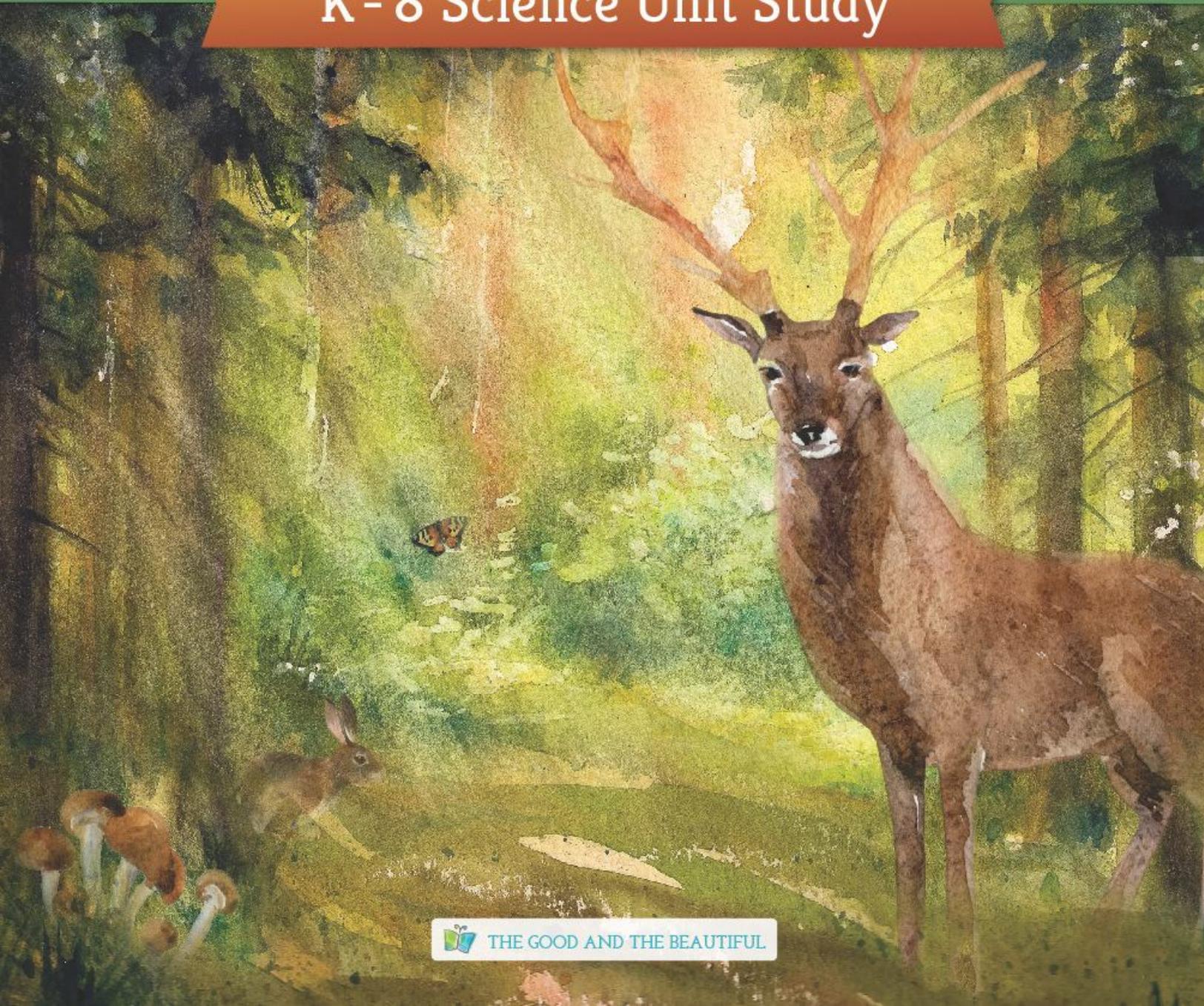


# KINGDOMS AND CLASSIFICATION

K - 8 Science Unit Study



# KINGDOMS AND CLASSIFICATION

Created by Karee Brighton, Lezlie-Anne Ivie, and Jenny Phillips

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# KINGDOMS AND CLASSIFICATION

## Unit Information

### Prerequisite Unit

Most of The Good & the Beautiful science units can go in any order. However, it is very helpful to complete this unit, Kingdoms and Classifications, before Botany and Mammals.



### Journal

All of The Good & the Beautiful science units include activities for a science journal. For each child, prepare a 1" to 2" 3-ring binder to function as his or her science journal. Tabbed divider pages may be used to separate the different units. Have wide-ruled paper and blank white paper on hand for journal activities. All completed journal activities are to be kept in the science journal. You may also consider having children create a cover for their journals, which they insert under the clear cover of the binder.



### Science Wall

All of The Good & the Beautiful science units include vocabulary words to be placed on your science wall, which is a wall (or a 3-fold presentation board) in your learning area on which you 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 Mini Books

Some lessons in this unit incorporate science mini books, which require very little assembly. To make your mini books, simply print the pages single-sided, cut them in half along the dotted lines, stack the pages together, and staple twice along the left side.



### Lesson Preparation

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



### Teaching Older Children?

This unit study is designed for Grades K–6. If you are teaching older children (Grades 7–8), look for the “older children” symbol (a magnifying glass) at the end of most lessons. There you will find ideas for guiding older children through more in-depth research and study. This course, even with the extensions, is not considered sufficient for high school level.



### Microscope Activities

This unit introduces the use of microscopes. In this unit there are several microscope activities. The Botany unit and Rocks and Minerals unit will also use a microscope. The microscope greatly enhances the lessons, but if you do not have a microscope, this unit can still be completed by skipping the microscope activities.

### Note About the Number of Kingdoms

This course teaches the six kingdom classification system. Some systems of classification, such as the five kingdom system, do not divide bacteria into two different groups as we do in this course. Scientists differ on the number of kingdoms, and you may see five, six, or more.

### Length of Unit

This unit is packed with information and opportunities for exploration. You may choose to spend more than one day on some lessons.

# KINGDOMS AND CLASSIFICATION

## Supplies Needed

### For Use with Lessons 3, 5, 6, 8, and 9

- **A high-quality microscope**
- **Glass slides and covers**

We have tested and reviewed microscopes. Our top-recommended microscope is [AmScope 40X-1000X All-Metal Optical Glass Lenses Cordless LED Student Biological Compound Microscope](#). This microscope is available on [www.amscope.com](#) and is usually available on [Amazon.com](#) and [www.jennyphillips.com/science](#). You do not have to use our recommended microscope; you can use one like it.

### Lesson 1

- Kitchen utensils
- 12-15 buttons for each child. Have a variety of shapes, sizes, number of holes, colors, etc.
- A highlighter or brightly-colored crayon for each child

### Lesson 2

- Seven sticky notes
- Seven paper/plastic cups
- Scissors
- Tape
- A glue stick
- Crayons, markers, or colored pencils

### Lesson 3

- A handful of Legos®, a variety of sizes and colors (needs to include differing pieces with a single stud and some with many studs—the connecting parts)
- Items for microscope activity: a microscope, toothpicks, glass slides, coverslips, methylene blue solution (or iodine stain solution), tape, distilled water, and a paper towel

### Lesson 4

- Two pieces of yarn or string (about 45 inches each)

### Lesson 5

- Yogurt with live and active cultures (See note under Experiment #1.)
- Items for microscope activity: a microscope, glass slides, coverslips, distilled water or methylene blue solution, and a paper towel
- A permanent marker
- Six cotton swabs
- Six agar plates

You can make these or purchase them on [Amazon.com](#). Instructions for making them are included in Lesson 4. You will need these items to make agar plates:

- six paper cups
- plastic wrap
- six rubber bands
- 1/2 cup water
- 2 tsp sugar
- 2 tsp gelatin

### Lesson 6

- Items for microscope activity: a microscope; glass slides; coverslips; an eye dropper; a paper towel; and pond, lake, or river water (You will need just a drop or two.)
- 15-20 junk drawer items, such as a paper clip, a thumb tack, a rubber band, a pencil, a sticky note, a 3X5 card, a hair elastic, a penny, a bobby pin, an eraser, staples, a screw, a receipt, an envelope, tape, a button, string, or a cotton ball

### **Lesson 7**

- One fresh mushroom for each child (other than a white button, if possible)
- A magnifying glass
- Optional items for older child (Grades 7+) extension project: a sheet of white (or black) paper for each child, a clear bowl for each child, and art fixative spray or hair spray

### **Lesson 8**

- A piece of bread
- A piece of pita bread (or a tortilla)
- Three empty, disposable water bottles
- Three balloons
- Water
- Three Tbsp active dry yeast
- Items for microscope activity: microscope, glass slides, an eye dropper, one Tbsp sugar, a paper towel
- Ingredients for honey wheat bread (optional) (See the recipe in this lesson or use your own.)

### **Lesson 9**

- A Bible
- A shallow pie pan of water
- A tall glass of water
- A straw
- A dry sponge
- Items for microscope activity: a microscope, glass slides, coverslips, distilled water or methylene blue solution, and a paper towel
- A small piece of an onion

### **Lesson 10**

- A pipe cleaner
- 15-20 “pony” beads
- An M&M<sup>®</sup> or plain piece of chocolate (one for each child)

**Instructions:** Cut out the boxes in this section. Place them on your “Science Wall” when prompted to do so in the lessons. Review the vocabulary words each day during this unit and at various times throughout the year.

# VOCABULARY

## Kingdoms and Classification

### Classify

to organize and sort into groups

### Living Organism

Living organisms can move, grow, and reproduce.  
Most living organisms need air, food, and water.

### Taxonomy



SPECIES  
GENUS  
FAMILY  
ORDER  
CLASS  
PHYLUM  
KINGDOM

the scientific term meaning to name, describe, and classify living things

# Lesson 1 - Introduction to Classification

## Objectives

Help the children understand the beauty, variety, order, and organization of God's creations and the basic terminology of kingdoms and classification.



## Preparation

- Make sure you have the vocabulary cards cut out for this lesson and all upcoming lessons. Make sure each child has a science journal for this lesson and all upcoming lessons.
- Read the instructions under the heading "Activity: Living and Non-Living Hunt" and determine which option you would like to use. Then print one copy of the applicable sheet for each child.
- Cut and assemble the "History of Taxonomy" mini book.

## Supplies Needed

- 12-15 buttons for each child. Have a variety of shapes, sizes, number of holes, colors, etc.
- A highlighter or brightly colored crayon for each child
- Kitchen utensils

## Optional Read-Alouds



At any point in the lesson, you may read the book listed in the read-aloud section at the beginning of the unit.

## Read to the children:

In the Bible we read, "For by him were all things created, that are in heaven, and that are in earth, visible and invisible, whether they be thrones, or dominions, or principalities, or powers: all things were created by him, and for him." (Colossians 1:16)

God created this world with majesty, beauty, and variety. In this unit we will study about God's living creations on earth, visible and invisible to our eyes. We will discuss how scientists organize and classify these creations. This will help us better understand the beauty and variety that God created for us.

## Art Observation



Have the children observe the paintings included in this lesson, titled "Deer in the High Meadow" by Walt Curlee and "The Rocky Mountains, Lander's Peak" by Albert Bierstadt. Discuss the grandeur of God, who creates such majestic things.

After looking at the paintings, have the children ponder and write on a sheet of paper at least five things God created for which they are grateful. Put the sheets in their science journals.

## Activity: Classification



**Part 1: Give each child a handful of buttons. Have each child sort the buttons in any similar groups desired (by color, shape, size, number of button holes, solid, or multi-colored, etc.). After the children are finished sorting, have them take turns presenting and describing their piles and identify the rules by which they chose to sort.**



CURLEE ©

Walt Curlee "Deer in the High Meadow," used with permission

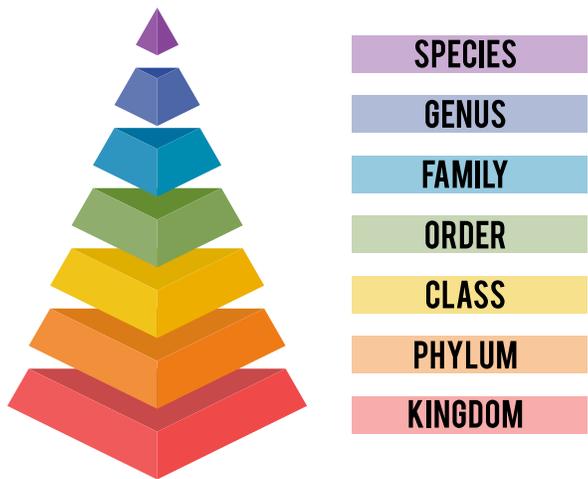


## History of Taxonomy



Taxonomy—the science of discovering, naming, describing, and classifying living things—has been around for a very long time. In the Bible we read about Adam naming animals:

“And out of the ground the LORD God formed every beast of the field, and every fowl of the air; and brought them unto Adam to see what he would call them: and whatsoever Adam called every living creature, that was the name thereof. And Adam gave names to all cattle, and to the fowl of the air, and to every beast of the field...” (Genesis 2:19-20)



If you were going to go to the library to find a book, where would you start looking? First, you would probably decide if the book is nonfiction or fiction. Then, you would go to that section of the library and look on the shelf according to subject or author.

