BOTANY

3–8 Science Unit Study

THE GOOD AND THE BEAUTIFUL

BOTANY

CREATED BY THE GOOD AND THE BEAUTIFUL TEAM

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UNIT INFORMATION

Student Journal

All The Good and the Beautiful science units include activities in a student journal. Each student should have his or her own student journal, and the parent or teacher will direct the student regarding when to complete the activities in the lessons. Student journals can be purchased by going to **goodandbeautiful.com/science** and clicking on the *Botany* 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 on which you can attach the vocabulary words and other images. ***Cut out the vocabulary word cards at the beginning of the unit.*** The course will indicate when to place them on the wall.

Lesson Preparation

All 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.

Experiment Videos

Go to **goodandbeautiful.com/sciencevideos** and click on the *Botany* unit link or use the Good and Beautiful Homeschool 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 Homeschool app.

Optional Microscope Activities

This unit introduces the use of microscopes. In this unit there are several microscope activities, beginning with Lesson 5. 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.**

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

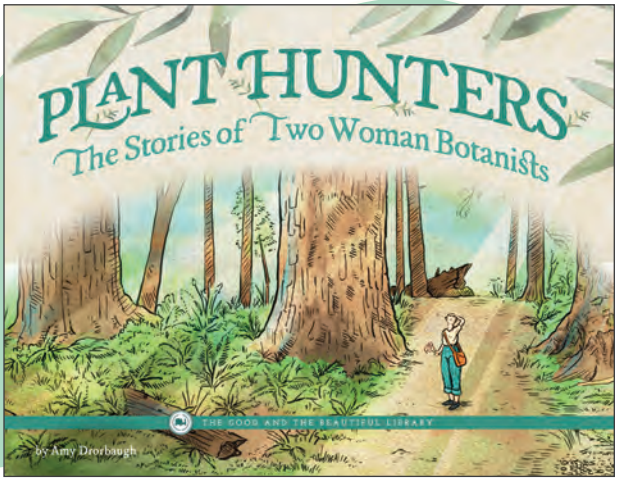
Some lessons include extra content that is more applicable for younger children (grades 3–6). Parents or teachers may choose to skip this content if instructing only older children.

Versions

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

READ-ALOUD BOOK PACK

The 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 *Botany* unit link.



Plant Hunters—The Stories of Two Woman Botanists
By Amy Drorbaugh

Carl in the Garden
By Molly Sanchez

The Good and the Beautiful Flower Study Book & Game
By Maggie Felsch & Molly Sanchez

CORRELATED BOOKS

The Good and the Beautiful Library has several books that correlate well with the *Botany* unit. It can be a wonderful experience for children to read books at their levels that are related to the subjects they are learning. The library includes both fiction and nonfiction books organized according to reading level. Find the Correlated Books by going to **goodandbeautiful.com** and clicking on the *Botany* unit product page.

GRADES 7–8

LESSON EXTENSIONS

How the Extensions Work

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

Answer Key

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

Flexibility

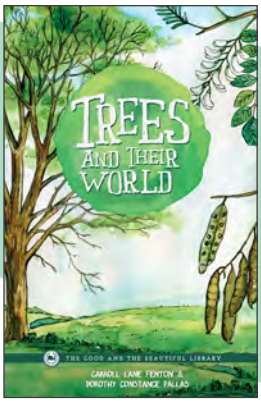
The amount of time it will take to complete each lesson extension will vary for each child. The average time is about 10–15 minutes per extension. Parents, teachers, and children may choose to omit parts of the lesson extension if desired. Encourage the children to stretch their capabilities, but also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

Taking Notes

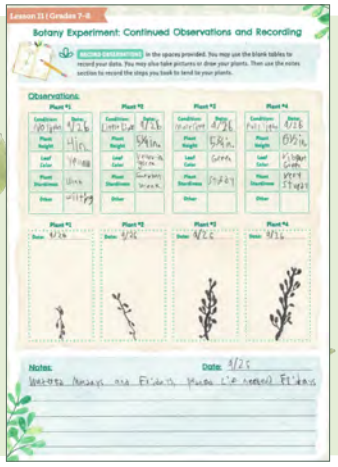
Some of the grades 7–8 lesson extensions have the children summarize the material read. Teach the children to look for key information, summarizing the most important points. Students can also add notes with their thoughts and the facts that are most interesting to them.

Optional Grades 7–8 Reading Book

We recommend ***Trees and Their World*** as extra reading for students in grades 7–8. This book can be purchased by going to **goodandbeautiful.com/science** and clicking on the *Botany* unit link.



Trees and Their World
By Carroll Lane Fenton & Dorothy Constance Pallas



SUPPLIES NEEDED

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** or on the Good and Beautiful Homeschool app. The activities, however, are not filmed.

Lesson 1

- None

Lesson 2

- Sandwich-sized zipper bag
- Paper towel
- Water
- 8 green bean or sunflower seeds
- Packaging tape
- 4 paper or plastic cups
- Potting media or soil
- Paper plate
- Stalk of celery with leaves
- Glass jar
- Water
- Red or blue food coloring

Lesson 3

- Live plant (see notes under the heading “Plant Parts Preparation”)
- Newspaper (to keep area clean)
- 1 drinking straw per child
- 1 glass of water per child
- Celery stalk prepared in the previous lesson
- Knife
- 1 dried bean per child

Lesson 4

- Previously soaked bean for each child
- 1 unsoaked bean
- Magnifying glass (optional)
- Outside grass with dandelions (optional)

Lesson 5

- Glue stick for each child
- Colored pencils, crayons, or markers
- Variety of real flowers
- Microscope
- Glass slides
- Slide covers
- Distilled water
- Paper towel

Lesson 6

- Glue stick
- Flowers (picked live or from a bouquet) (optional)
- 1 blank piece of paper per child (optional)
- 2 pieces of cardboard 9"x6" in size (optional)
- 4 rubber bands (optional)
- Microwave oven (optional)
- Microwave-safe glass or ceramic bowl (optional)
- Small picture frame (optional)
- Laminator and laminating sheets (optional)

SUPPLIES NEEDED
(CONTINUED)

Lesson 7

- Access to real leaves and needles
- Bag for each child to gather leaves (optional)
- Permanent marker
- Blank piece of paper (optional)
- Crayons (optional)

Lesson 8

- Wide leaf on a live plant (wait to pick it)
- Clear tape
- Clear nail polish
- Microscope
- Glass slides
- Tweezers or forceps
- Colored pencils or crayons
- 3 colors of play dough
- Flower cards from Lesson 6

Lesson 9

- 1 LEGO® brick
- Small piece of lumber (any size)
- Scissors
- Glue
- Small piece of celery
- Glass slides
- Distilled water
- Slide covers
- Microscope
- Paper towel (optional)
- Fingernail clippers

Lesson 10

- 1 pair of scissors per child
- 1 glue stick per child

Lesson 11

- 3 dirt samples (obtained outside or from bags of potting soil) placed in large containers
- Flower cards from Lesson 6 (optional)

Lesson 12

- Glue stick
- Crayons (optional)
- 1 blank piece of paper per child (optional)
- Sap from a tree
- Resin from a pine tree
- Microscope
- 2 slide covers and slides
- Paper towel

Lesson 13

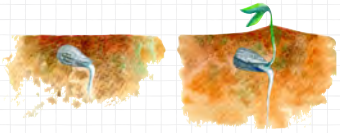
- None

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.

Botany

the study of plants, their structure, classification, and importance

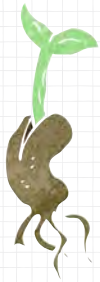


Germination

the process of a seed becoming a plant

Cotyledon

the infant leaf within a seed in seed-bearing plants



Introduction to BOTANY

Objective

Help the children understand what botany is, what botanists do, and the majesty and importance of the creation of plants.

Preparation:

- ☐ Cut out the six quotes included in this lesson and place them around the room with the pictures visible.
- ☐ Cut out the numbered pictures (1 and 2) and remove picture (3) included in this lesson.

Activity Supplies:

- None

☐ Optional Read Aloud

At any point in the lesson, you may read one of the books from the optional Read-Aloud Book Pack. *Carl in the Garden* by Molly Sanchez is suggested with this lesson.

☐ Botany Quotes Activity

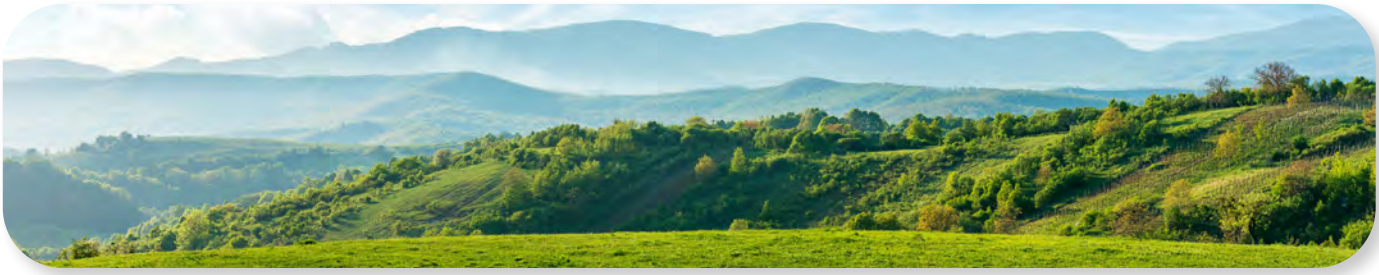
Have the children walk around and read the quotes that you placed around the room. (If the children cannot read, you may read the quotes aloud.) Have each child pick a quote and share why he or she likes it.

