the organism and will describe it in writing and by drawing pictures of its external and internal features. When the mystery of the organism is solved, they will write their findings in a

scientific paper and publish the paper in magazines or research journals.

There are many reasons these publications are useful. For example, fishermen will often contact taxonomists to determine the correct species of their catch for legal paperwork and market worth. Developers putting in a new shopping center might contact a taxonomist to determine the species of a resident animal before they can begin building. And conservationists need to know specific species to track their numbers and determine changes in population. To identify a species correctly, there must be documentation on that species—documentation that comes through published findings of taxonomists around the world.

New Species

FIND



To find new species, taxonomists go out in the field and collect unfamiliar organisms. Sometimes new species are found by scientists in other fields or even by common citizens.

IDENTIFY



Once found, an organism must be identified. This is done through DNA analysis, microscopic examination, and the study of the organism’s overall appearance. If the organism is unique, as in the case of a new species, it is given a name.

DESCRIBE



Taxonomists describe the creature by drawing its internal and external structures and writing down its characteristics and unique features.

PUBLISH



All the information about the new species is compiled into a scientific paper and published to benefit the entire scientific community.

AGAR PLATE BACTERIA COLLECTION RECORDING SHEET

DATE COLLECTED: _____

Bacteria Collected From: _____ #

Bacteria Collected From: _____ #

My Prediction

My Results
Date: _____

My Prediction

My Results
Date: _____

Bacteria Collected From: _____ #

Bacteria Collected From: _____ #

My Prediction

My Results
Date: _____

My Prediction

My Results
Date: _____

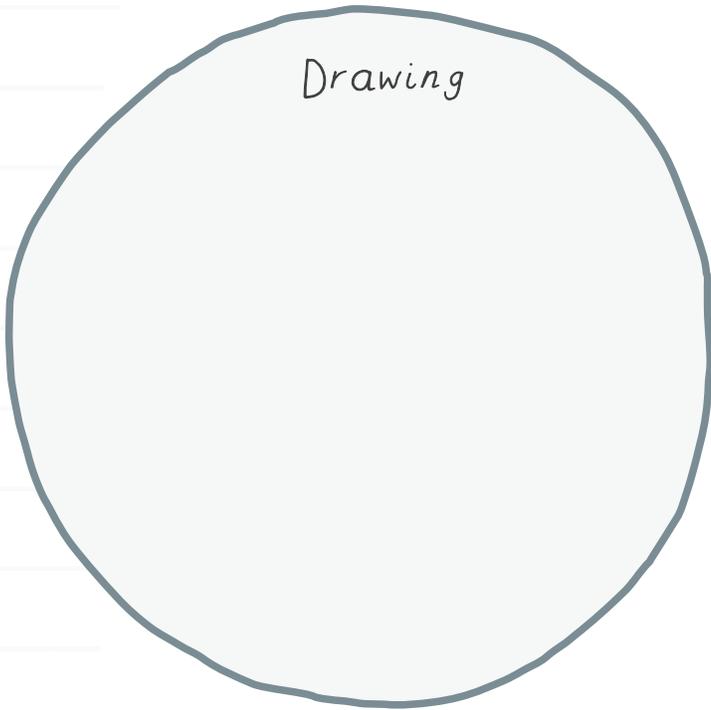
Control: _____ #

My Prediction

My Results
Date: _____

PROTIST MICROSCOPE LAB

Drawing

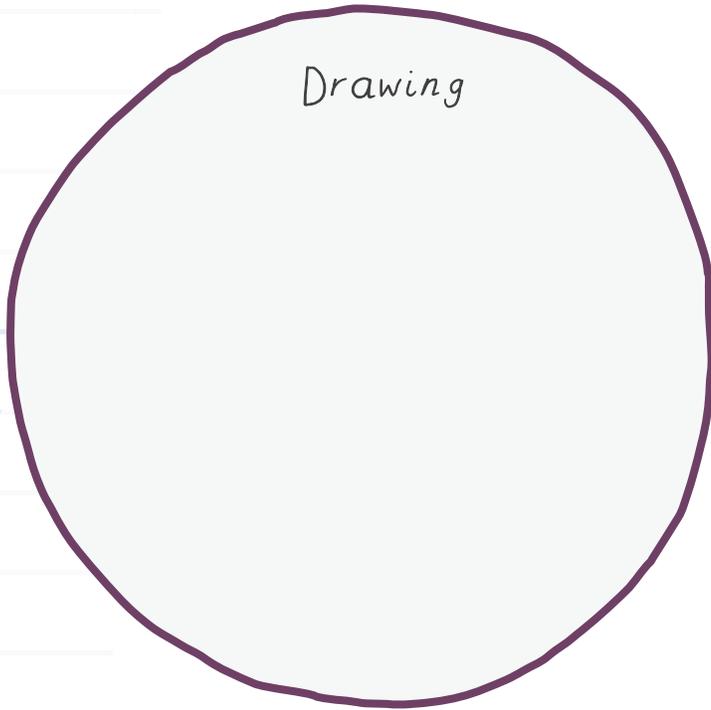


Date _____

Specimen Observed _____

Notes _____

Drawing



Date _____

Specimen Observed _____

Notes _____

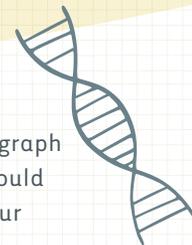




EXTENSION

Instructions:

1. Read the information below.
2. Imagine you are a scientist studying bioluminescence. Write a paragraph about what you hope to achieve with bioluminescence and how it could benefit mankind. Include two sentences on how you will conduct your research—working in a lab, diving deep into the ocean, etc.