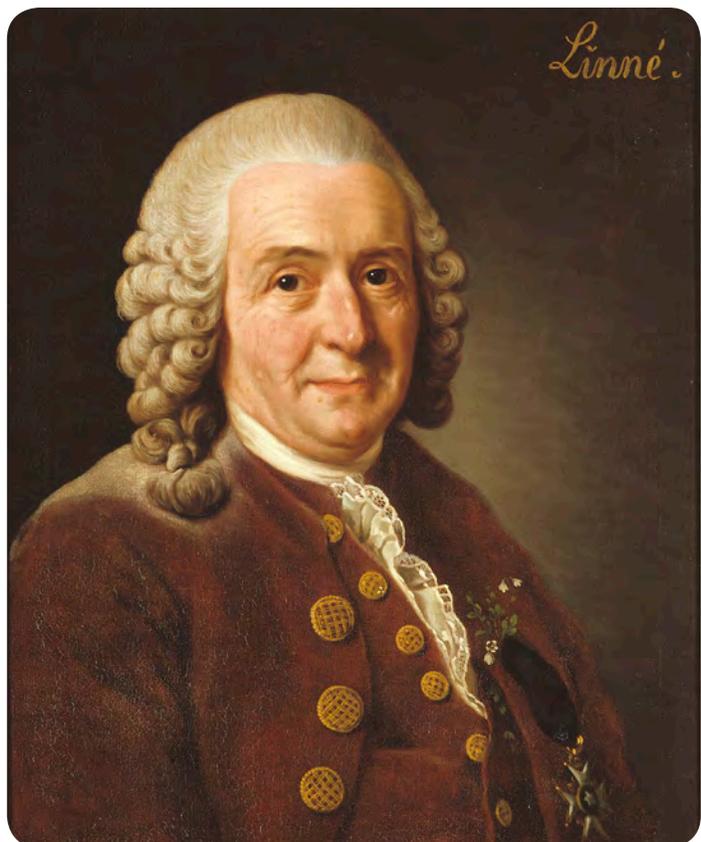
This is similar to how Carl organized species. The names of the species were like books in the library. He needed to develop a way to classify them further. He grouped certain species together according to their similar characteristics, like librarians do with books in the library. He divided everything into three main categories or kingdoms: animal, plant, and mineral (like nonfiction and fiction in a library). He then classified them into a more specific group called division (or phylum for animals). He divided them further into class, order, family, and then finally genus and species. His classification system went from very broad to very specific.

6

While there are some differences from Carl Linnaeus' original system of classification (such as adding three more kingdoms to his original three), we still use the basis of his classification and naming system today. He made a significant scientific contribution to organizing, naming, and classifying organisms—taxonomy!

*“The Earth’s creation is the glory of God, as seen from the works of Nature by Man alone. The study of nature would reveal the Divine Order of God’s creation, and it was the naturalist’s task to construct a ‘natural classification’ that would reveal this Order in the universe.”*

—Carl Linnaeus



Alexander Roslin, “Carl von Linne” (1718–1793)

7



## Lesson 2 - Levels of Classification

### Objective

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



### Preparation

- Cut out and glue the “Where I Live” and “Levels of Classification” squares onto the paper cups. See the “Before Lesson Preparation” details included under the first Activity heading in this lesson. **Save these cups for future lessons.**
- Print one copy of the sheet titled “Taxonomy of a Human” for each child.
- Print one copy of the booklet titled “My Six Kingdoms of Life Booklet” (all four pages) for each child.

### Supplies Needed

- Seven paper/plastic cups
- Seven sticky notes
- Scissors
- Tape
- Crayons, markers, or colored pencils
- A glue stick

### Read to the children:

Carl Linnaeus, the Swedish botanist we talked about in Lesson 1, was known to have said, “God created, and Linnaeus organized.” We are going to learn more about how living things are organized by Linnaeus’ system.

Scientists today still organize living things according to the system developed by Carl Linnaeus. He divided living things according to their characteristics and then put them into categories. The categories range from very broad to very specific.

### Activity: Classification Cups

#### Before Lesson Preparation

1. Cut out each of the “Where I Live” squares and tape or glue each of them onto an upside-down paper cup. (Be sure to glue/tape the edges down well enough that the papers do not bend as you stack and unstack the cups.)
2. Cut out the “Levels of Classification” squares and tape or glue each one onto the opposite

side of the corresponding paper cup (Kingdom with Solar System, Phylum with Planet, Class with Continent, Order with Country, Family with State, Genus with City, Species with Home).

3. Stack the cups in order, beginning with “Solar System” visible on the outside. Be sure that all of the “Where I Live” sides of the cups are lined up, facing out.



Front



Back

feet and make complex tools.

Our specific species is called sapiens. This means that we don't have a tail. Whenever we refer to a species, we always include the genus with it. We are never referred to simply as "sapiens." Scientifically we are always referred to as *Homo sapiens*.

In the last lesson we learned about using two names in Latin as the scientific names of organisms. Do you remember what this term is called? [binomial nomenclature]

Which name do we capitalize? [the first one; the genus]

### Activity: Vocabulary Words



Review the vocabulary words on your science wall. Place the vocabulary word **BINOMIAL NOMENCLATURE** on the science wall. Read and discuss the word and definition.

Binomial  
Nomenclature

### Read to the children:

In this unit we will be learning about the six kingdoms of life. The six kingdoms are: Archaeobacteria, Eubacteria, Protista, Fungi, Plantae, and Animalia. We are going to create a booklet with a page for each kingdom. Today we will cut and assemble the booklet and color the title page. In future lessons, we will fill out the kingdom information pages.

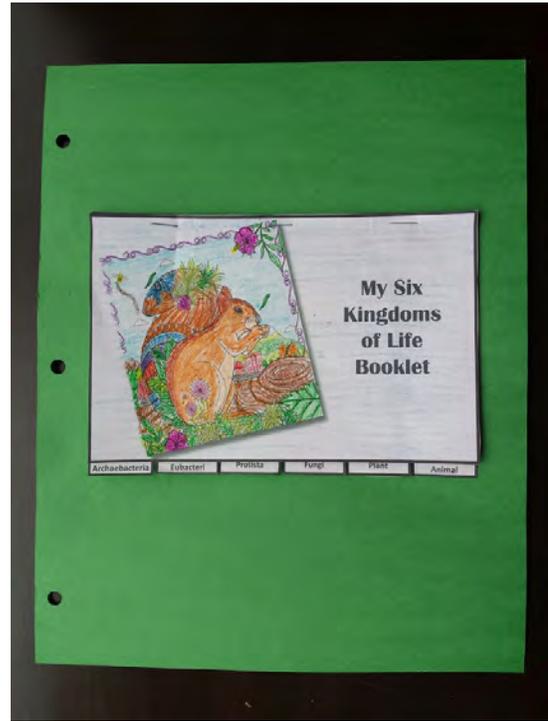
### Activity: My Six Kingdoms of Life Booklet

Have the children create the booklet and cut out the pages by following these instructions:

1. Have each child color the title page of the "My Six Kingdoms Booklet."
2. Cut out each of the pages and staple along the top edge.
3. Glue the back page to a full piece of card stock

or construction paper.

4. Three-hole punch the card stock or construction paper and have the children put it in their science journals.



### Older Children - Lesson Extension

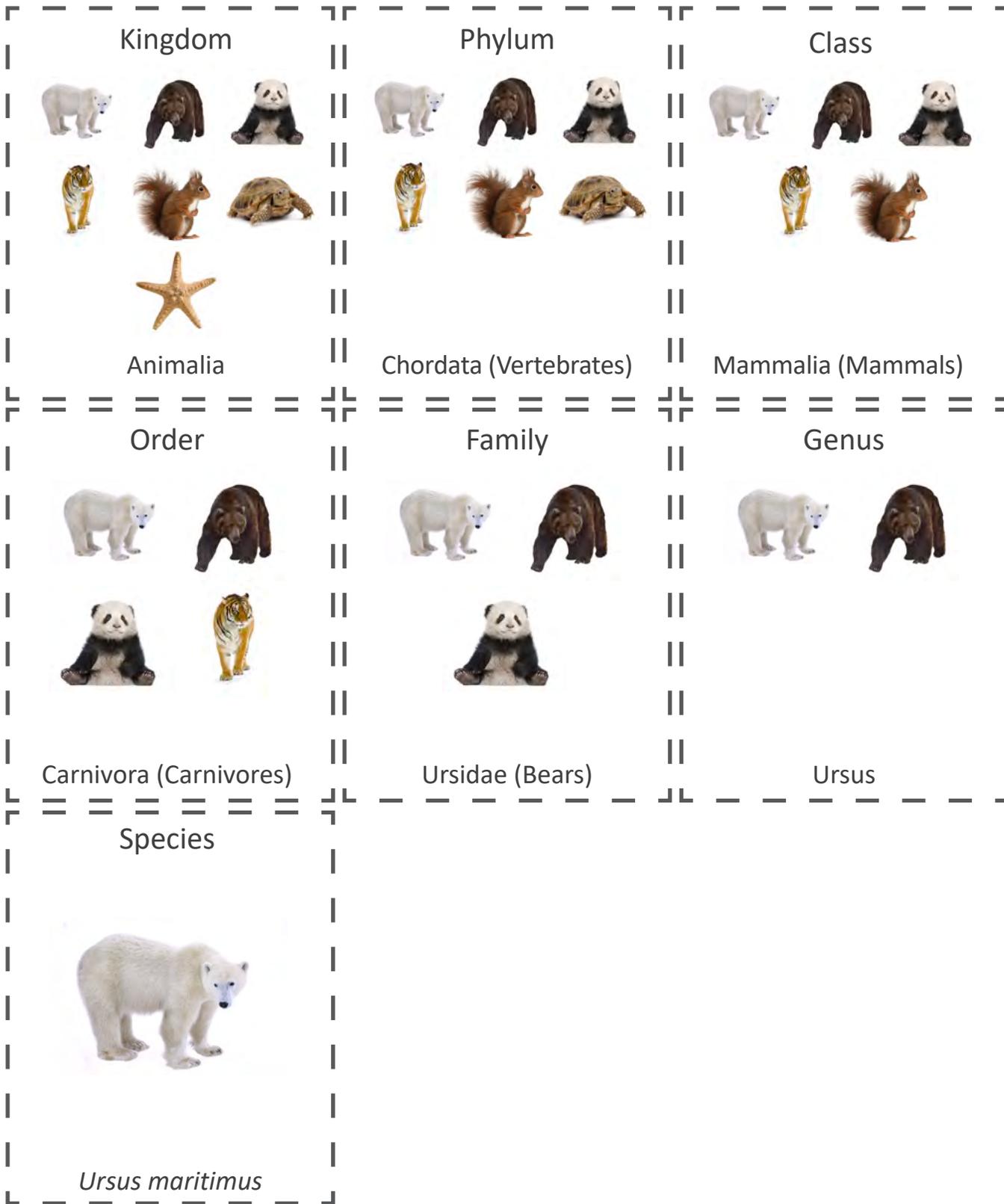


Have older children (Grades 7–8) read and complete the following activity:

There are seven main levels of classification that we have discussed in these lessons, but there are actually more.

1. Research about the different domains that exist in taxonomy.
2. Classify the taxonomy of a human again. This time include the domain, subphylum, superclass, and subclass.
3. Look up the complete taxonomy of a pet or favorite animal (or plant) and present it to other students or family members.