☐ The Study of Plants

Read to the children: Do you know what botany is? ***Botany*** is the study of plants. We get to spend this entire science unit discovering and learning all about the amazing plants that beautify the earth and provide the necessities of life for living things.

☐ Science Wall: Vocabulary Word

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



Picture Activity

Place the numbered pictures in front of the children. Read the following paragraphs one at a time and have a child point to the corresponding picture.

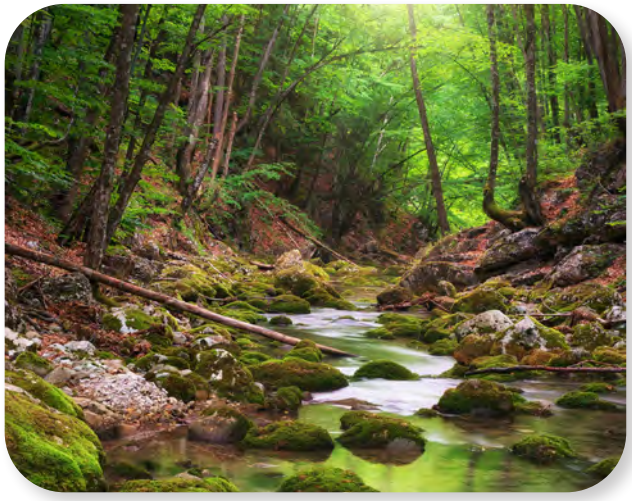
Read to the children: "In the beginning God created the heaven and the earth" (Genesis 1:1). On the first day, He created light and divided it from the darkness. On the second day, He created the firmament (the sky or atmosphere). And on the third day, God created the land and sea, along with all manner of plants. All other forms of life—fish and fowl, beasts and human beings—were still to come.

1. Plants are vital for life on the earth. They are beautifully designed by God to help give life to all other life forms. Nearly all living things depend on plants for food, including *carnivores*—animals that rely primarily on meat for their food—because plants are an integral part of sustaining life at some point in the food chain. Plants also provide shelter for many animals. Besides being a source of food and shelter, plants are also vital because they produce oxygen, a critical element for life.
2. Plants are different from other living organisms in a special way. While most life forms depend on other organisms for food and life, plants make their own food. The sequence and order of God's creations are important and build upon each other. The creations that were prepared before plants were things needed for plants to survive—light, air, water, and earth. God created all things in His wisdom and order.
3. Plants provide humans with food, shelter, medicine, fuel, and clean air, among other things. Humans need to be good caretakers of the plants God has given us.

Nature Activity: Show and Tell

Have the children turn to the "Show and Tell" page in Lesson 1 of their student journals and take them to a cozy place to sit in nature. *Note: If the children are unable to go outside for this activity, have them imagine they are in the setting of the image below and complete the activity accordingly.*

Read to the children: Experiencing nature personally is one of the best ways to learn about and be inspired by the beauty of this earth that God has created for us. Spend a few minutes quietly listening to the sounds of nature.



Walk around and smell, touch, and observe different things you find, such as soil, grass, leaves, flowers, or bark. Complete the sections under the words "hear," "smell," "feel," and "see" as you discover each category around you. Choose one or two items that you can show and tell about. After 10–15 minutes, we will gather together, and you will show and tell about the nature item you found.

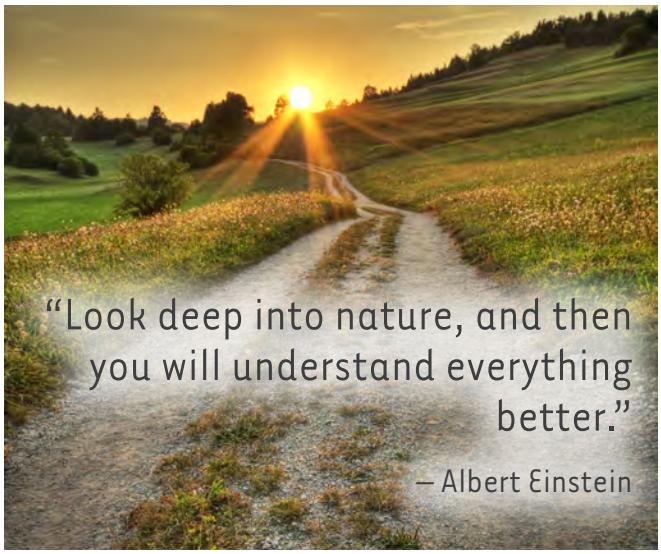
Lesson 1 Extension

7–8

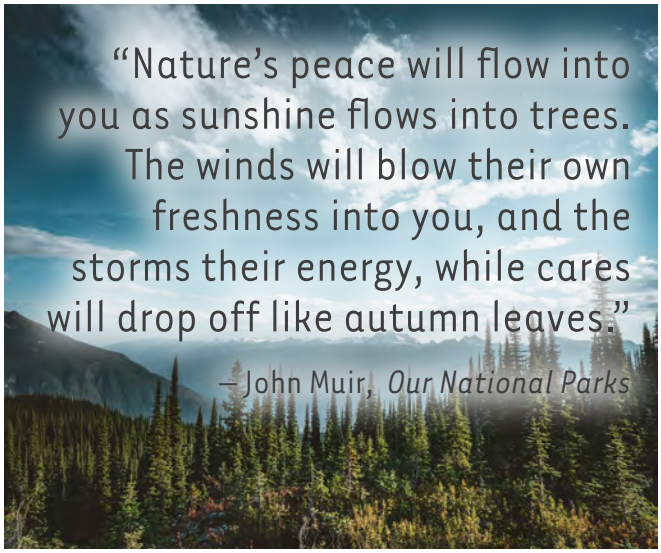
Have children grades 7–8 complete the self-directed Lesson 1 extension titled "Botanist: George Washington Carver" in their student journals.

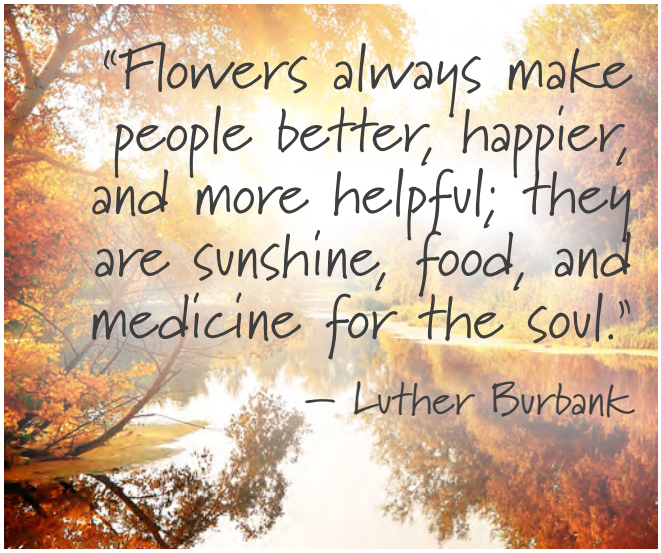
Quotes

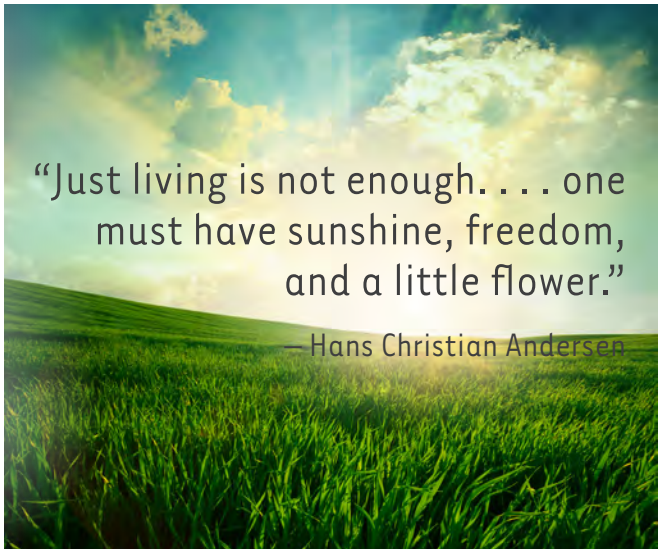

"Adopt the pace of nature:
her secret is patience."
– Ralph Waldo Emerson


"Look deep into nature, and then
you will understand everything
better."
– Albert Einstein