Bioluminescence: The Language of Light

If light could talk, what would it tell us? The rhythmic green flashes of a firefly might say, “Hello,” and “How are you?” The sudden cloud of light coming from shrimp in the ocean might send the message “Stay away!” A fish swimming through a sea of plankton elicits an alarm of light that sounds, “Help!” In the darkness of night or the deep ocean, many creatures produce their own light in order to find food and protect themselves from predators.

The amazing chemical process behind the glow of fireflies, some fungi, and many deep-sea creatures is known as **bioluminescence**. The exact chemical compounds may differ by species, but in most cases when two chemicals come in contact with each other and oxygen within the creature’s body, they react, and a byproduct is light. For example, fireflies have two compounds in their bodies: luciferin (a light-emitting compound) and luciferase (a substance that promotes chemical reaction). When oxygen is introduced to these compounds, the abdomen of the firefly begins to glow. Other creatures, such as the angler fish, do not produce their own light but rather trap bioluminescent bacteria within folds of skin. The resulting glowing orb is the perfect lure for food.

Light in the darkness is a powerful tool for evading predators. Dinoflagellates are marine plankton that swim in great clouds. When a predator disturbs them by swimming too close, they will glow to attract a larger predator to eat the animal trying to eat them! This

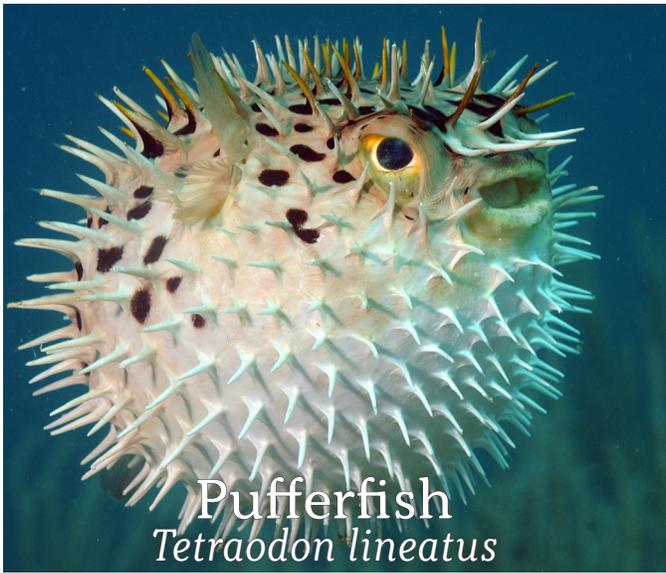
is known as the bioluminescent burglar alarm.

The fire shooter squid ejects blobs of light when threatened by a predator, instead of clouds of ink, to confuse and scare a predator while the squid swims away.

While fireflies glow green or yellow, most creatures in the ocean produce blue light. This is because blue light is the easiest to see at long distances, and therefore it is the most effective color at attracting prey from far away or sounding an alarm. Most creatures in the ocean can only see blue light. Some fish use color blindness to their advantage. By producing red light instead of blue, they are able to look for their prey without being seen by predators.

Bioluminescence is amazing, but it is surprisingly more common than we might realize. It is estimated that 80-90% of creatures in oceans are able to create light, most of which we have yet to discover! Scientists are working to harness this natural production of light by recreating in a lab the chemical reactions that take place within bioluminescent creatures. The potential benefits are numberless. For example, by creating bioluminescent trees, we could have lights along our highways that don’t require electricity. Flashlights might no longer require expensive batteries but shine with their own bioluminescent lights. What benefits can you think of for natural light production?