# Levels of Classification



# Taxonomy of a Human

Kingdom: \_\_\_\_\_

Phylum: \_\_\_\_\_

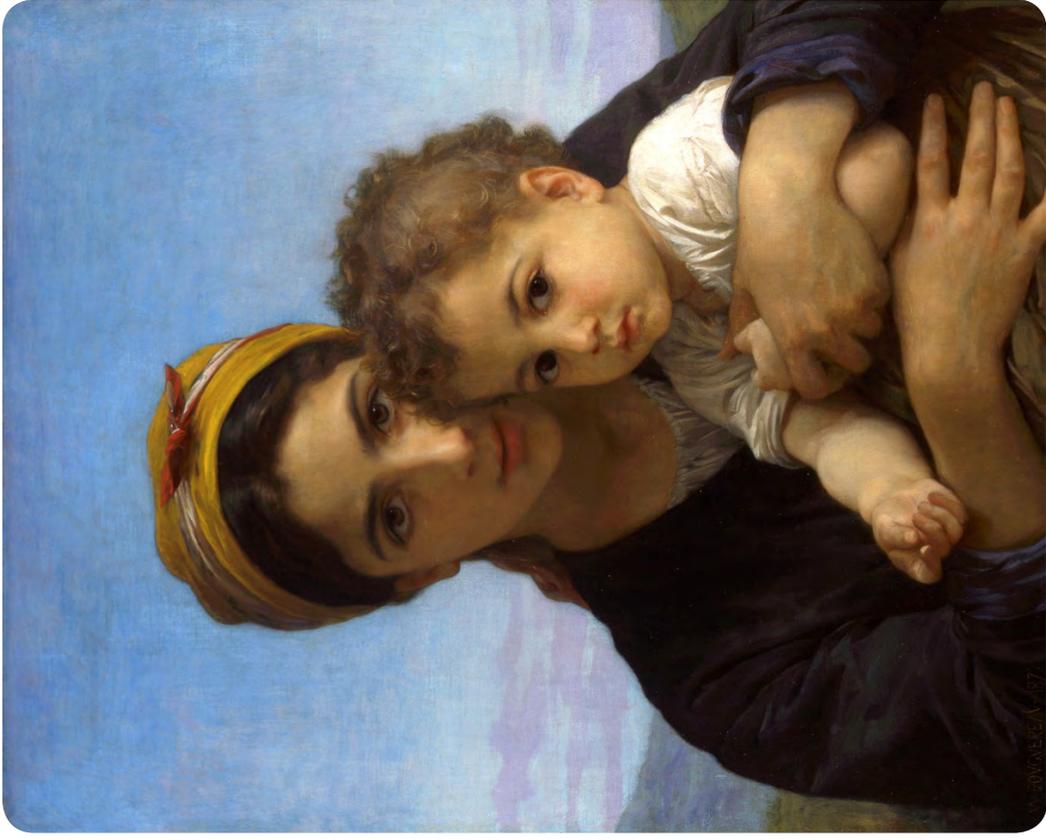
Class: \_\_\_\_\_

Order: \_\_\_\_\_

Family: \_\_\_\_\_

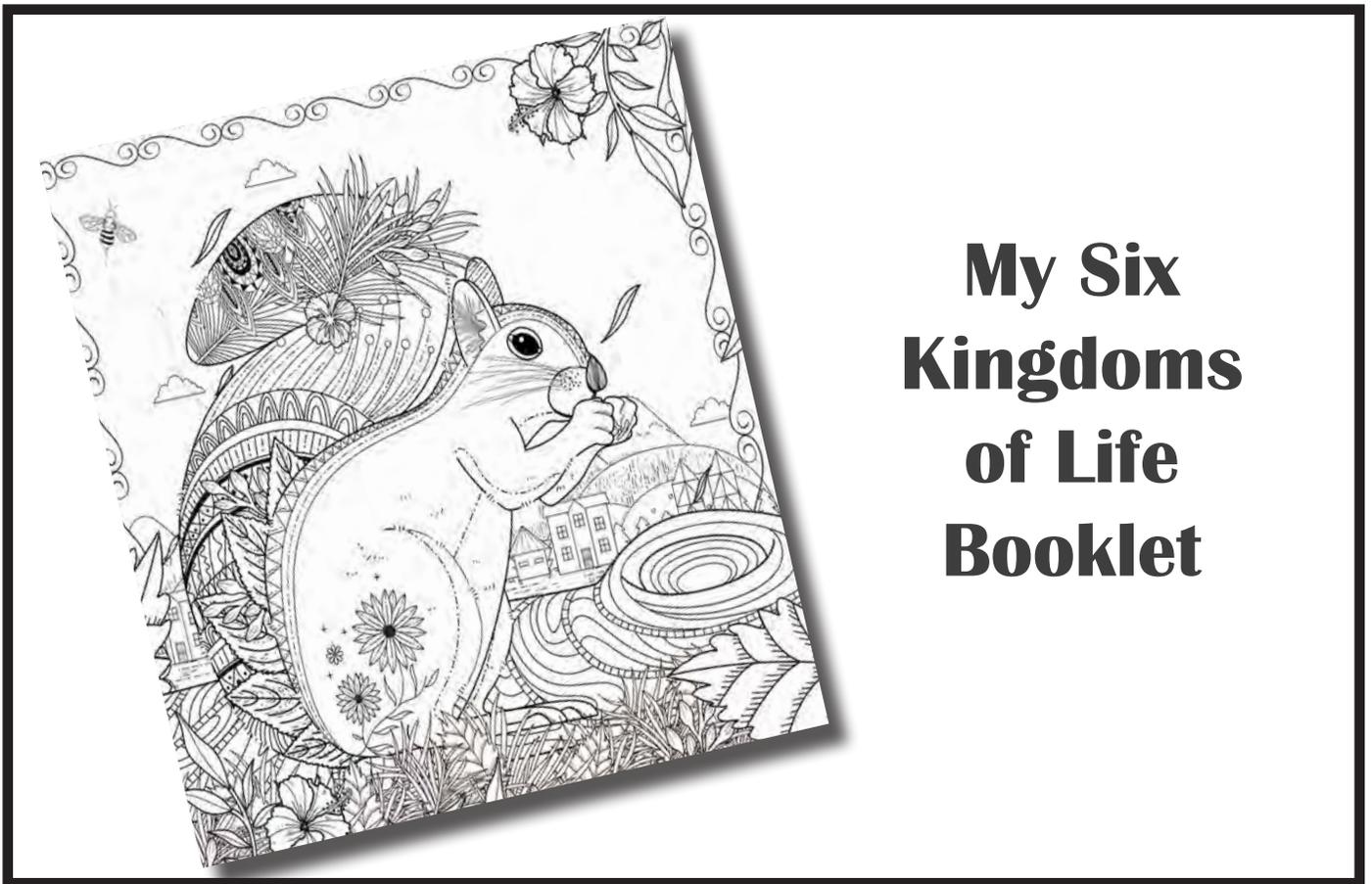
Genus: \_\_\_\_\_

Species: \_\_\_\_\_



William-Adolphe Bouguereau, "Young Girl and Child" (1825-1905)

Color and cut out the booklet and staple at the top. Glue the back page to a piece of card stock. Three-hole punch the card stock and place it in your science journal.



# **My Six Kingdoms of Life Booklet**

Illustration:

Approximately how many species?

Do the cells have a nucleus?  
Eukaryote or Prokaryote?

Two examples:

Fun Facts:

How do they obtain food?  
Heterotrophic/Autotrophic or both?

Where do they live?

What is the cell structure like?  
Unicellular or multicellular?

### Archaeobacteria

Illustration:

Approximately how many species?

Do the cells have a nucleus?  
Eukaryote or Prokaryote?

Two Examples:

Fun Facts:

How do they obtain food?  
Heterotrophic/Autotrophic or both?

Where do they live?

What is the cell structure like?  
Unicellular or multicellular?

### Eubacteria

# Lesson 3 - Discovery of Cells

## Objectives

Help the children understand what cells are and the difference between unicellular and multicellular organisms.



**Note:** If still available, you may want to start the lesson with the video “Powers of Ten (1977)” (nine minutes) by Eames Office on YouTube for children in Grades 3+. This video is old, with low quality images, but it has fantastic content.

## Preparation

- Cut out the sheet titled “Parts of the Microscope.”
- Print one copy of the sheet titled “Microscope Chart” for each child.
- Print one copy of the sheet with the quote from Victor Hugo for each child.
- Cut out the cell pictures and names on the “Cell Identification” sheet.
- Print two copies of the sheet titled “Microscope Labs” for each child.

## Supplies Needed

- A handful of Lego® bricks, a variety of sizes and colors (needs to include differing pieces with a single stud and some with many studs—the connecting part)
- “Microscope Activity” materials: a microscope, toothpicks, glass slides, coverslips, methylene blue solution (or iodine stain solution), tape, and a paper towel

## Optional Read-Alouds



**At any point in the lesson, you may read the books listed in the read-aloud section at the beginning of the unit.**

## Read to the children:

In the Bible we read, “For by him were all things created, that are in heaven, and that are in earth, visible and invisible, whether they be thrones, or dominions, or principalities, or powers: all things were created by him, and for him.” (Colossians 1:16)

During the next several lessons, we are going to talk about things God created that are so small that they are invisible to our eyes. Sometimes this can be hard to comprehend, but remember that God also said:

“For my thoughts are not your thoughts, neither are your ways my ways, saith the LORD. For as the heavens are higher than the earth, so are my ways higher than your ways, and my thoughts than your thoughts.” (Isaiah 55:8-9)

## Read to the children:

Earlier in the unit, we learned how the creations of God have been organized into categories. We began by talking about something as large as our Solar System. We use telescopes to view things as large as our Solar System. But today we are going to begin learning about things that are very, very small. We are going to learn about things that are so small, they are invisible to our eyes. What tool can help us see things that are invisible to our eyes? [a microscope]



## Read to the children:

Robert Hooke was a scientist from England and lived from 1635–1703. He looked at a piece of cork through a microscope. The bark came from a cork oak tree. What do you think he saw as he looked through the microscope? **Pause for answers. Show the children the drawing of Robert Hooke’s microscope and the drawing of what he saw (included in the lesson).** Hooke named the sections of the cork that he saw “cells.”

Place the cut out pictures and names from the “Cell Identification” sheet on the table. Have the children see if they can match the correct cell picture and name. Use the key to check and correct their work.

### ☐ Science Journal



Give each child a copy of the sheet with the quote from Victor Hugo. Read the quote. Below the quote, have the children trace their hands.

**Read to the children:** You are a living organism. You have over 1 trillion cells in your body! (It would take you more than 31,000 years to count to one trillion!) Scientists have estimated the number of observable galaxies in the universe to be between 1 to 2 billion. You have more cells in your body than galaxies we can see in the universe!

Your body is made of several different functioning systems that all work together called organ systems. Each system is made up of groups of similar organs to support a body process.

Look at your hand. What are the different parts that make up your hand? **Pause for answers. Discuss skin, bones, blood vessels, fingernails, tendons, joints, muscles, etc.** Skin, bones, blood vessels, and muscles are all considered organs. Even though your hand is made up of many different parts, just focus on your skin for a moment. **Have the children use a crayon or colored pencil to add skin to the outlines of their hands.** Your skin is part of an organ system called the integumentary system which also includes your nails, hair, and exocrine glands. **Have the children add fingernails to their drawings (and hair and sweat glands, if desired).**

While your skin is part of an organ system, your skin is an organ. If your eyes had microscopic vision and you were to zoom in even closer to your skin, you would see that your skin is made up of skin tissues. Tissues are simply lots of the same kind of cells all connected and working together. So, if you zoom in on a group of skin tissues, what would you see as the smallest unit? [a skin cell]

**Have the children insert the following labels to the outlines of their hands: Organism, Organ System,**

**Organ, Tissue, and Cell with arrows moving from largest unit to the smallest unit. (See the example included.)**

Read the quote from Victor Hugo once more. Discuss with the children what he may have meant and which view they think is greater. When finished, have the children place the sheets in their science journals.