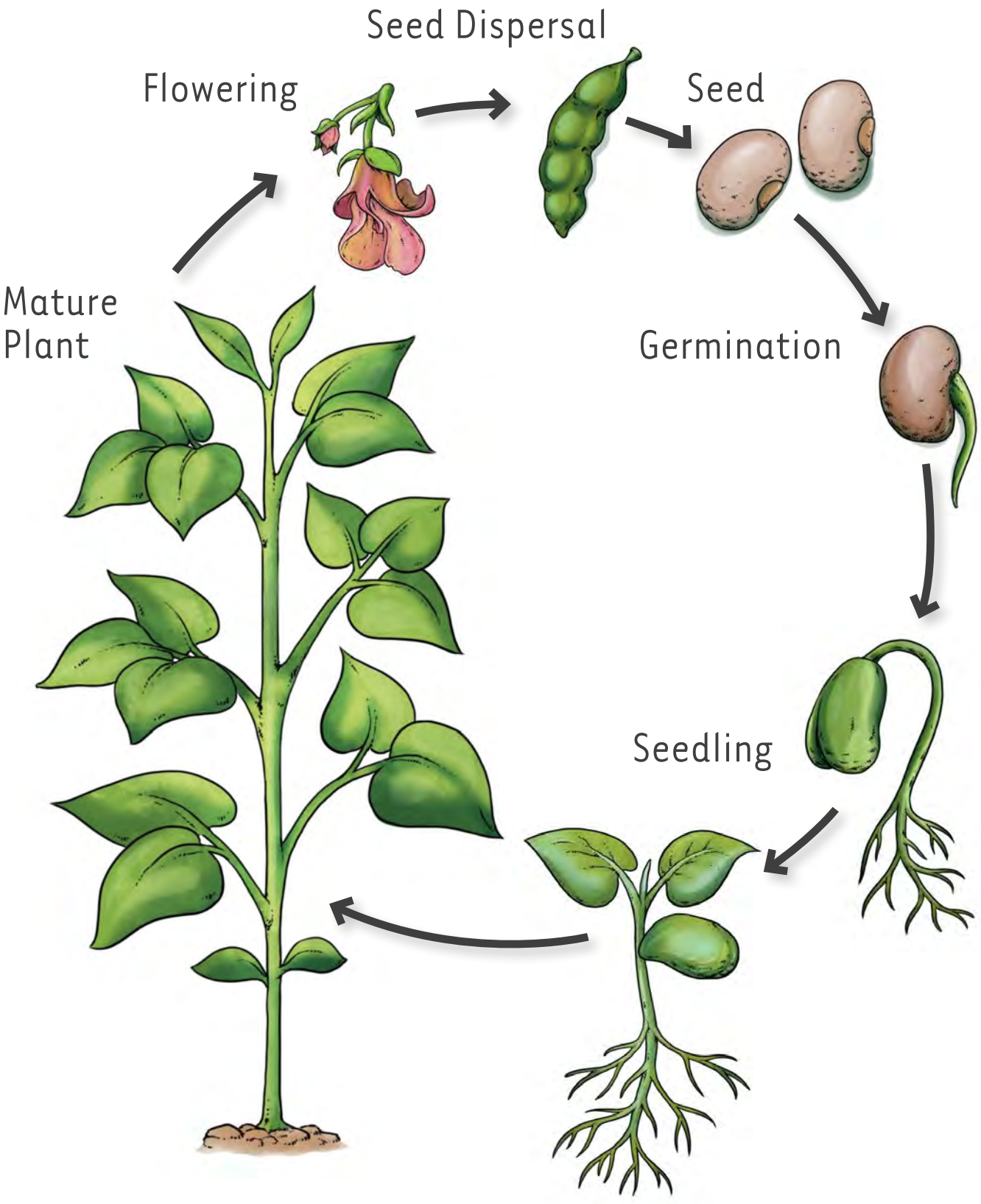

"If you truly love nature,
you will find beauty
everywhere."
– Vincent van Gogh


"Nature's peace will flow into
you as sunshine flows into trees.
The winds will blow their own
freshness into you, and the
storms their energy, while cares
will drop off like autumn leaves."
– John Muir, *Our National Parks*


"Flowers always make
people better, happier,
and more helpful; they
are sunshine, food, and
medicine for the soul."
– Luther Burbank


"Just living is not enough. . . . one
must have sunshine, freedom,
and a little flower."
– Hans Christian Andersen

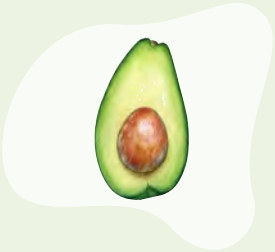
A Plant's Life Cycle



SEEDS

Objective

Help the children understand the parts of a seed, different types of seeds, and seed dispersal.



Preparation:

- ☐ For the experiment, place one dried lima bean (or other dried bean) per child in a cup of water overnight. This needs to be done 12–24 hours before the lesson.
- ☐ Cut out the "Seed Dispersal" pictures included in this lesson.

Experiment Supplies:

- Previously soaked bean for each child
- 1 unsoaked bean
- Magnifying glass (optional)
- Outside grass with dandelions (optional)

☐ Plant Observation

Have the children observe the seeds they planted in Lesson 2. What happened to the seeds in the bag that were turned? **Have the children turn to the "Plant Observation Log 2" page in Lesson 4 of their student journals and complete the observation section. Complete the notes section if desired. The seeds planted in plastic bags may now be discarded. In all future lessons, the children will be observing only the growing seeds in the cups.**

Read to the children: Seeds have an incredible way of using gravity to orient themselves and determine which direction is up or down. No matter which way a seed is turned, the gravitational pull will send the sprouts up and the roots down. **Children who completed the "Plant Movement" extension for grades 7–8 in Lesson 3 may be able to identify this as *geotropism*.**

☐ Seed Dissection Experiment

WATCH ONLINE

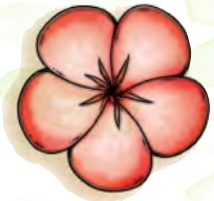
Have the children turn to the "Seed Dissection" page in Lesson 4 of their student journals. Have them draw a picture of what they think the seed will look like inside.

Have the children perform the experiment below or watch the video titled "Seed Dissection Experiment" at goodandbeautiful.com/sciencevideos or on the Good and Beautiful Homeschool app.

Read to the children: Every seed has within itself the beginnings of life. A bean is the seed of a bean plant. **Give each child a soaked bean that was previously prepared. Also have an unsoaked bean for the children to see.** What do you notice about these beans? [The soaked beans have swelled up with water.] What do you think the inside of the bean looks like?

Now rub the bean between your fingers to peel off the thin outer layer of the seed. This is called a seed coat. The seed coat protects the seed from physical damage. Find the

Angiosperms: Monocot vs. Dicot Chart

Monocot		Dicot
	SEED	
One cotyledon		Two cotyledons
	ROOT	
Several main roots		One main root
	STEM	
Scattered tubes		Ringed tubes
	LEAF	
Parallel veins		Branching veins
	PETALS	
Multiples of 3		Multiples of 4 or 5

Seed Dispersal

FLOWERS
Part 2

Objective

Help the children gain a greater appreciation for the beauty of flowers and identify different types of flowers.

Preparation:

- ☐ Cut out the two pages of "Flower Identification" cards included in this lesson.

Activity Supplies:

- Glue stick
- Flowers (picked live or from a bouquet) (optional)
- 1 blank piece of paper per child (optional)
- 2 pieces of cardboard 9"x6" in size (optional)
- 4 rubber bands (optional)
- Microwave oven (optional)
- Microwave-safe glass or ceramic bowl (optional)
- Small picture frame (optional)
- Laminator and laminating sheets (optional)

☐ Optional Read Aloud

At any point in the lesson, you may read one of the books from the optional Read-Aloud Book Pack. *Plant Hunters—The Stories of Two Woman Botanists* by Amy Drorbaugh is suggested with this lesson.

☐ Art Observation

Have the children turn to the painting by Armand Point called "La Joie des choses" in Lesson 6 of their student journals.

Read to the children: This artwork was painted by the French artist Armand Point. The title of this painting is "La Joie des choses" [pronounced "la zwa day shows"]. It is French for "the joy of things." Why do you think the artist gave the painting this title? **Observe and discuss the painting.**

☐ Flower Variety

Read to the children: How many varieties of flowers do you think there are in the world? There are more than 400,000 types of flowers in the world. If we were to observe 100 different types of flowers every single day of the week, we would have to continue for almost 11 years to observe them all. God certainly created a beautiful variety of flowers in our world.

☐ Flower Identification Game

Read to the children: Let's do an activity that explores some of the amazing flowers on Earth. **Place all the flower pictures and name cards on the table.** First, I am going

Flower Identification Key

#1 ROSE

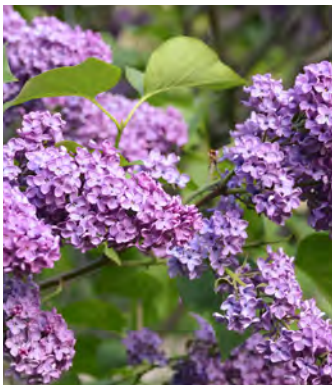
#2 VIOLET

#3 TULIP

#4 DAISY

#5 CROCUS

#6 IRIS



#7 LILAC

#8 ORCHID

#9 LAVENDER

#10 DAFFODIL

#11 HOLLYHOCK

#12 LILY

Leaf Classification Chart

SHAPE

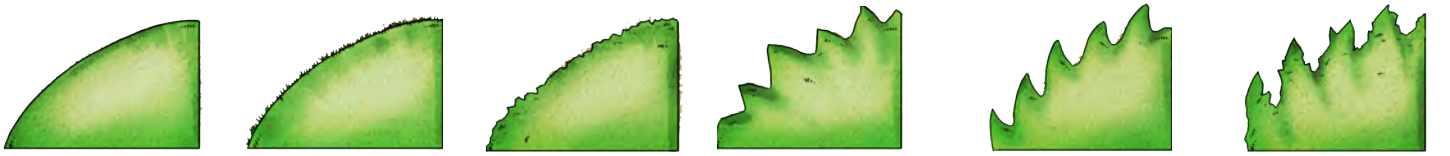
acicular — needle
cordate — heart
cuneate — wedge
deltoid — triangle
elliptic — oval
flabellate — fan
lanceolate — pointed
linear — narrow
obcordate — heart

oblong — rectangle
obovate — upside-down egg
ovate — egg
orbiculate — circular
palmate — hand
peltate — shield
reniform — kidney
sagittate — arrowhead
spatulate — spoon