Pufferfish
Tetraodon lineatus



Poison Dart Frog
Oophaga pumilio



Chameleon
Chamaeleo chamaeleon



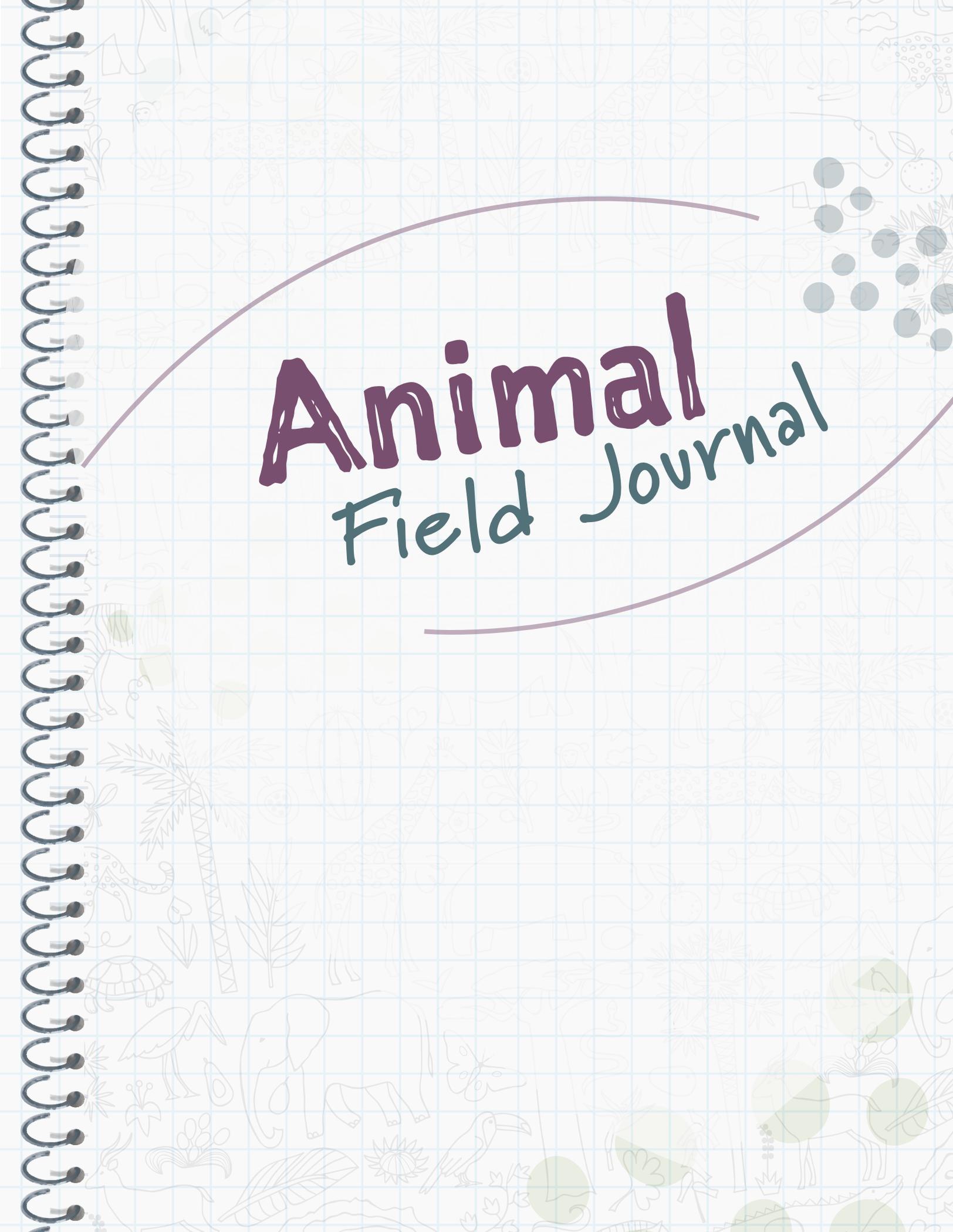
Ruby-Throated Hummingbird
Archilochus colubris



Dusky Leaf Monkey
Trachypithecus obscurus



Bottlenose Dolphin
Tursiops truncatus



Animal Field Journal

Animalia

Arthropoda

Insecta

Coleoptera

Lampyridae

Photinus

While many underwater creatures can produce their own light through bioluminescence, these small beetles are one of few on land to do so. On summer nights in warm climates, they will use these lights, created by a chemical reaction, to find a mate.

Animalia

Porifera

Demospongiae

Haplosclerida

Petrosiidae

Xestospongia

This creature is called home to many animals and looks more like a rock than an animal. It eats by pumping the water around it through its walls and filtering out nutrients. With a width up to 2 meters (6.5 feet) across, these giants are capable of pumping, filtering, and cleaning a lot of water.

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Invertebrates

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Animalia

Cnidaria

Scyphozoa

Semaeostomeae

Cyaneidae

Cyanea

Glowing in the ocean is a creature with over a thousand tentacles that can grow to 37 meters (120 feet) long! It lives in cold waters near the surface and dangles its tentacles below to catch its prey. Like others in its phylum, it has stinging barbs that can kill unsuspecting fish that swim too close.

Animalia

Echinodermata

Echinoidea

Echinoida

Strongylocentrotidae

Strongylocentrotus

These spiny relatives of sea stars live in rocky, shallow water near the shore. Eating primarily algae and the base of kelp, these tiny creatures can have a big impact on water ecosystems. These invertebrates can eat away the bases of an entire kelp forest, but predators keep their population in check.

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