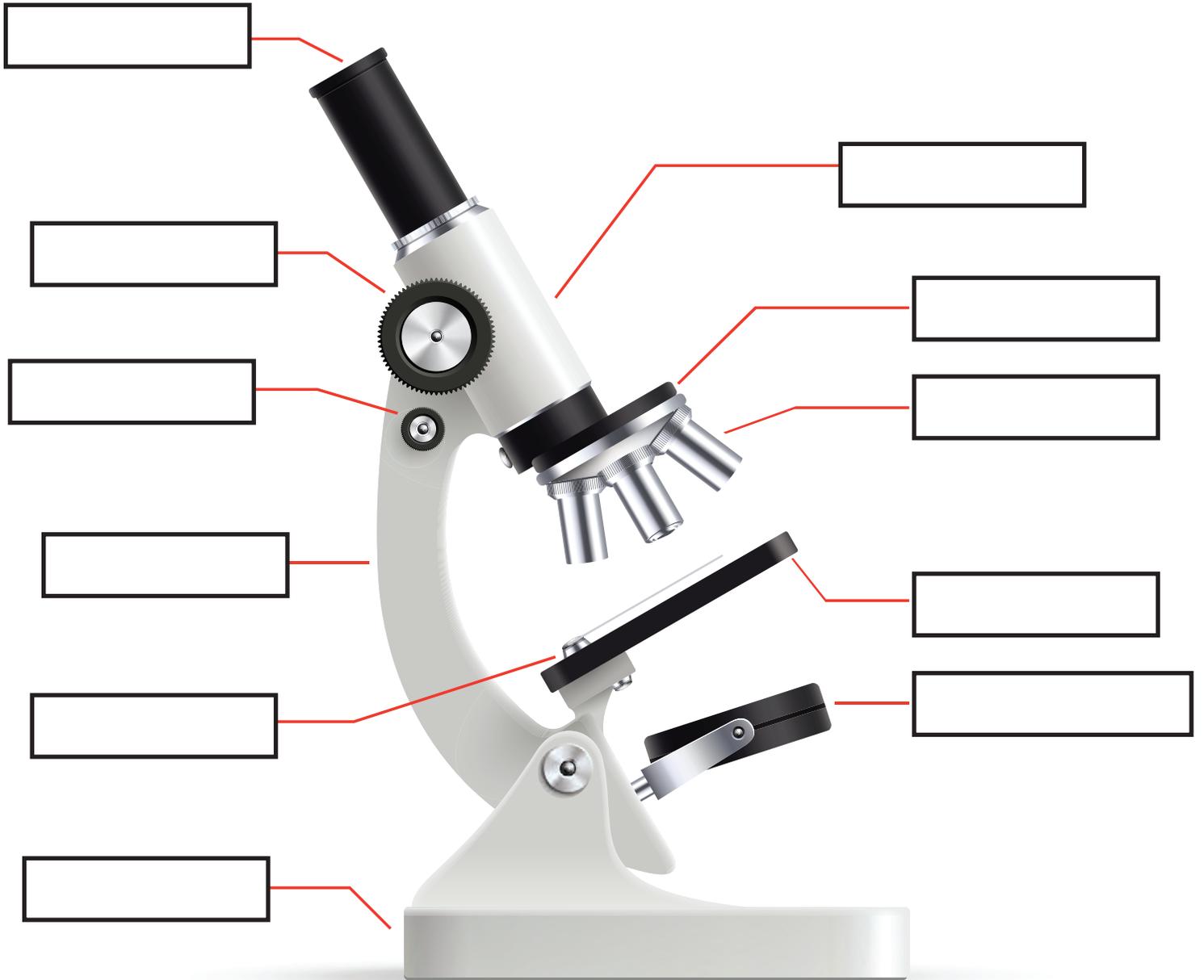
### ☐ Microscope Activity



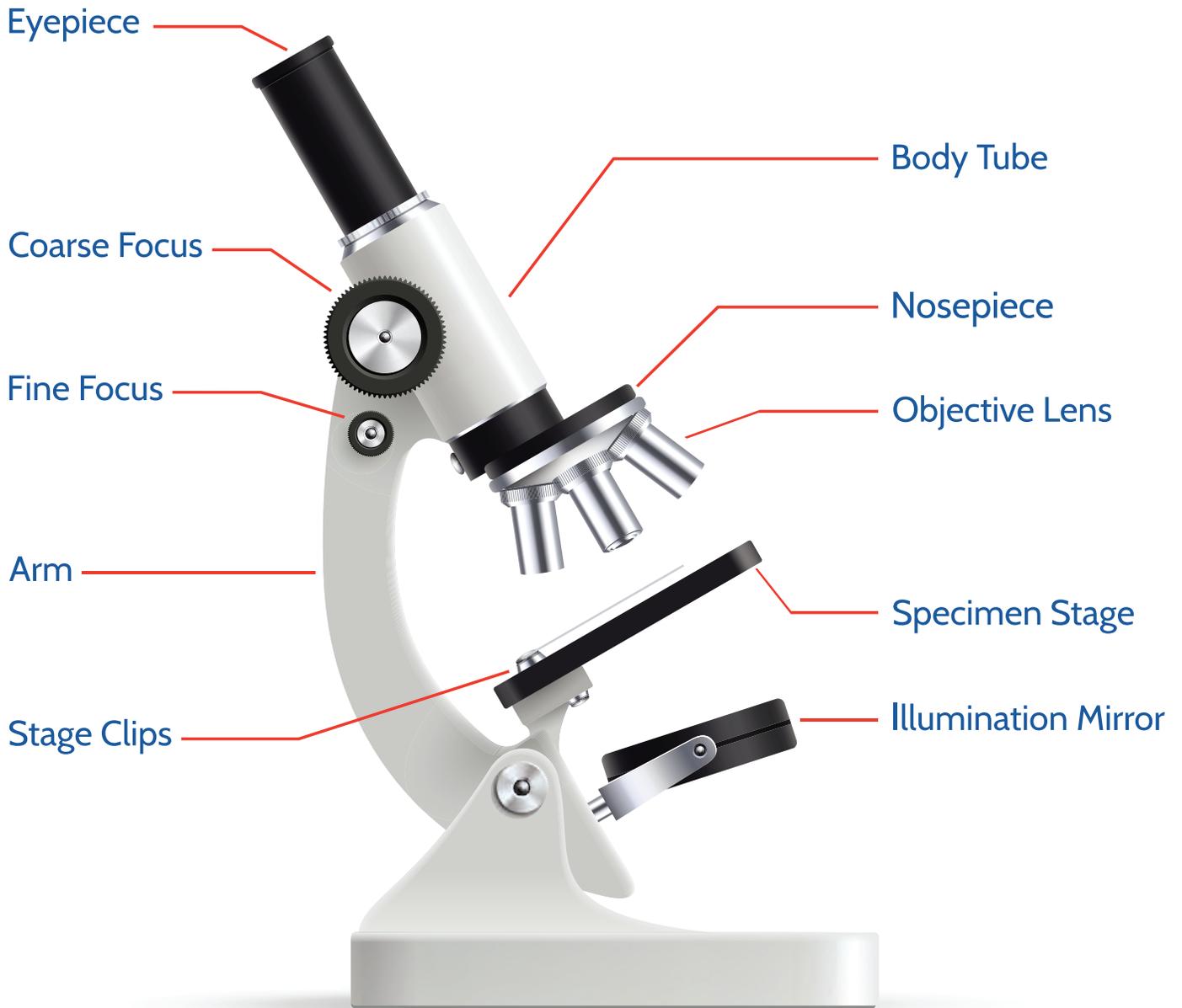
This activity will give the children an opportunity to see an actual skin cell. Give each child a copy of the sheet titled “Microscope Lab.” These sheets will also be used for future labs. Have the children fill out one lab sheet (half sheet) for each item viewed, using the following directions. Then place them in their science journals.

1. To obtain a skin cell specimen, gently scrape the inside of your cheek with the side of a toothpick. You may also obtain a skin sample from your wrist. First, wash your hands and wrists, then place a piece of tape on your wrist and gently pull the tape off.
2. Wipe the toothpick onto a glass slide or place the tape sticky side up onto the glass slide.
3. Place one drop of methylene blue solution (do not ingest or inhale!) onto the specimen. Gently place a coverslip on top and gently dab any wet edges with a paper towel. Be careful to avoid air bubbles.
4. Find the specimen under the microscope. Adjust magnification as needed. The dark blue circles are nuclei (the center of the cells). Each nucleus has cytoplasm surrounding it (light blue) and a cell membrane (outer circle).
5. Using the “Microscope Lab” sheet, label the specimen, add the date, draw a picture of what you see, and add any notes you would like.
6. Look at a hair sample (tape the hair down on the ends of the slide) and a fingerprint (color your finger with a pencil and use tape to collect the sample), using the same steps listed above. (methylene blue solution is not needed for these samples.)

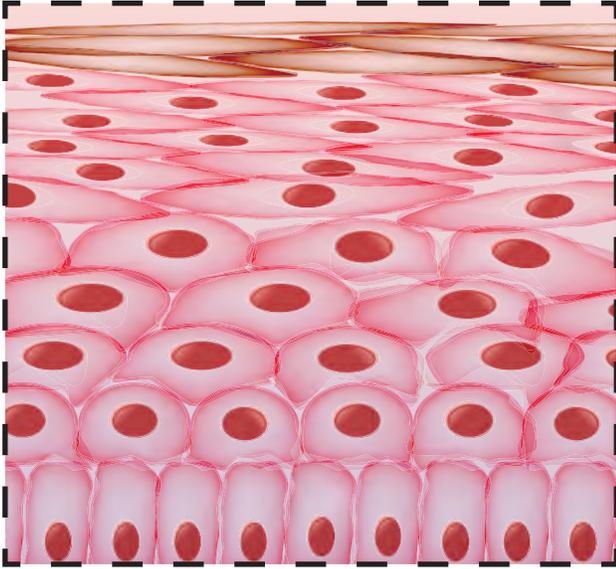
# MICROSCOPE CHART



# MICROSCOPE CHART



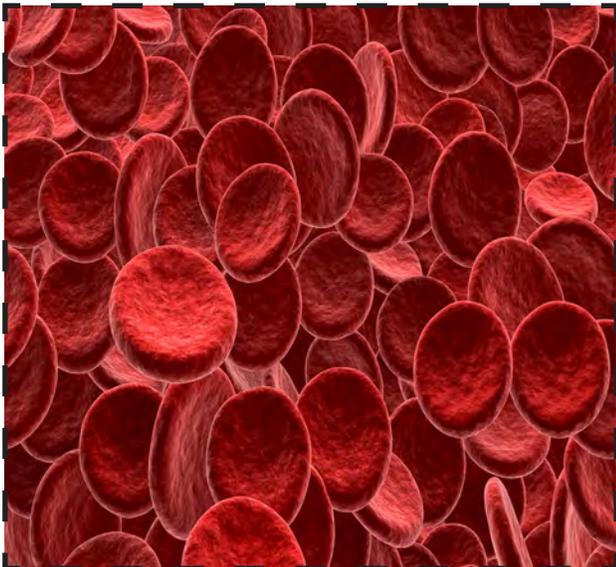
# Cell Identification



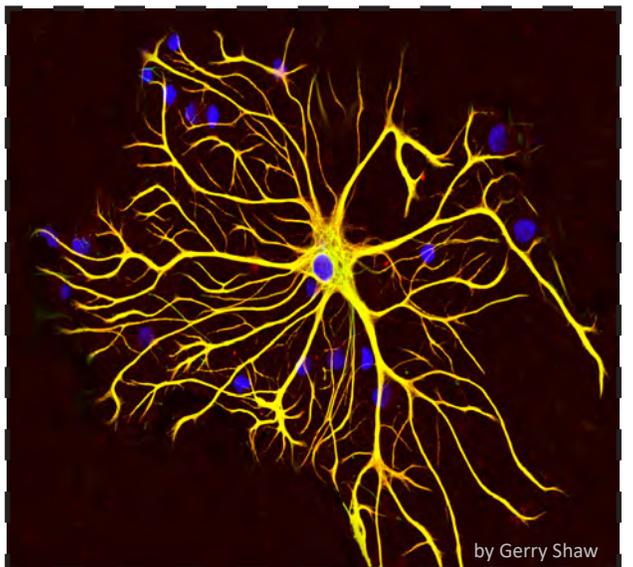
Skin Cells



Plant Cells



Red Blood Cells



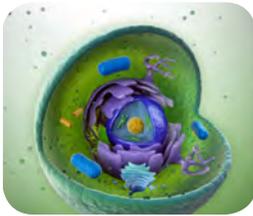
Nerve Brain Cells



# Lesson 4 - Cell Functions

## Objective

Help the children understand the characteristics and functions of prokaryotic and eukaryotic cells.