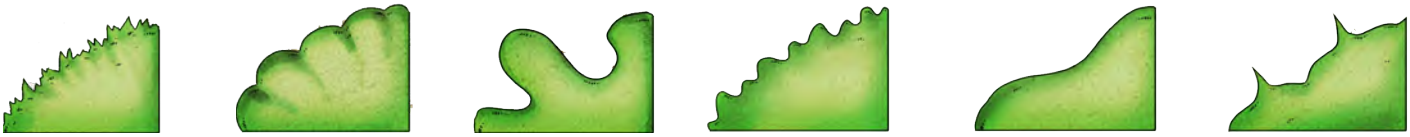
ARRANGEMENT

Simple — one leaf on petiole
Alternating — leaves alternate on stem
Compound #1 — multiple leaves on petiole
Opposite — leaves opposite on stem
Compound #2 — multiple leaves on petiole
Whorled — leaves grow around stem

MARGIN (EDGES)



Entire — smooth
Ciliate — with fine hairs
Denticulate — with fine teeth
Dentate — with straight, pointed teeth
Serrate — with pointed teeth at angle
Doubly Serrate — serrate with sub-teeth



Serrulate — fine serration
Crenate — with rounded teeth
Lobate — indented toward midrib
Sinuate — wavy indentations
Undulate — wide, wavy indentations
Spiny — with sharp, stiff points

VENATION

Arcuate — veins bending toward apex
Cross-Venulate — smaller veins connecting larger veins
Dichotomous — veins branching in pairs
Longitudinal — veins mostly aligned along midrib
Palmate — several primary veins diverging from a point
Parallel — veins aligned with midrib, without intersecting

Pinnate — veins paired oppositely
Reticulate — smaller veins forming a network
Rotate — veins radiate from petiole in peltate leaves

PHOTOSYNTHESIS

Objective

Help the children understand what photosynthesis is and how the photosynthesis process works.

Preparation:

- ☐ Place the "Photosynthesis" page out where the children will see it.

Experiment Supplies:

- Wide leaf on a live plant (wait to pick it)
- Clear tape
- Clear nail polish
- Microscope
- Glass slides
- Tweezers or forceps

Activity Supplies:

- Colored pencils or crayons
- 3 colors of play dough
- Flower cards from Lesson 6

☐ Plant Observation

Have the children observe the seeds they planted in Lesson 2. Do you notice any differences between the plants that are receiving more or less sunlight or water? **Have the children turn to the "Plant Observation Log 6" page in Lesson 8 of their student journals and complete the page.**

☐ The Sun Gives Life

Read to the children: What did our world already have when plants were created? [light, air, water, soil] Each of these things is important to give life to plants. The sun is an amazing source of light for the earth. What do you think of when you think of the sun?

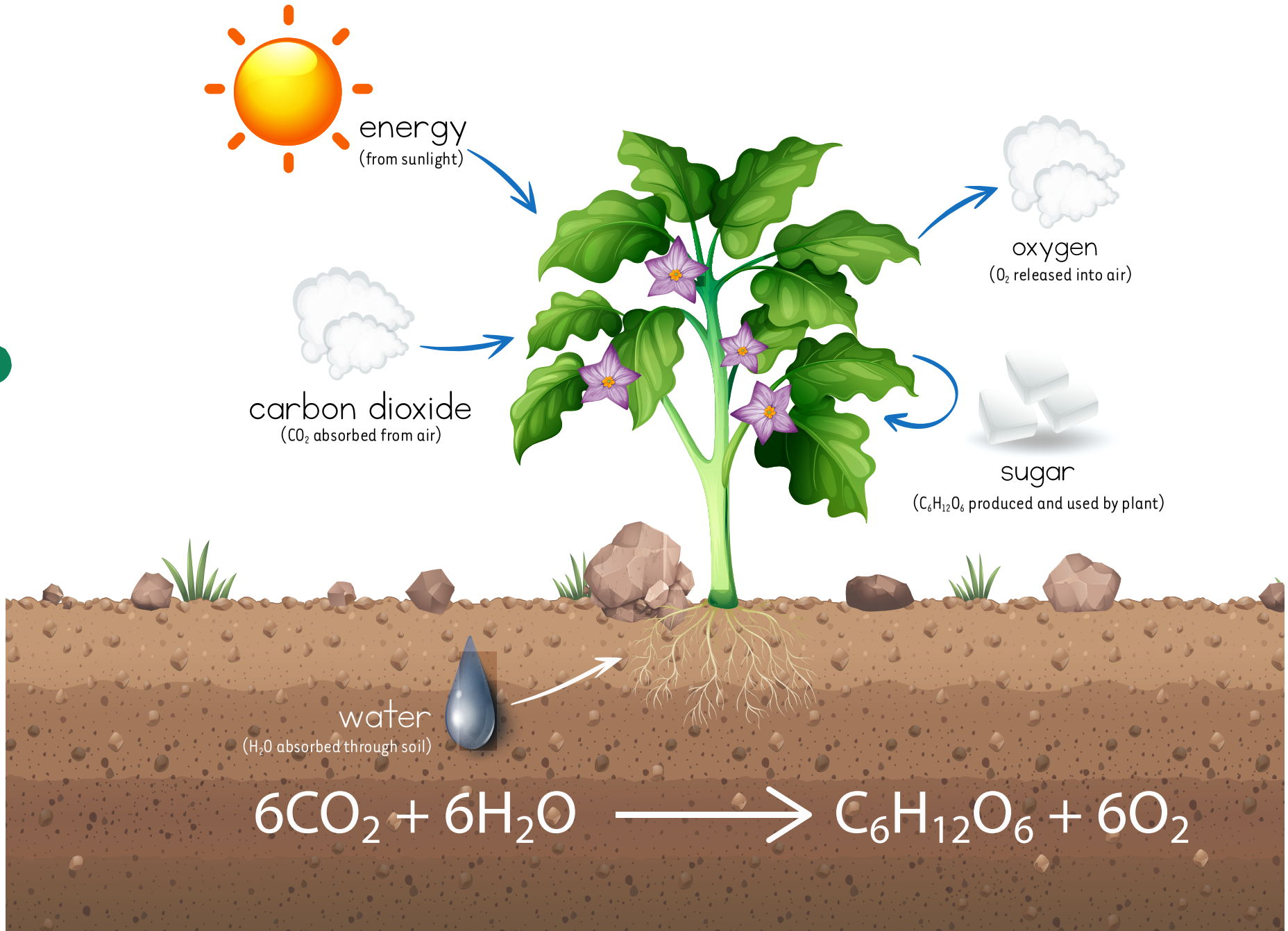
Why is the sun so important for us? The sun gives us life on the earth and makes it possible for plants to grow. There is amazing symbolism between the life the sun gives the earth and the life the Son—the Son of God—gives us. **Discuss how the sun is like the Son of God.** God has provided us with witnesses of Him and His love through His creations. As we observe nature, we will see God's love all around us.

☐ Leaf Stomata Microscope Experiment Preparation

Note: There is a video for this activity, mentioned later in this lesson. If you plan only to watch the video, you can skip this preparation section.

Read to the children: We are going to learn more about how the sun gives life to plants, but before we do, we need to prepare for the microscope experiment we will complete later in the lesson.

Photosynthesis



PLANT CELLS

Objective

Help the children learn basic cell functions and the difference between a plant cell and an animal cell.

Preparation:

- ☐ None

Activity Supplies:

- 1 LEGO® brick
- Small piece of lumber (any size)
- Scissors
- Glue

Experiment Supplies:

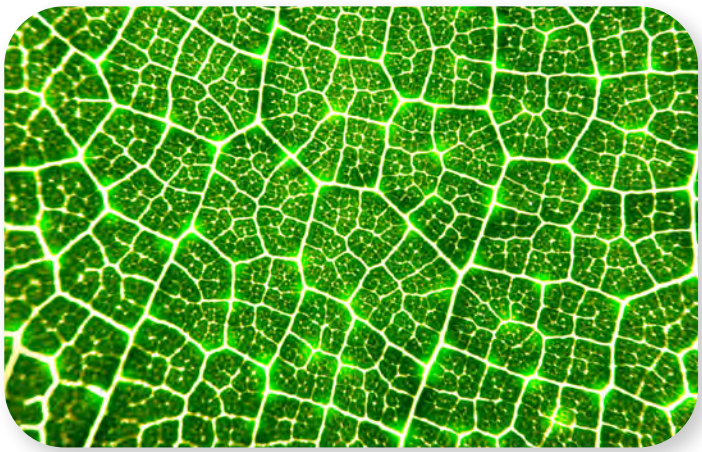
- Small piece of celery
- Glass slides
- Distilled water
- Slide covers
- Microscope
- Paper towel (optional)
- Fingernail clippers

☐ Plant Structure

Show the children a LEGO® and a piece of lumber.
Read to the children: What do these two items have in common? What are some differences between them?

Both of these items can be used to build structures, but the structures will have different purposes and uses. Just as there are basic materials that can be used to build buildings, there are basic building blocks for all living things, such as plants, animals, humans, bacteria, protists, etc. These basic building blocks are called ***cells***.

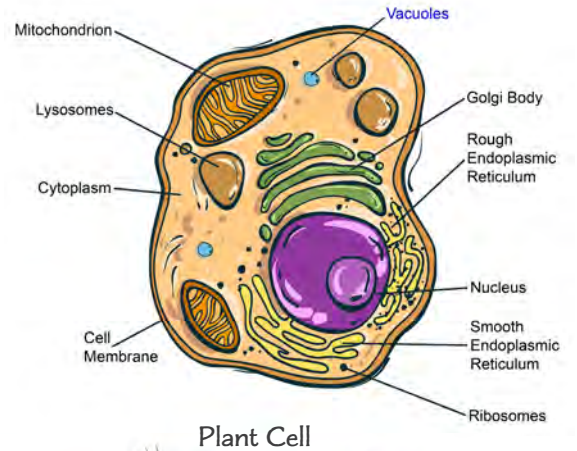
Plant cells are ***eukaryotic*** [you–carry–AW–tick]. This means they have a true nucleus—the round structure of most cells that has a double membrane and is the control center of the cell. The nucleus is a specialized



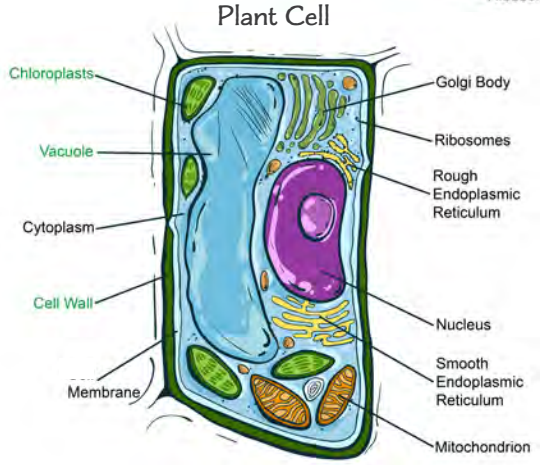
structure that can carry out different functions in the cell. Humans, animals, protists, and fungi also have eukaryotic cells, while bacteria have simpler *prokaryotic* [pro–carry–AW–tick] cells. Plants are ***multicellular***, which means there is more than one cell in the plant to perform the functions of life.

is what you would see. **Show the children the animal cell and plant cell images below. Give the children a moment to look at the two cells.**

Animal Cell



Plant Cell



What differences and similarities do you notice about the cells now? **If needed, point out the plant's cell wall, chloroplasts, and vacuole.** When you looked at celery under the microscope, you were probably able to see patterns of cell walls that you could not see in the fingernail sample. That is because plant cells have walls, and animal cells do not.

Organelle Identification

Read to the children: Why do you think plant cells have these differences?

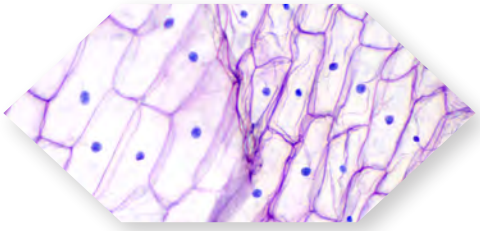
Look again at the animal cell and plant cell images above. **Have the children find each organelle, or part of the cell (in both cells if possible), as you read:** All eukaryotic cells have a *nucleus* that functions as the cell's command center, or brain. It controls what is happening in the cell. The *cell membrane* is what holds all the organelles (parts) of the cell together. It is *semipermeable*, which means it can allow certain things to go in and out of the cell. The *cytoplasm* is made up of a gel-like substance and helps cells maintain their shapes. It contains the organelles of the cell. The *mitochondrion* is known as the powerhouse of the cell, giving the cell its energy. *Ribosomes*, the *endoplasmic reticulum*, and *Golgi bodies* all work together to make and process proteins that are needed for the cell to function. *Lysosomes* are found in all animal cells, and they break down and recycle sugars and proteins.

Plant and animal cells both have *vacuoles*, but they function a little differently. Animal cells have several smaller vacuoles, and plant cells usually have just one large, permanent vacuole. Animal cell vacuoles store nutrients, waste, and some water, while a plant cell vacuole mainly stores water. A plant vacuole takes up the majority of the cell, so when a vacuole does not have enough water, the plant will wilt.

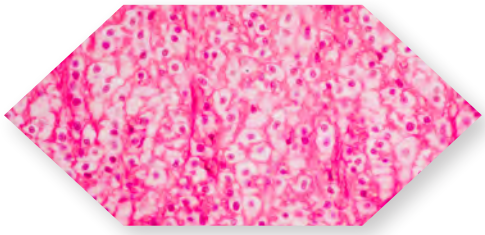
Plant cells need *chloroplasts*, which have the special job of capturing the energy of the sun so that photosynthesis can take place. Chloroplasts are also responsible for a plant's green color.

The last major difference between a plant cell and animal cell is that a plant has a *cell wall* in addition to the cell membrane. A cell wall can hold the plant's structure and shape when the vacuole is full of water and also when the vacuole's water level is low and the plant is wilting. **Note: *The Good and the Beautiful***

Onion Skin Cells



Cartilage Cells



Kingdoms and Classification unit goes into greater depth and detail about the cell and cell functions.

Animal and Plant Cells Journal Page

Have the children turn to the "Animal and Plant Cells" page in Lesson 9 of their student journals and complete the page. The answer key can be found at the end of the lesson.

Venn Diagram

Have the children turn to the "Venn Diagram" page in Lesson 9 of their student journals. Have the children fill in the Venn diagram with the things you discussed together. The answer key can be found at the end of the lesson.

Plant Observation

Have the children observe the seeds they planted in Lesson 2. Have the children turn to the "Plant Observation Log 7" page in Lesson 9 of their student journals and complete the page.

Lesson 9 Extension

7–8

Have children grades 7–8 complete the self-directed Lesson 9 extension titled "Botany Experiment: Observations and Recording" in their student journals.

PLANT CLIMATE MAPPING

Cut along the dotted lines. Read each description, and then match the color to the map.

POLAR

Plants grow on every continent in the world, including Antarctica. While it is true that most of Antarctica cannot support plant life, some plants do grow along the Antarctic Peninsula and on nearby islands. There are no trees or shrubs, only liverworts and two flowering plant species: the Antarctic hair grass (pictured) and the Antarctic pearlwort.

TEMPERATE

Temperate climate zones are able to sustain a large variety of plants and are distinguished by their four seasons: winter, spring, summer, and autumn. The temperature ranges greatly depending on the season, and precipitation is generally higher than in an arid region and less than in a tropical one.

ARID

Plants can grow in very dry, arid areas, but not as abundantly as plants in temperate or tropical regions. The plants that grow in deserts, such as cacti, yuccas, and sagebrushes, are able to handle harsher conditions without as much water. The Joshua tree pictured here grows shallow roots spread out vertically to catch rainwater and can survive with only one good rainfall a year. It has thick, waxy bark to prevent water loss.

TROPICAL

The Amazon rainforest in South America is the largest tropical rainforest in the world. With moderate temperatures and lots of rain, a large variety of plants can grow here. The forest is so vast and there are so many plants that some plants are still being discovered. The plants you see on the water are giant water lilies; they can grow to almost 3 meters (10 feet) across!

MEDITERRANEAN

Known for grape vineyards and olive groves, the Mediterranean climate has dry, hot summers and cold, rainy winters. Compared to tropical regions, the rainfall is low, but it does not experience a snowy winter like temperate regions.

TREES

Objective

Help the children learn the parts of a tree and their functions.

Preparation:

- ☐ Cut out the leaves on the page titled "Tree Benefits—Leaves."
- ☐ Cut out the strips on the page titled "Tree Parts—Definitions."

Activity Supplies:

- Glue stick
- Crayons (optional)
- 1 blank piece of paper per child (optional)

Experiment Supplies:

- Sap from a tree
- Resin from a pine tree
- Microscope
- 2 slide covers and slides
- Paper towel

Note: For this lesson you may decide to go outside and sit under a big shady tree. This lesson also includes an optional nature walk. Plan for the additional time, or you may decide to reserve another day for the "Nature Walk and Bark Rubbings" activity to allow for more time to enjoy each of the activities.

☐ Redwoods Video

Watch the video titled "Redwoods" at goodandbeautiful.com/sciencevideos or on the Good and Beautiful Homeschool app, and then discuss the questions below.

1. What is one condition a redwood needs to reach its greatest height? [cool, damp climate, fog, etc.]
2. A redwood's roots go down only 3.048 meters (10 feet); how do they anchor themselves? [roots go out 15.24 meters (50 feet) and wrap around other tree roots]

☐ Tree Benefits

Read to the children: The tallest living things on Earth are not only incredible to look at, but they also provide great benefit to our planet. What are some of the benefits we receive from redwoods and other trees? [shade, beauty, fruit, etc.] We are going to learn some more benefits of trees. Some of them may be ones that you already listed.