## Preparation

- Cut out the sheet titled “Venn Diagram: Organelles.”
- Cut out the sheet titled “Cell Function Matching Cards” (2 pages).

## Supplies Needed

- Two pieces of yarn or string (about 45 inches each)
- See “Preparation for Lesson 5: Make Agar Plates” at end of the lesson.

## Classification Cups

Place the Classification Cups from Lesson 2 on the table (with the taxonomy side facing out) and have the children practice putting them in order, starting with “Kingdom.” Also, have the children try to say the levels of classification on their own without looking at the cups.

## Observation Activity

Have the children look at the picture of the “Prokaryote vs Eukaryote Cells,” included in the lesson, as they answer the questions below.

What differences do you see between the two cells?

What similarities do you see?

## Read to the children:

In the last lesson, we talked about unicellular and multicellular organisms. Unicellular organisms only have one cell; multicellular organisms are made of many cells.

Cells can also be prokaryotic and eukaryotic [you - CARE - ee - awe - tic]. All multicellular organisms are eukaryotic. Unicellular organisms can be prokaryotic or eukaryotic.

## Activity: Vocabulary Words



Review the vocabulary words on your science wall. Then place the vocabulary words PROKARYOTIC, EUKARYOTIC, and ORGANELLES on your science wall. Read and discuss each of the words and meanings.

Prokaryotic

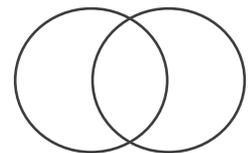
Eukaryotic

Organelles

## Science Journal: Venn Diagram



Using the two pieces of yarn or string, have the children help you create two overlapping circles (to create a Venn Diagram) on the floor. Using the “Venn Diagram: Organelles” strips, place the word PROKARYOTE above one circle, and EUKARYOTE above the other. Have the children draw similar Venn Diagrams in their science journals. Then have the children take turns picking an organelle. Do the following for each organelle that is picked:



replace the cards and let the next person take a turn. Continue until all the cards have been matched.

### Optional Activity for Children in Grades 5+



Have children in Grades 5+ draw the anatomy of an animal cell, referencing the illustrations on this page. Place the completed pages in the children's science journals.

### Older Children - Lesson Extension

Have older children (Grades 7–8) read and complete the following three-step activity:

Cells multiply and divide through processes called "mitosis" and "meiosis."

1. Find out the differences between the two processes.
2. Write a definition of each process.
3. Draw a picture of the two processes.

### Preparation for Lesson 5: Make Agar Plates

In the next lesson, you will use agar plates. They are easy to make, or they may be

purchased online. If you make them, they need to set for 24-hours before use. Instructions are included here.

Materials needed:

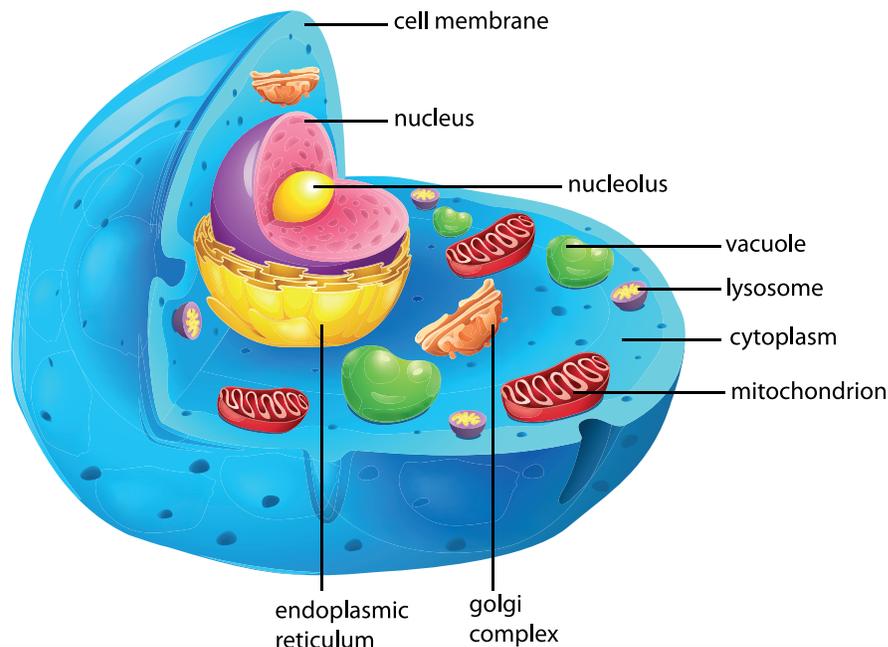
- six paper cups
- plastic wrap
- six rubber bands
- 1/2 cup water
- 2 tsp sugar
- 2 tsp gelatin



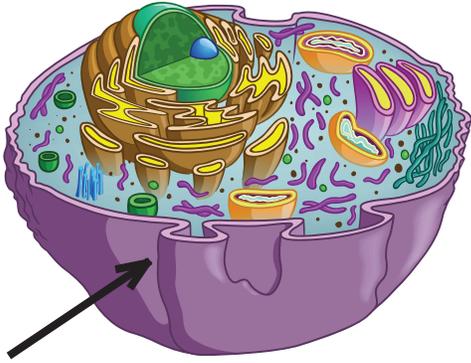
Instructions:

1. Cut the paper cups down so that they are only about 2-3 inches high.
2. Boil the water, then add the sugar and gelatin. Stir quickly to dissolve.
3. Pour the mixture evenly into the six paper cups. (There should be about a 1/4 inch of mixture in each cup).
4. Cover the cups with plastic wrap and secure with a rubber band. Place in the refrigerator to chill for at least 24 hours.

## Anatomy of an Animal Cell



# Cell Function Matching Cards



Cell Membrane



Ribosomes



Nucleus



Cytoplasm



Mitochondria



Lysosome



Endoplasmic Reticulum



Golgi Apparatus

# Cell Function Matching Cards

<p>It protects the cell, provides structure, and determines what goes in and out of the cell. It is also called the "gatekeeper."</p>	<p>These simple organelles float freely around the cell and make protein.</p>	<p>It directs the cell's activities and is known as the "control center."</p>
<p>All of the living material inside of a cell, minus the nucleus.</p>	<p>Rod-shaped organelles that make energy for the cell. They are the powerhouse of the cell.</p>	<p>These are made by the Golgi bodies and are like the clean up crew (think "disinfectant spray"); they digest and dispose of old and excess organelles.</p>
<p>It transports proteins and breaks down the toxins in the cell. You can think of it as a bus or subway system.</p>	<p>This stores, processes, and packages proteins and lipids (fats). It is like the postal service, moving materials around the cell, and in and out of the cell.</p>	

## Archaeobacteria Kingdom Fact Sheet

*Cyanobacteria algae mats in New Zealand*



By Avenue [CC BY-SA 3.0]

**Cell Structure:** They are prokaryotic. This means they are unicellular and do not have a nucleus within the cell.

**How They Eat:** They can be autotrophic (they make their own food) or heterotrophic (they obtain their food from other organisms).

**Where They Live:** They live in extreme environments: extremely hot water, or extremely salty or acidic places.

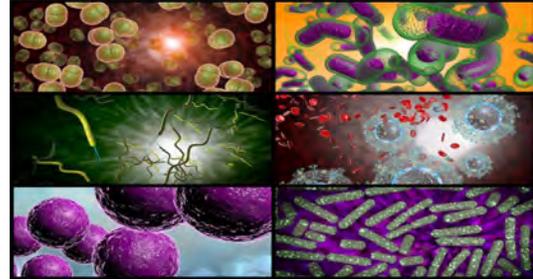
**Examples:** Hydrothermal sea vents, the Great Salt Lake, hot springs (Yellowstone), and wetlands

**How many species:** There are more than 400 known species.

**More Facts:** Some thermophile archaeobacteria that live in hot springs are harmful and infectious to humans.

The Great Salt Lake is home to several species of bacteria that can cause the water to have a red or purple tint. These bacteria create toxic methyl mercury ions.

## Eubacteria Kingdom Fact Sheet



**Cell Structure:** They are prokaryotic. This means they are unicellular and do not have a nucleus within the cell.

**How They Eat:** They can be autotrophic (they can make their own food) or heterotrophic (they obtain their food from other organisms). Some bacteria are parasites (obtain their nutrition from other living organisms) and some are saprophytes (obtain nutrition from dead organisms and organic waste materials). Some use chemical energy to create their own food (E. coli bacteria).

**Where They Live:** Everywhere!

**Examples:** There are three main types of bacteria:

1. Cocci: sphere-shaped; grows in chain formation. Streptococcus (Strep) grows this way.
2. Bacilli: whip-like structure; forms in chains. *Escherichia coli* (E. coli) grows this way and is found in the intestines of mammals.
3. Spirilla: spiral-shaped; uses its shape to propel itself like a corkscrew. *Borrelia burgdoferi* (Lyme disease) grows this way.

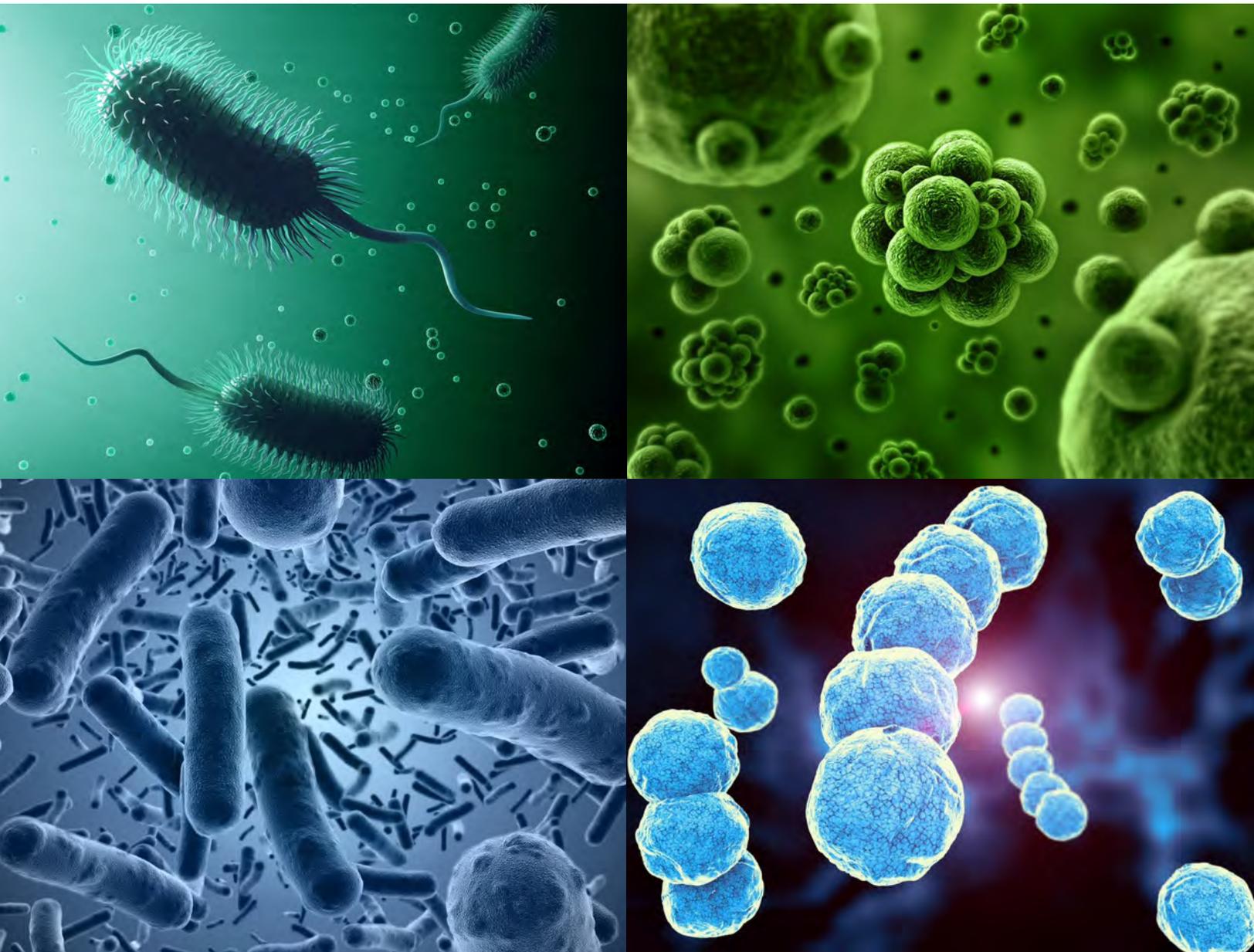
**How many species:** There are more than 10,000 known species of eubacteria.