Put the leaves from the "Tree Benefits—Leaves" page in front of the children. Have the children take turns picking a leaf, reading what it says, and gluing it to the tree on the page titled "Tree Benefits." Place the completed page on the science wall. *Note: The leaves, when glued on, may hang off the page.*

Parts of a Tree

Have the children turn to the "Parts of a Tree" page in Lesson 12 of their student journals. Put the cut-out "Tree Parts–Definitions" strips on the table. Have the children take turns picking a definition and reading it aloud. Have the children determine which part of the tree the definition belongs to and glue or write their answers in their student journals. If you are sitting near a tree, have the children find the same part on the real tree. The answer key can be found at the end of the lesson.

Tree Resin and Sap Microscope Experiment

WATCH ONLINE

Have the children perform the experiment below or watch the video titled "Tree Resin and Sap Microscope Experiment" at goodandbeautiful.com/sciencevideos or on the Good and Beautiful Homeschool app.

1. Place a drop of sap on one slide and a drop of resin on the other.
2. Gently place slide covers on top of each and dab any wet edges with a paper towel. Carefully push out any air bubbles.
3. Have the children turn to the "Microscope Lab" page in Lesson 12 of their student journals. They should label the specimens, add the date, and draw a picture of what they see.

Science Wall: Vocabulary Words

Place the vocabulary cards SAP and RESIN on your science wall. Read and discuss the words and their definitions.

Poetry Activity

Read the following poem and discuss the messages the children find within the poem.

The Oak Tree

By Johnny Ray Ryder Jr.

A mighty wind blew night and day.
It stole the Oak Tree's leaves away,
Then snapped its boughs and pulled its bark
Until the Oak was tired and stark.

But still the Oak Tree held its ground
While other trees fell all around.
The weary wind gave up and spoke,
"How can you still be standing, Oak?"

The Oak Tree said, "I know that you
Can break each branch of mine in two,
Carry every leaf away,
Shake my limbs and make me sway.

But I have roots stretched in the earth,
Growing stronger since my birth.
You'll never touch them, for you see,
They are the deepest part of me.

Until today, I wasn't sure
Of just how much I could endure.
But now I've found, with thanks to you,
I'm stronger than I ever knew."

Plant Observation

Have the children observe the seeds they planted in Lesson 2. Have the children turn to the "Plant Observation Log 10" page in Lesson 12 of their student journals and complete the page.

Read to the children: Now that all the plants are receiving water and

BOTANY
LESSON 13

CARNIVOROUS AND POISONOUS PLANTS

Objective

Help the children learn the characteristics of carnivorous plants and recognize common poisonous plants.

Preparation:

- ☐ Cut out the pictures and descriptions on the pages titled "Memory Game."

Activity Supplies:

- None

☐ Carnivorous Plants

Read to the children: We have learned about trees as tall as skyscrapers and cacti that can grow without water for a year, but today we are going to learn about some of the most unique plants on our planet. These rare plants do not rely solely on photosynthesis for nutrients. They obtain food by catching and digesting insects; like wolves or tigers, they are carnivorous!

Carnivorous plants eat insects because their soil does not contain the nutrients they need to survive—especially nitrogen, phosphorus, and potassium. Carnivorous plants often grow in places where many other types of plants cannot grow because of the lack of nutrients.

Gratefully, carnivorous plants are not harmful to humans. While a human could trigger a trap to close, he or she would be much too large to actually get trapped, harmed, or digested.

Carnivorous plants may not be harmful to humans, but some plants are poisonous to touch or eat, and they can give you rashes or make you sick. We are going to play a matching game to learn about and recognize specific carnivorous and poisonous plants.

☐ Carnivorous and Poisonous Plants Memory Game

Shuffle the "Memory Game" cards and spread them out on the table. Place all the picture cards on the right side of the table and the description cards on the left side of the table. Turn all the cards facedown, and then proceed as follows:

1. **Have a child pick one description card and ask the child, or adult if needed, to read it aloud.**
2. **Have the child pick one picture card and determine if the cards match.**

Memory Game


VENUS FLYTRAP


BLADDERWORT


RAFFLESIA


PITCHER PLANT


SUNDEW


BUTTERWORT


POISON OAK


POISON IVY

BOTANY

Grades 3-6

STUDENT JOURNAL

This journal belongs to:

THE GOOD AND THE BEAUTIFUL

INSTRUCTIONS

This student journal accompanies *The Good and the Beautiful Botany* 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.

TABLE OF CONTENTS

SHOW AND TELL

To be completed outdoors in any season:
Circle items that you hear, smell, feel, and see outside. Draw pictures in the circles as desired.

HEAR

SMELL

FEEL

SEE

Lesson 3

PLANT PARTS

Draw your plant with as much detail as possible. Include the stem, roots, leaves, and flowers.

Draw a line from the plant part to its function.

Flower

Fruit

Seed

Stem

Leaf

Root

Contains the embryo of a new plant

Anchors the plant in place and holds nutrition

Supports the plant's leaves and sucks up water

Performs photosynthesis

Part of the plant that makes seeds

Protects seeds

Microscope Lab

Date: _____

Specimen Observed:

_____

Notes:

Date: _____

Specimen Observed:

_____

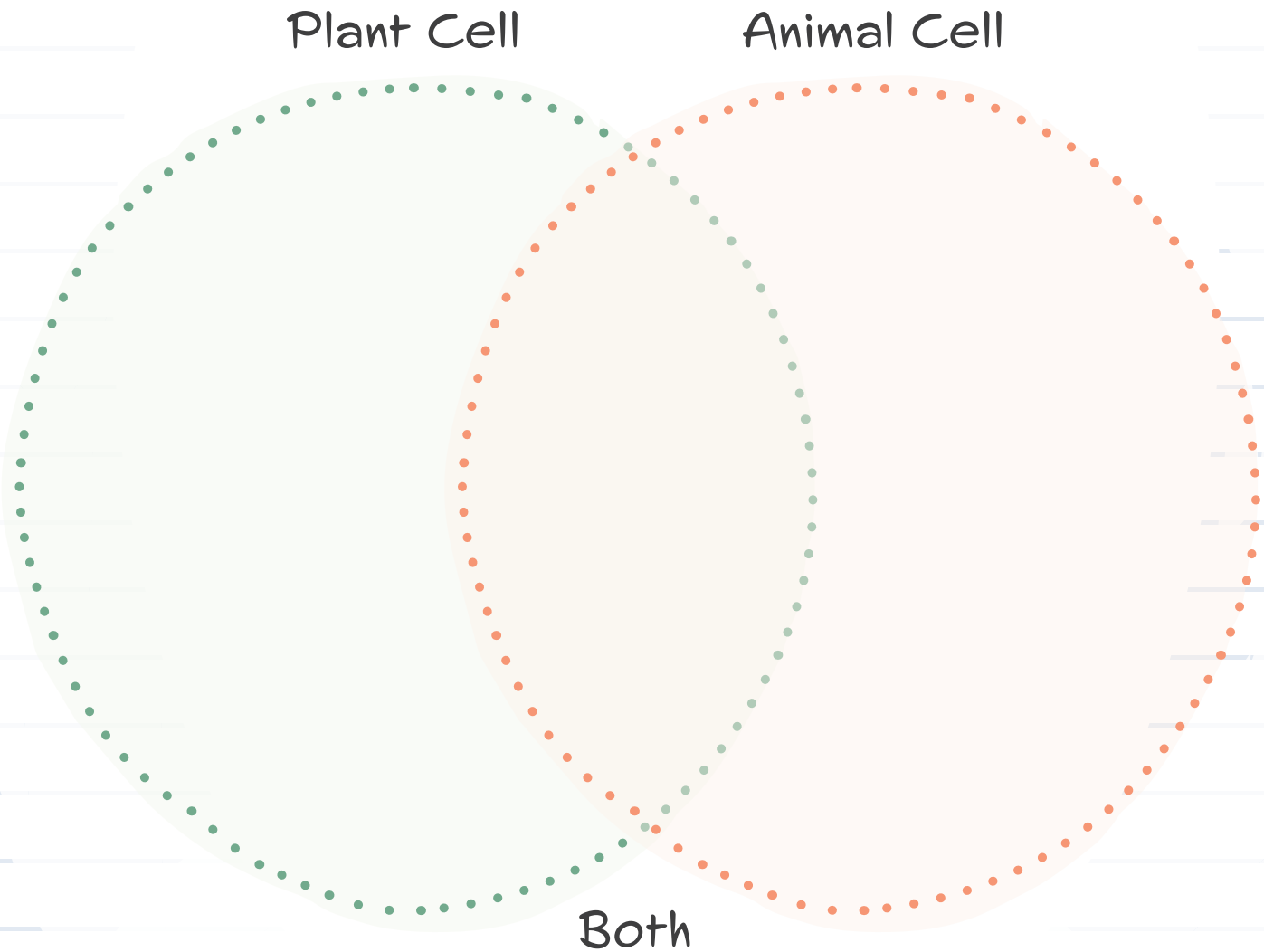
Notes:

ART STUDY

"La Joie des choses" by Armand Point (1860–1932), 1884

VENN DIAGRAM

Cut out the words at the bottom of the page and glue them in the correct places on the Venn diagram.



Rectangular shape	Circular shape	Lysosomes	Nucleus
Cell wall	Chloroplasts	One large vacuole	Several small vacuoles
Cell membrane	Cytoplasm	Mitochondria	Ribosomes
	Golgi body	Endoplasmic reticulum	

Lesson 11

SOIL EXPLORATION

Look at three different samples of soil. Use the boxes below to draw what you see when you look at your soil samples up close.

Sample 1	Sample 2	Sample 3

Circle all the words that describe your soil samples.

Dry Wet Muddy Damp Soft Hard Rocky

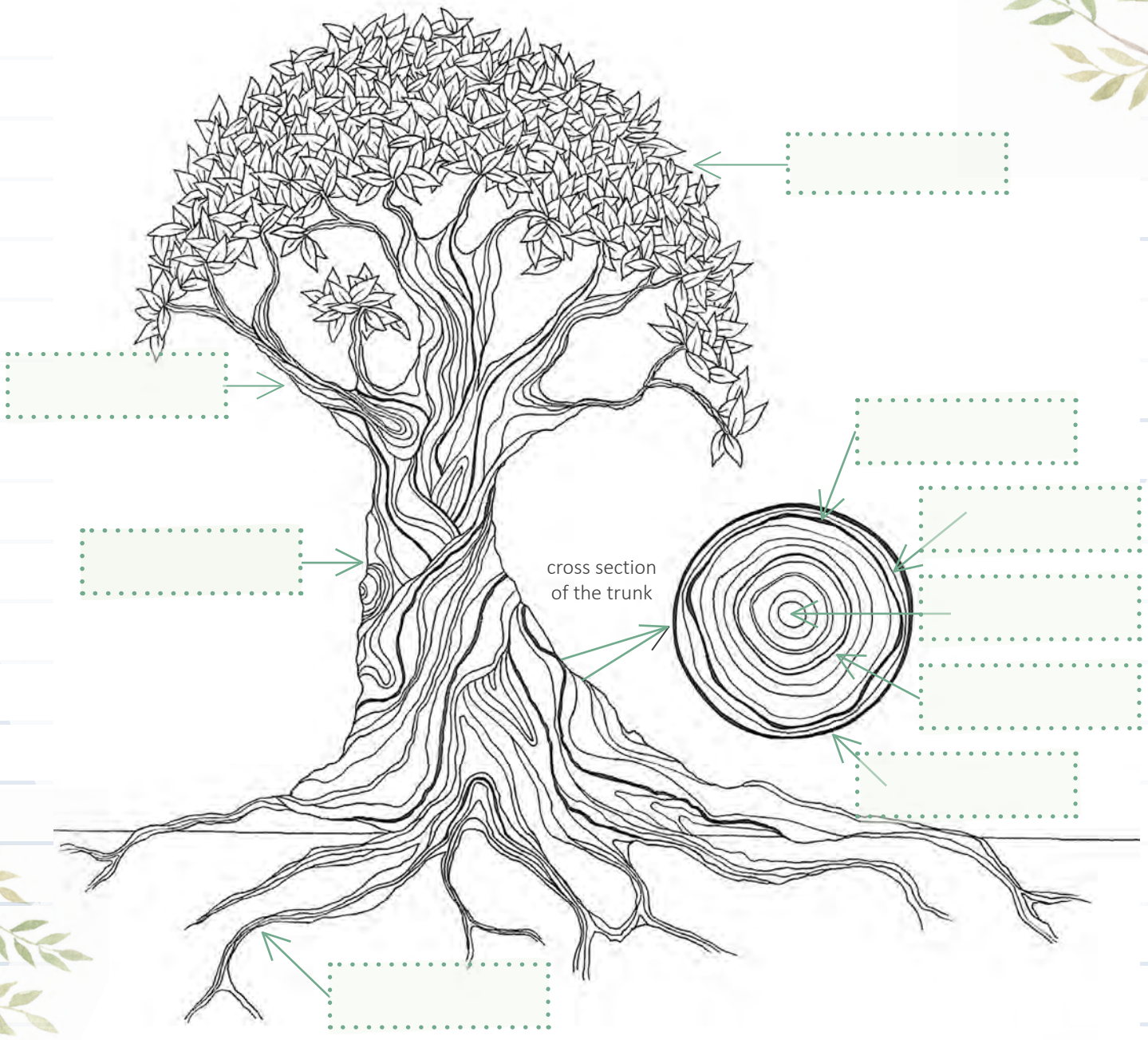
Sandy Grainy Smooth Clumpy Crumbly

Black Gray Brown Lighter Darker

Did you find anything interesting in your soil samples (rocks, plant roots, bugs, leaves, etc.)? Use the box below to draw the things you found.

PARTS OF A TREE

After reading the tree parts definitions, cut out the word boxes on the previous page and glue them below in the correct space.



Lesson 13

POISONOUS PLANTS

Draw a picture of poison ivy and write a one-sentence description of poison ivy and two other poisonous plants. Refer to the memory game cards if needed.

Name: Poison Ivy

Name:

Name:

BOTANY

Grades 7-8

STUDENT JOURNAL

This journal belongs to:

THE GOOD AND THE BEAUTIFUL

INSTRUCTIONS

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

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

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

TABLE OF CONTENTS

SHOW AND TELL

To be completed outdoors in any season:
Circle items that you hear, smell, feel, and see outside. Draw pictures in the circles as desired.

HEAR

SMELL

FEEL

SEE

EXTENSION

Instructions:

1. Read the information below.
2. Write 1–2 sentences about each of the following prompts:
   a. How did others positively influence George Washington Carver's life?
   b. How did George Washington Carver affect the field of agriculture?
   c. What inspired you the most about George Washington Carver?

Botanist: George Washington Carver

George Washington Carver was born into slavery on July 12, 1864, near Diamond Grove, Missouri, but he would eventually gain a college education and become a prominent scientist. These accomplishments were not easily achieved, considering the circumstances of his day. George was kidnapped shortly after his birth, along with his mother and a sibling. He was found and returned to his slaveholder, Moses Carver. Moses and his wife, Susan, raised and educated George and his brother after the Civil War ended slavery in 1865.

As a young boy, George developed a love for plants. He spent time gardening and exploring the woods. The joy he found there resonates in his words: "Nothing is more beautiful than the loveliness of the woods before sunrise." He collected flowers and rocks, and he helped friends take care of their sick plants. Because of this tender gift, he was called the "Plant Doctor."

At only 12 years old, George left home to acquire more education. He attended several different schools. After high school, he wanted to further his education but was rejected at some universities because he was black. Even though the 13th Amendment abolished slavery, heavy discrimination continued in the United States for many years. Despite this injustice, George still found ways to educate himself. With his friends' encouragement, he applied to Simpson College and was accepted. At first he studied art, but when his art teacher noticed his love for plants, she advised him to pursue the study of botany at Iowa State Agricultural College. George applied, was accepted, and became the first black student at Iowa State. He earned his bachelor's degree in science in 1894, and he continued his education by learning to identify and treat plant diseases. Later he received a master's degree in agriculture and began teaching.

George developed many new ideas that helped improve agriculture and the livelihood of farmers. In studying soil, George realized that the practice of crop rotation would greatly benefit agriculture. When the planting and growing of cotton was not rotated with a different sort of crop in successive years, the nutrients in the soil became depleted. As a result, cotton plants became less productive over the years. Rotating different types of crops each growing season increased yields. When farmers planted nitrogen-fixing crops (such as peanuts, soybeans, and sweet potatoes), nitrogen was restored back into the soil, making the soil healthier for the cotton plants the following season. In order to teach this science of crop rotation, George made a demonstration lab on a wagon called the Jessop Wagon, which he drove around to farmers, distributing pamphlets that taught them how to rotate crops. He believed this was his most significant contribution toward educating farmers.

George's contributions greatly impacted the world for the better. He was known for his good heart, his desire to help others (especially farmers), his promotion of racial harmony, and his faith as a Christian. George left a lot of his work unpatented and said his talents and gifts came from God.

> *"It is not the style of clothes one wears, neither the kind of automobile one drives, nor the amount of money one has in the bank, that counts. These mean nothing. It is simply service that measures success."*
>
> *—George Washington Carver*

GROWING SEEDS—HYPOTHESIS

DATE PLANTED: _____

In three days, I think my seeds will look like this:

_____

_____

_____

In one week, I think my seeds will look like this:

_____

_____

_____

In two weeks, I think my seeds will look like this:

_____

_____

_____

In one month, I think my seeds will look like this:

_____

_____

_____

EXTENSION

Instructions:

1. Read the information below.
2. Summarize the differences between annual, perennial, and biennial plants.
3. Optional: Sketch one of the plant illustrations on this page.

Plant Growth Cycles

Just like all plants come in different shapes, sizes, and colors, they also have different life cycles. Some plants may take only a month to complete their life cycles, while others may take several years! Plants are classified as annual, perennial [per–EN–ee–ull], or biennial [by–EN–ee–ull], depending on how long it takes them to complete their full life cycles.

Annual

Annual plants go through their entire life cycle from seed to death within one year or growing season. Plants that grow best starting in the cooler months are called cool-season annuals. Peas are an example of this; they are planted in the early spring and are resistant to frost. Annuals that must be planted after the last chance of frost in order to survive, such as tomatoes, are called warm-season annuals.

Squash is a warm-season annual.

Perennial

Plants that live for more than two years (or two growing seasons) are called ***perennials***. These plants become ***dormant***, or stop growing to conserve energy, during colder months. When conditions are favorable and warm again, they resume growing. Perennial plants continue this cycle of growth and dormancy year after year. Woody perennials, such as trees and shrubs, tolerate the cold temperatures, but herbaceous [er–BAY–shuss] perennials have soft stems that die during the winter. New stems grow in the spring from the dormant parts.