**More Facts:** Eubacteria can be helpful or harmful. Some help produce cheese, yogurt, pickles, and other food. Some bacteria are very harmful and can cause illness.

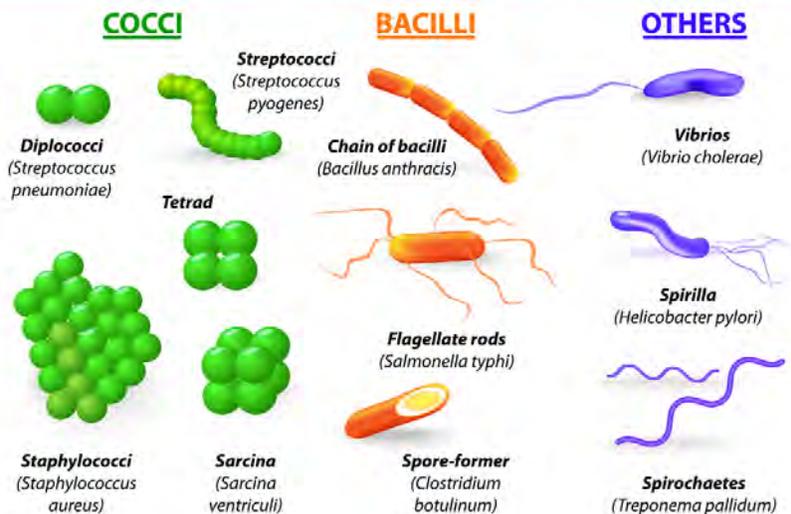
# Photograph Matching: Picture Cards



# Microscopic Photos of Bacteria Shapes



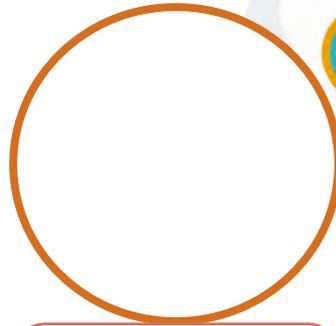
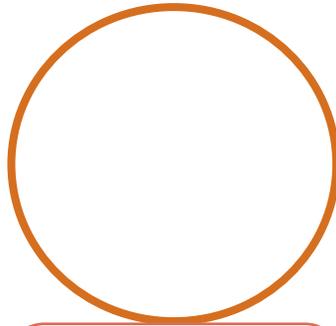
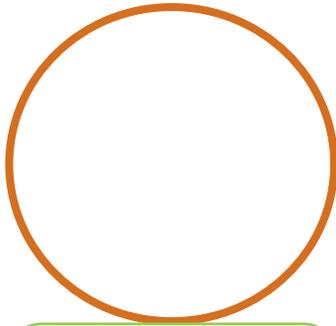
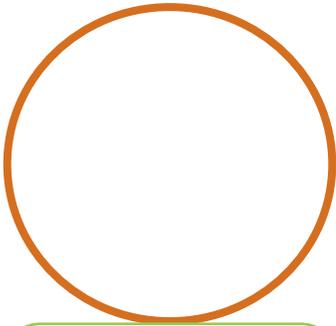
## SHAPES OF BACTERIA



# Agar Plate Bacteria Collection Recording Sheet

Bacteria Collected From:

Bacteria Collected From:



My Prediction

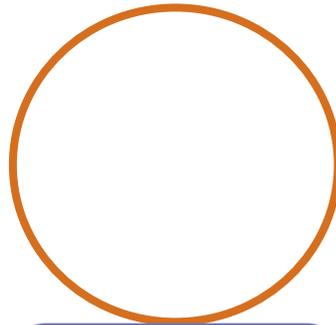
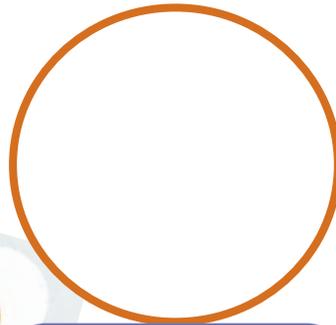
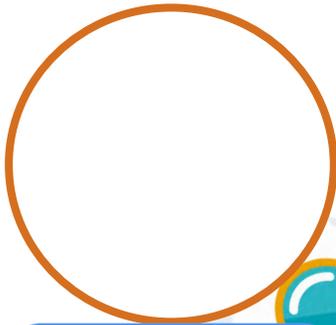
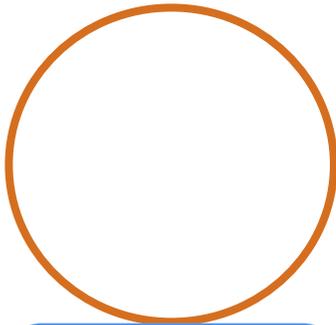
My Results

My Prediction

My Results

Bacteria Collected From:

Bacteria Collected From:



My Prediction

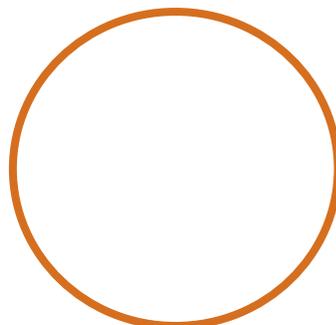
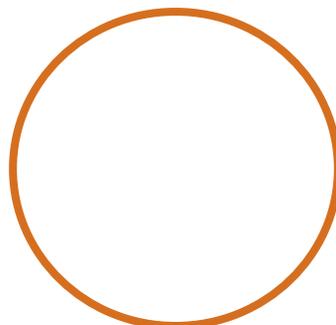
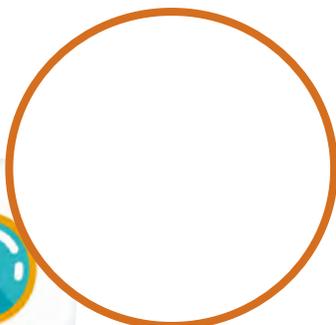
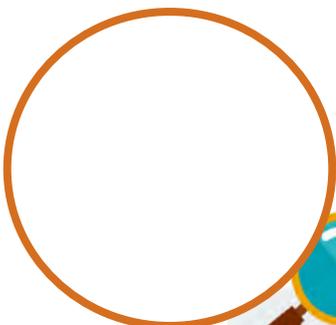
My Results

My Prediction

My Results

Bacteria Collected From:

Bacteria Collected From:



My Prediction

My Results

My Prediction

My Results

# Lesson 6 - Protista Kingdom

## Objective

Help the children understand the characteristics of living organisms in the Protista Kingdom.



## Preparation

- Obtain the “Agar Plate Bacteria Collection Recording Sheet” from the previous lesson (one for each child).
- Cut and assemble the “The Protist Kingdom” mini book.
- In a container with a lid, collect a sample of pond, lake, or river water (for “Microscope Activity”).
- Cut out the pages titled “Guess Who?”

## Supplies Needed

- A microscope; glass slides; coverslips; an eye dropper; a paper towel; and pond, lake, or river water (You will need just a drop or two.)
- 15-20 junk drawer items, such as a paper clip, a thumb tack, a rubber band, a pencil, a sticky note, a 3X5 card, a hair elastic, a penny, a bobby pin, an eraser, staples, a screw, a receipt, an envelope, tape, a button, string, or a cotton ball

## Activity: Bacteria Experiment - Part 3

Have the children check the agar plates with bacteria collections from the last lesson. Without removing the plastic wrap, observe each of the samples. If there is not enough growth yet, you may decide to wait until the next lesson. Have the children draw a picture of each bacteria colony, and then safely dispose of the samples.

## Activity: Junk Drawer Classification

**Read to the children:** Earlier in the unit we learned how Carl Linnaeus created a system of classification. Do you remember how many kingdoms he originally classified living things into? [three; plant, animal, and mineral] Since then, scientists have discovered and classified a greater number of living organisms that now make up the six kingdoms we use for classification today. In a previous lesson we classified buttons (**if buttons were not available you may have used something else**). Today, we are going to classify

some different items.

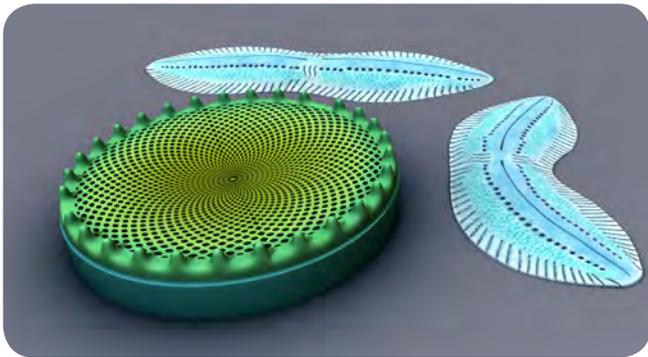
**Place the “junk drawer” items on the table. Instruct the children to classify them into different groups using any rules they would like. Have the children describe the rules they used to classify the items. Then, place the items all back into the center of the table and instruct the children to classify them again, this time, using different rules than they used before. If desired, have the children see how many ways they can think of to classify the items.**

## Read to the children:

The Protist Kingdom is sometimes referred to as the “junk drawer” kingdom. This means that there are organisms placed in this kingdom that don’t quite fit in with other kingdoms, nor do they all fit together well with each other. The organisms classified into the Protist Kingdom have changed over the years. The rules of what determines a protist have been redefined and refined several times.

Other types of plant-like protists include dinoflagellates and diatoms.

There is a great diversity in the forms of dinoflagellates. Some produce toxins and can cause a type of algae bloom called a red tide. In a red tide, dinoflagellates reproduce so quickly that the water appears red or golden. This is harmful to sea life, and if humans eat fish found in a red tide, it can cause illness.



Diatoms are a type of algae that are also one of the most common forms of phytoplankton. They live anywhere there is water. They are important because they provide the base of the food-chain for marine and fresh water organisms.

6

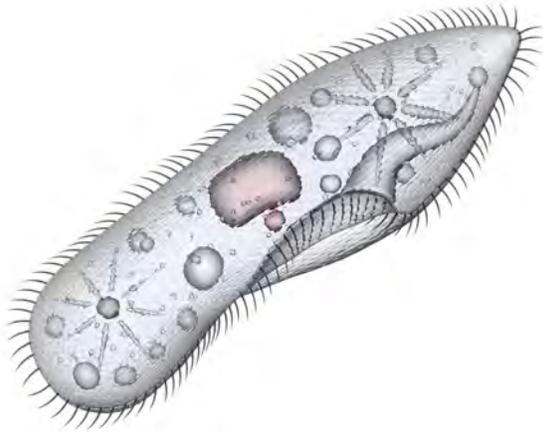
The last type of protists are fungus-like. These include molds such as slime molds, water molds, and downy mildew. Slime molds can be a red, orange, or bright yellow in color. They live in moist environments and feed on decaying organisms. Water molds typically grow on decomposing algae and animals in fresh water. They can look like white, cottony fluff on animals. Some water molds live as parasites, invading the living organisms and using them as a source of food. Downy mildew, a type of water mold, can actually live on land and can harm plants. This is what caused the Irish potato famine in the 1840s.



7

# Guess Who?

Paramecium



Diatom

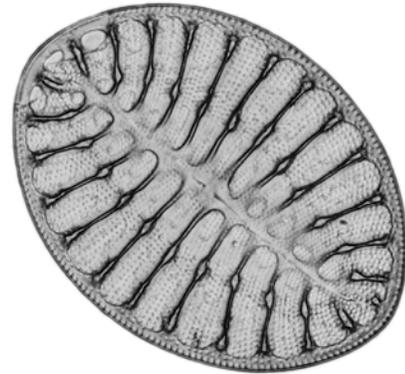
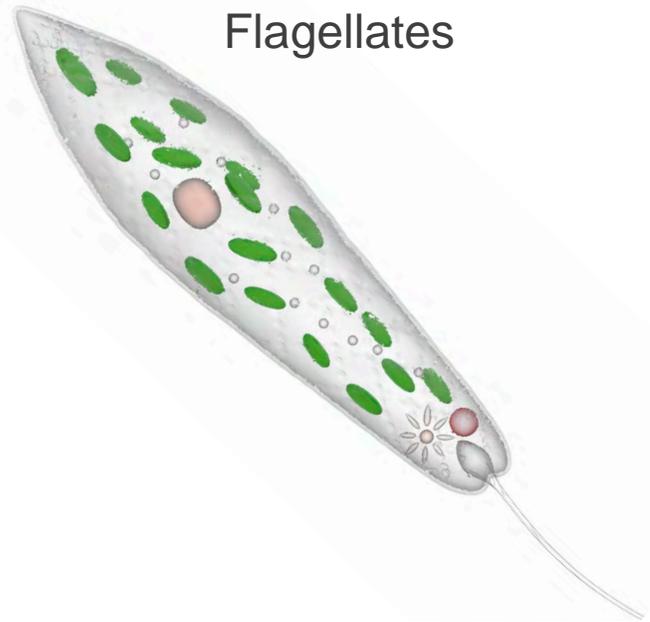


Photo by PicturePest

Amoeba



Flagellates



# Guess Who?

I flutter my short “hair” called cilia to move around.

I have several special structures in my cell, including a mouth.

Who am I?

I live in the ocean and resemble a sea shell. Many of me put together make up the phytoplankton in the ocean. I am small, but I am an important organism. Who am I?

I resemble a blob of jelly. I move by changing shapes and using my pseudopodia or “false feet” to get where I want to go. I can also wrap my pseudopodia around food to swallow it. Who am I?

I have a whip-like structure that acts like a motor to help me move around. I can make my own food using photosynthesis. I live in quiet ponds or puddles. Who am I?

# Lesson 7 - Fungi Kingdom: Mushrooms

## Objective

Help the children understand the characteristics of mushrooms in the Fungi Kingdom.



## Preparation

- Cut out the sheet titled “Mushroom Life Cycle–Stages.”
- Print one copy of the sheet titled “Mushroom Observation” for each child.
- Cut out the sheet titled “Mushrooms Types.”

## Supplies Needed

- One fresh mushroom for each child (different than a white button, if possible) The mushrooms can be the same type or different.
- A magnifying glass
- Optional items for spore print (Grades 7+)

## Read to the children:

In this lesson and the next lesson, we are going to explore the Fungi Kingdom. Fungi are eukaryotic [you - CARE - ee - awe -tic]. What does eukaryotic mean? [The cells contain a nucleus.] They are heterotrophic, meaning they obtain their food from other organisms. Fungi are the main decomposers in our environment. Yeast, mold, and mushrooms are the main types of organisms in the Fungi Kingdom. In this lesson, we will focus on mushrooms.

## Read to the children:

Have you eaten mushrooms from the store or seen them growing in your backyard? **Pause for answers.** Some mushrooms are edible, some are used for medicine, and some are very harmful and poisonous to humans. A mycologist is someone who collects, identifies, and analyzes mushrooms. Because wild mushrooms are difficult to identify, and some can be poisonous, you should never eat or touch mushrooms that grow in your yard or in the wild. Mushrooms are safe to eat when bought from the store or grown from a mushroom kit bought from a reputable source.

## Activity: Mushroom Life Cycle

**Mix up the boxes from the “Mushroom Life Cycle – Stages” page and place them on the table with the “Mushroom Life Cycle” page. Have the children read the stages and try to figure out which stage description goes with the appropriate picture of the mushroom life cycle. When the children are finished, check their answers with the key.**

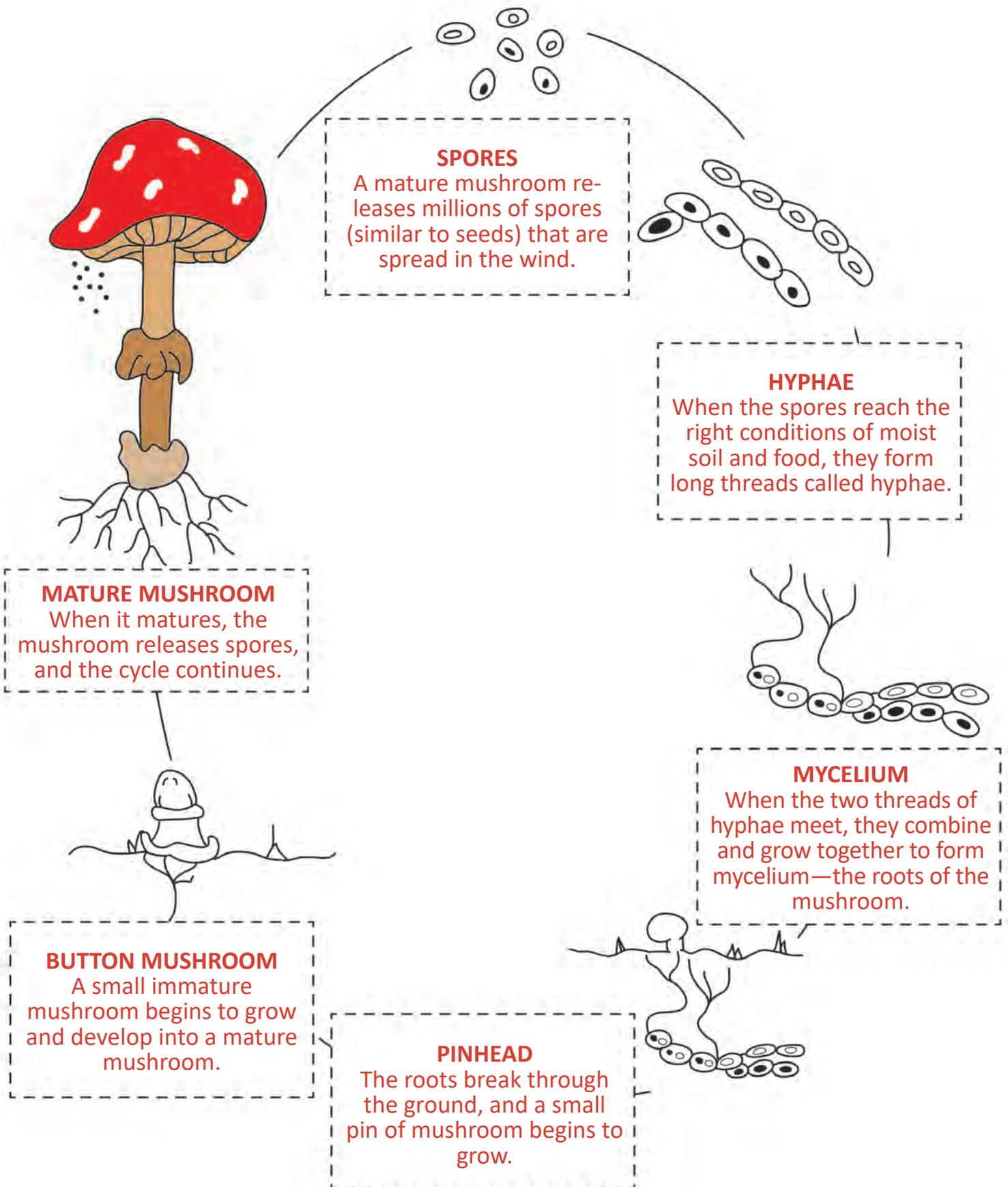
## Mushroom Types

**Read to the children:** Mushrooms can be divided into three different categories based on how they eat.

**Put the “Mushrooms Types” photographs on the table. Have the children choose a picture. Then read to them the corresponding paragraph below.**

1. **Saprotrophic** [sap - pro - troph - ic] mushrooms thrive on decaying matter. They break down decaying wood, plants, and some animals. White button (*Agaricus bisporus*) are saprotrophic and are the most common species of mushroom. This is the type of mushroom you may have eaten before.
2. **Mycorrhizae** [MY - core - RISE - ee] mushrooms have a unique partnership with trees and

# Mushroom Life Cycle-KEY



# Mushroom Observation

Lesson 7

Using your senses and a magnifying glass, observe the characteristics of your mushroom. Use descriptive words to describe the characteristics of the mushroom. Draw and label a picture of your mushroom. Note: If you cannot see the gills on your mushroom, you can remove the layer of tissue called the “veil.”

	Cap	Gills	Stem
Color			
Texture			
Shape			
Appearance			
Smell			

**My Mushroom**

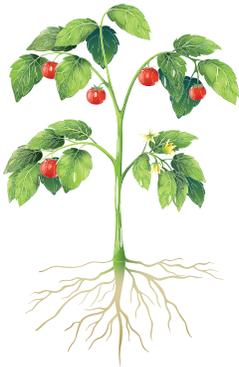
# Mushroom Match



## Lesson 9 - Plantae Kingdom

### Objective

Help the children understand the characteristics of living organisms in the Plant Kingdom.



### Preparation:

- Print out one “Bible Plants” sheet for each student.

### Supplies Needed:

- A Bible
- A shallow pie pan of water
- A tall glass of water
- A straw
- A dry sponge
- Items for microscope activity: a microscope, glass slides, coverslips, distilled water or methylene blue solution, a paper towel, and a small piece of an onion

### Read to the children:

As we have progressed through these lessons, the living organisms we have learned about have progressively increased in complexity and capacity. In a similar way, as we learn about the Plant Kingdom, we will watch it progress from simple organisms to more complex organisms.

God created the earth, divided the day and night, divided the water from the land, and created the plants—all before men and women were created.

In the Bible we read, “. . . in the day that the Lord God made the earth and the heavens, And every plant of the field before it was in the earth, and every herb of the field before it grew: for the Lord God had not caused it to rain upon the earth, and there was not a man to till the ground.” (Genesis 2:4-5)

We need air, light, water, bacteria, fungi, and also plants in order to survive and thrive on this planet. The Plant Kingdom is one of the most diverse and beautiful.

### Activity #1: Bible Plants

**Read to the children:** Carl Linnaeus was known as the father of botany. He traveled far to collect specimens and study and name plants. One of his goals was to name all of the plants that were mentioned in the Bible.

**Have children complete the “Bible Plants” sheet to discover some of the species Linnaeus named from the Bible. Children should look at the photograph of the plant, read the corresponding Bible verse, and write the common name.**

### Read to the children:

The Plant Kingdom is made up of living organisms that are eukaryotic (the cells contain a nucleus) and multicellular (there is more than one cell in the plant to perform the functions of life). Organisms in the Plant Kingdom are autotrophic. They all make their own food using the sun in a process called photosynthesis.

### □ Activity: Vocabulary Words



Review the vocabulary words on your science wall. Then place the vocabulary words PHOTOSYNTHESIS and PLANT CELL on your science wall. Read and discuss

each of the words and meanings.

Photosynthesis

Plant Cell

### □ Read to the children:

“Photo” in Latin means “light,” and “synthesis” means “to make.” Members of the Plant Kingdom are autotrophic, meaning they make food (sugars) using the energy provided by sunlight. With the help of leaves, the plants use the sun, gases in the air (carbon dioxide), and water to make their own food

by creating glucose, a type of sugar. While making sugar, the plant produces oxygen and water and releases it into the air. We get much of the oxygen we breath from this process. We will learn more about photosynthesis when we study botany.