Oregano is a perennial herb.

Biennial

Biennial plants complete their growing cycle in two years (or two seasons). During the first year, biennials grow their roots, stems, and leaves; then they enter a state of dormancy. During the second year, they continue to grow, mature, form flowers and fruit, and then disperse seed. In a garden, it is common to allow biennials to only grow for their first growing season, and then to harvest them so they will not enter the second season (flowering, etc.). Onions and parsley are examples of plants that are harvested after their first growing season.

Gardening Note: Some plants are botanically classified as perennials based on their potential to grow back year after year. However, if gardeners know that a perennial will die over the winter because the climate is too cold, they will say they are "growing the perennial as an annual."

The carrot is a biennial plant.

Microscope Lab

Date: _____

Specimen Observed:

_____

Notes:

Date: _____

Specimen Observed:

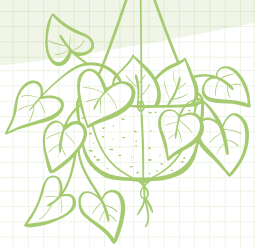
_____

Notes:

EXTENSION

Instructions:

Read the following information. The content in this lesson extension will be referred to in Lessons 6–13.



Botany Experiment: Introduction

Everything you've learned about in science has been the result of someone testing ideas, carefully recording the observations of those tests, and forming conclusions based on those observations. When experiments are repeated over and over again and the same results consistently occur, scientists can then form theories. For the remainder of the lesson extensions in this unit, you will design and perform an experiment in the field of botany. Designing and performing experiments are great ways to learn how scientific discoveries are made. Valuable life skills, such as critical thinking, patience, and problem-solving, are also learned through performing scientific experiments.

Scientific Method

Before you begin experimenting, you will learn how scientists perform experiments. Scientists follow the ***scientific method***. This is a list of steps that are followed during an experiment, though not every experiment follows these steps exactly; they are more like guidelines to help scientists organize what they're studying. The proper steps greatly depend on what is being tested. For example, scientists who study astronomy use mathematical calculations and observations for their research since it's physically impossible to travel to a nearby star to study it.

The scientific method generally flows as shown in the image at the bottom of this page.

Question

Many discoveries begin with a question. What happens to the growth of my plant if it has no sunlight? Which type of soil is best for my plant? How much water does my plant need?

Hypothesis

Research is often done to help scientists form a ***hypothesis*** (an educated guess) that may answer their question. Through research, scientists can make better predictions about what to expect during experiments. For example, a scientist may do some research and learn that plants need 7–8 hours of sunlight per day. Then the scientist may form a more educated hypothesis. In this example, the scientist may hypothesize that plants grow faster when there is more sunlight. Notice how this example hypothesis is one that can be tested; this is also an important part of forming a hypothesis.

Plan and Test

The next steps—defining traits of science—are to plan and test an experiment. You will learn more about the planning and testing of an experiment when you design your own.

Record Observations

During experimentation, scientists analyze and record their observations. It is crucial for them to take careful and organized notes so that they can form accurate conclusions.

Results & Conclusion

A conclusion is a report of the results of the experiment that includes a statement about the outcome.

Scientists' experiments will often lead to more questions and new or revised experiments, so the scientific method becomes more like a cycle than a pathway.

Question | Hypothesis | Plan an Experiment | Test the Experiment | Record Observations | Results & Conclusion

My Botany Experiment

Write the name of your botany experiment below.

Record which variable you're testing and under which conditions you're testing the plants. (Make sure this is approved by your parent or teacher.)

Example: Variable: Light; Conditions: no light, low light, more light, and regular light exposure (the control). Each plant except for the "control" will be covered with a cardboard box. The "low light" plant will have small slits cut in its cardboard box, and the "more light" plant will have large slits cut in its cardboard box. The "no light" plant's box will have no slits cut.

Variable:

Conditions:

Record which plant type you will be testing. If you will be starting from seed, it is recommended that you use a plant type that germinates quickly, such as bean, tomato, or sunflower. You may also decide to use a flowering plant, such as a petunia. Be sure to choose a plant that isn't too sensitive.

Example: I will be using tomato plants in my experiment.

Record where you will be conducting your experiment. Keep in mind that all other variables must not change.

Example: I will place my plants on the table by the window.

Following the scientific method, next write a **QUESTION** for your experiment. Be sure to identify your control.

Example: What are the effects of light on indoor tomato plants when I expose them to no light, low light, more light, and regular light exposure (the control)?

Question:

Extra Notes:

ART STUDY

"Tess" by James M. Nairn
(1859–1904), 1893

Lesson 8

WHAT IS PHOTOSYNTHESIS?

1. Provide the Latin translation of the word photosynthesis.

PHOTOSYNTHESIS

PHOTO → _____ SYNTHESIS → _____

2. Hypothesis: What do you think plants are "putting together with light"? Write or draw your response.

3. Diagram: Draw a picture of photosynthesis.

4. In addition to sunlight, what two things do plants need to start the photosynthesis process? What do plants make during photosynthesis? What does the plant use, and what is released?

_____

_____

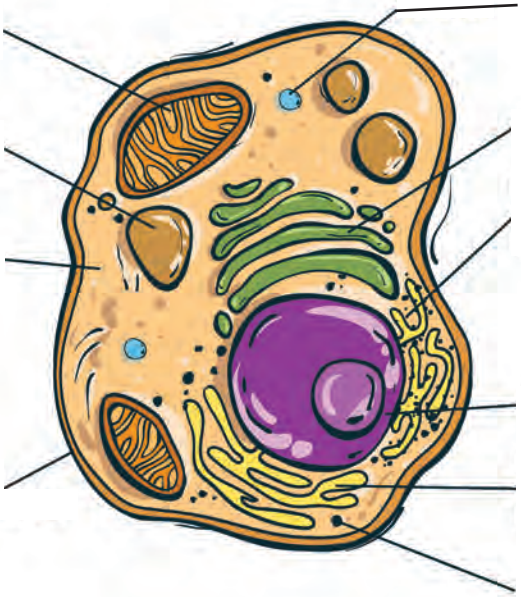
_____

_____

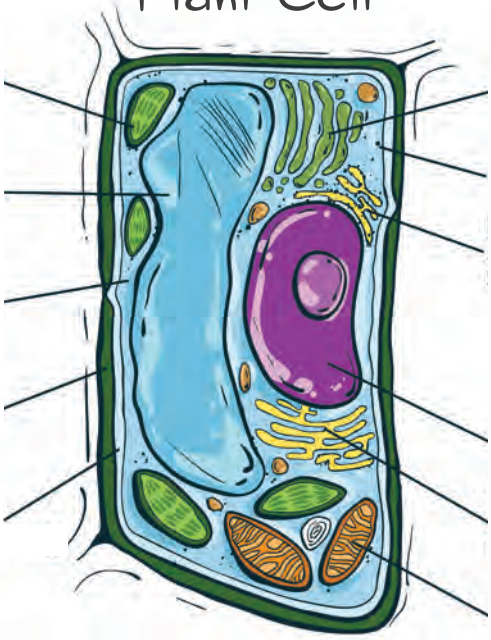
ANIMAL AND PLANT CELLS

Using the word bank as a guide, label the animal cell and plant cell. Hint: Blue words are unique to the animal cell, green words are unique to the plant cell, and black words are shared by both cell types.

Animal Cell



Plant Cell



Note: The rough endoplasmic reticulum has ribosomes on it. The smooth endoplasmic reticulum does not have ribosomes.

Vacuoles Golgi body Rough endoplasmic reticulum Lysosomes
Ribosomes Mitochondrion Vacuole Smooth endoplasmic reticulum
Cell membrane Cytoplasm Cell wall Chloroplasts Nucleus

Lesson 10

WHAT'S IN A NAME?

Use the page titled "Plant Latin Words" in the Botany course book and your own word skills to match each scientific name to its common name.

1. Pinus cembra
2. Juglans nigra
3. Umbellularia californica
4. Solanum nigrum
5. Quercus alba
6. Rose virginiana
7. Rosmarinus officinalis
8. Allium giganteum
9. Toxicodendron radicans

A. California bay tree
B. White oak
C. Virginia rose
D. Rosemary
E. European black nightshade
F. Black walnut
G. Cembrian pine
H. Giant onion
I. Poison ivy

Give your own names to each of the flowers pictured below using the "Plant Latin Words" page.

My scientific name:

My scientific name:

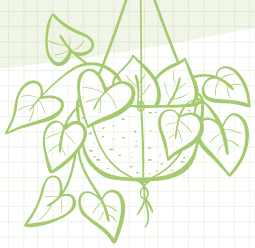
My scientific name:

My scientific name:

EXTENSION

Instructions:

Follow the instructions below and complete the assignment to conclude your experiment.



Botany Experiment: Results and Conclusion

After you have completed your experiment, make final observations and record the final date. If you have completed the *Botany* unit and your plants have not had enough time to show an effect from the experiment, extend your experiment as long as you wish.

Once you have completed your final observations, summarize your results in a concluding statement explaining whether or not your hypothesis was correct. Here is an example of a concluding statement:

> Plant growth is not affected by the acidity of water. Over a one-month period of testing, I observed that each of the plants grew in height by approximately the same amount.

Assignment:

Use the following page to record your final observations. Then summarize the results of your experiment and write a concluding statement.