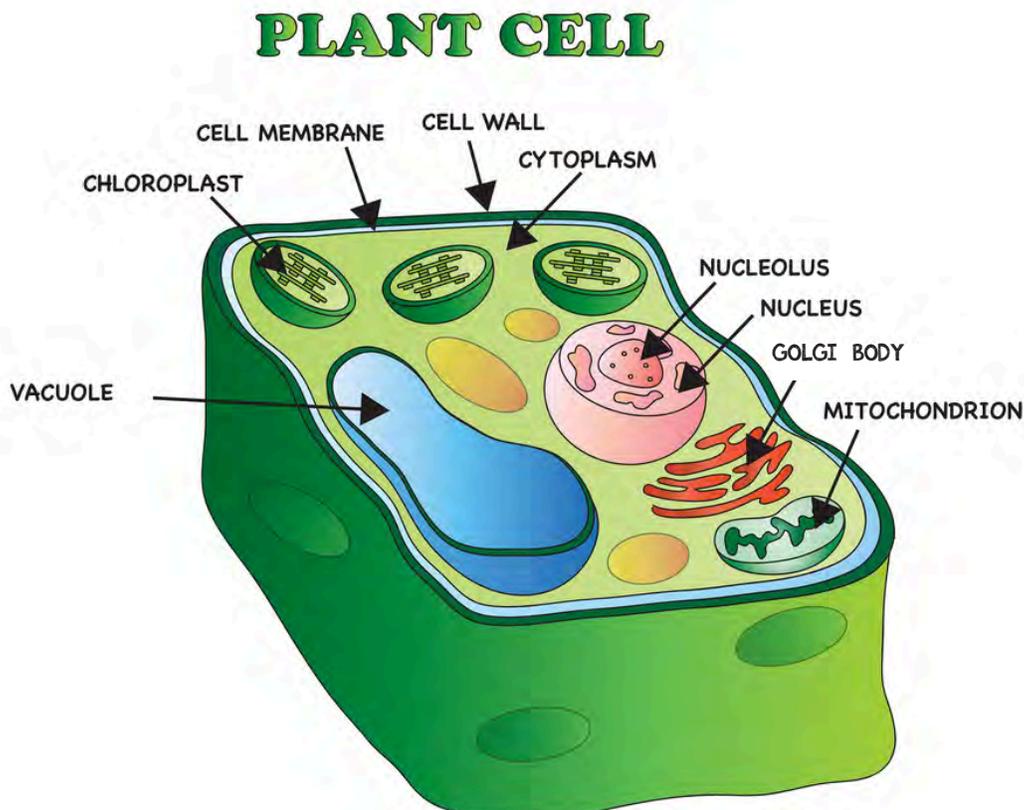
Look at the illustration on this page of a plant cell. Plant cells are the basic unit of life in all organisms of the kingdom Plantae. Plant cells are eukaryotic cells. This means they have a true nucleus along with specialized structures called organelles that carry out different functions. Animals, protists, and fungi also have eukaryotic cells, while bacteria and archaea have simpler prokaryotic cells.

### □ Microscope Activity



Give each child a copy of the sheet titled “Microscope Lab.” Have the children fill out one lab sheet (half sheet) using the following directions. Place the completed

sheets in their science journals.



up a small puddle of water? A sponge or paper towel are built more for soaking up water that is close to the surface. Plants that have no stem and are close to the ground are nonvascular plants. These plants act like a sponge to soak up the water and nutrients from the ground. This soaking process is known as osmosis.

### □ Activity #3: Art Observation

Have the children observe the painting included in this lesson by Carl Frederick Aagaard. Discuss all the types of plants that you can see. Read to the children: Notice the rocks and the plants growing on them. Would these plants be vascular or nonvascular?

□  Read the mini book *Plant Kingdom Classification* included in this lesson.

### □ My Six Kingdoms Booklet

Have the children take turns reading sections of the “Plant Kingdom Fact Sheet.” As each section is read, have the children complete the “Plantae Kingdom” page of the “My Six Kingdoms Booklet.”

## Plantae Kingdom Fact Sheet



**Cell Structure:** Plantae are eukaryotic. This means they have a nucleus within the cell. Plants are multicellular, which means they have more than one cell to perform the necessary functions of life.

**How they eat:** Organisms in the Plant Kingdom are all autotrophic and create energy in the form of glucose (or sugar) during the process of photosynthesis.

**Where they live:** Plants can live nearly anywhere on earth from extreme cold to extreme heat. Most plants need light, soil or rocks, and sunlight to survive.

**Examples:** Plants are divided into two main categories: vascular and nonvascular. Mosses, ferns, fruit trees, grasses, wheat, corn, rice, cotton, cacti, vegetables, and flowers all belong to the Plant Kingdom.

**How many species:** There are nearly 400,000 species in the Plant Kingdom, but scientists think there are more waiting to be discovered.

**More Facts:** Humans use plants for clothing (cotton, linen), food (any fruit, vegetable, or grain), shelter, paper, medicine, and more.

# Bible Plants - KEY

Look at the photograph of the plant, read the corresponding Bible verse, and write the common name that you read about.

Scientific Name	Bible Verse	Common Name
 <i>Salix babylonica</i>	Psalms 137:1-2	Willow or Weeping Willow
 <i>Ficus carica</i>	Luke 13:6	Fig Tree
 <i>Punica granatum</i>	Song of Solomon 4:13	Pomegranate Tree
 <i>Lilium candidum</i>	Matthew 6:28	Lily
 <i>Cinnamomum cassia</i>	Song of Solomon 4:14	Cinnamon

Carl Frederick Aagaard (1833-1895)



# Plant Kingdom Classification



Have you experienced the feeling of grass between your toes, witnessed the miracle of vegetables growing in your garden, seen the beauty of colored leaves falling from the trees, rejoiced in pink blossoms on a tree in spring, or smelled a rose in bloom? Grass, vegetables, trees, and roses are all members of the Plant Kingdom. When we enjoy nature, we gain gratitude for God's creations.

5. Can you think of other animals that have a backbone? [cats, dogs, chickens, etc.]
6. **Read to the children:** All animals with a backbone (vertebrae) have all of their bones on the inside of their bodies. This provides protection for the bones. Some animals don't have backbones at all. They are called invertebrates. Can you think of animals that would fit into this category? [worms, jellyfish, squids, snails, oysters, insects, crabs, sea stars, sponges, etc.]

**Activity: Vocabulary Words**



Review the vocabulary words on your science wall. Then place the vocabulary words VERTEBRATE and INVERTEBRATE

on your science wall. Read and discuss each of the words and meanings.

Vertebrate

Invertebrate

**Activity #2: Invertebrate vs Vertebrate Sort**

Have the children sort the "Animal Sort Photograph" cards into vertebrate animals (Chordata phylum) and invertebrate animals on the "Animal Sorting Mat" included with this lesson.

**Activity #3: Invertebrates**

**Read to the children:** Invertebrates are much more common than vertebrates. There are nearly 1.3 million species of invertebrates (think of all the spiders and insects in the world). There are only about 650,000 species of vertebrates in the world.

Invertebrates include insects, mollusks, crustaceans, corals, arachnids, velvet worms, and horseshoe crabs. We are going to explore an invertebrate that is a member of the mollusk phylum.

- Hand a chocolate chip (or piece of plain chocolate) and an M&M<sup>®</sup> to each child. Read to the children:** What is the difference between a chocolate chip and an M&M<sup>®</sup>? **Discuss size, shape, color, etc.** What is similar? [They both have chocolate, but the M&M<sup>®</sup>'s chocolate is protected with a shell.]
- Have the children use a spoon or their fingers to take the coating off of the M&M<sup>®</sup>.**
- Read to the children:** The coating on the M&M<sup>®</sup> is similar to an invertebrate animal's outer "bones" or shells. Many invertebrates (crabs, lobsters, clams, oysters, grasshoppers, snails, and spiders) have hard coatings on the outside of their bodies to protect their soft, inside body parts. This is called an exoskeleton. Some invertebrates, such as worms, jellyfish, and squids, don't have these protective coatings. Their body parts are left unprotected, similar to the plain chocolate or the M&M<sup>®</sup> without the shell.

Clam closed with protective shell



Clam open with body parts showing. Many invertebrates have similar body parts to vertebrates.



# ANIMAL SORTING MAT – KEY

## VERTEBRATES



## INVERTEBRATES



# Invertebrate Groups

## Other

Echinodermata include sea stars, sea urchins, and sea cucumbers. There are 15,000 known species of Echinodermata.

The Porifera phylum includes sponges. Sponges don't have muscles, nerves, or internal organs.



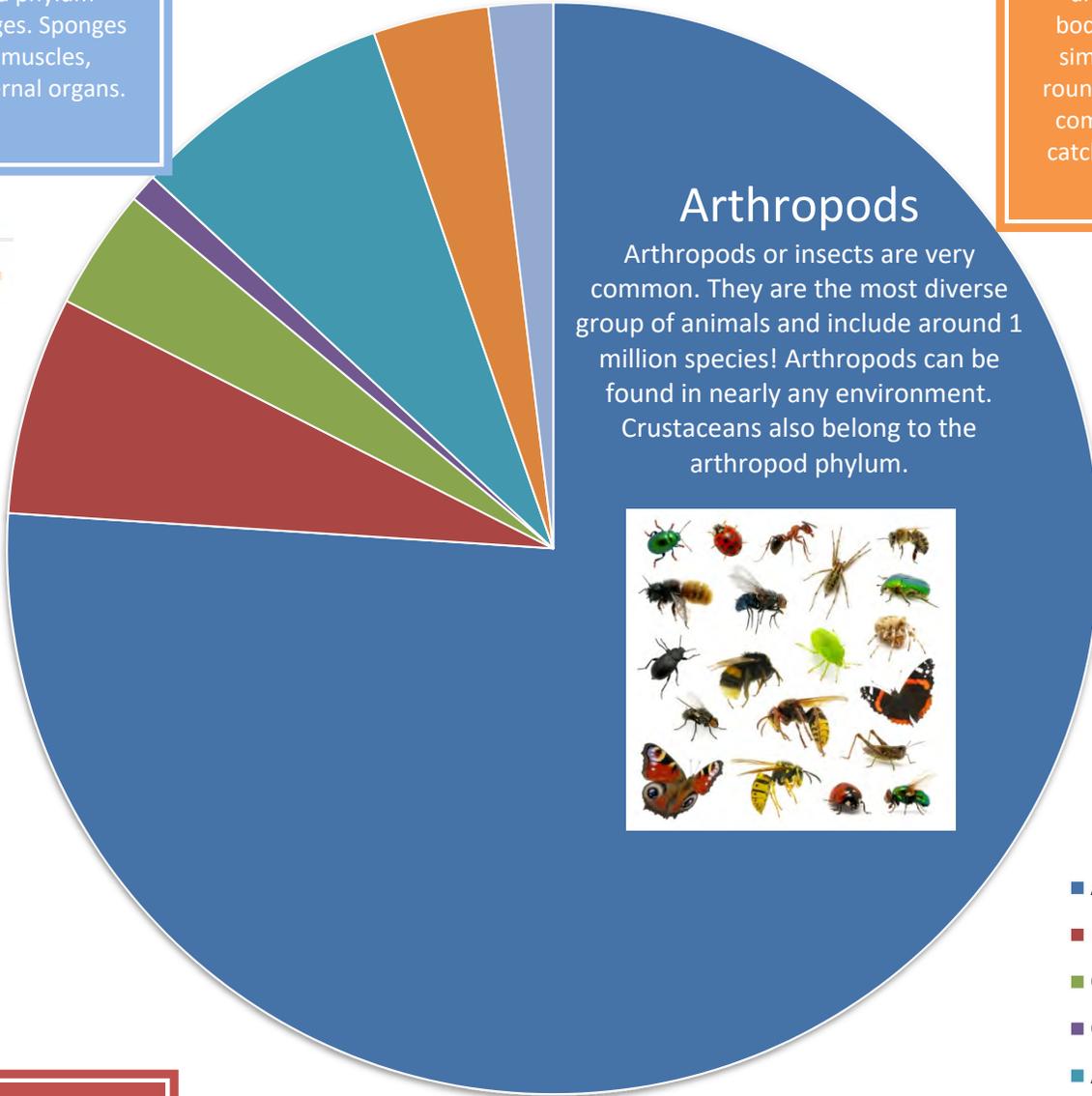
## Worms

Worms are divided into four different categories. There are nearly 45,000 species of worms. Annelida are earthworms and have segmented bodies. Flatworms have simple, soft bodies and roundworms are the most common. Velvet worms catch prey by spraying an adhesive slime.



## Arthropods

Arthropods or insects are very common. They are the most diverse group of animals and include around 1 million species! Arthropods can be found in nearly any environment. Crustaceans also belong to the arthropod phylum.



- Arthropods
- Mollusks
- Crustaceans
- Cnidarians
- Arachnids
- Worms
- Other

## Mollusks

There are nearly 85,000 species of mollusks. They include snails, squids, clams, oysters, and slugs. Mollusks have "feet," a heart, gills, a circulatory system, stomach, nerves, a "brain," and are capable of reproducing.



## Crustaceans

Crustaceans actually belong to the arthropod phylum! They have an estimated 47,000 species and include crab, lobsters, shrimp, and even woodlice.



## Cnidarians

There are 11,000 species of Cnidarians. Corals can be seen in the ocean and live in colonies. Sea anemones and jellyfish also belong to this group. Cnidarians are found exclusively in marine environments. Some may not even look like animals, but they are!



## Arachnids

Although spiders are the most common species of arachnids, the group also includes scorpions, ticks, and mites. They have 8 legs.

