Unit 5 Overview

Lesson	TE pages	ST pages	AM pages	Assessment	Content
Chapter 12: Plant and Animal Reproduction					
139	315–17	287–89	191		• Unit and chapter opener • Preview the chapter content
140	318–21	290–93	192		• Parts of a flower • Pollination and fertilization • Types of fruit • Parts of a seed • Germination
141	322–23	294–95	193–94	Rubric	**Activity: Flower Dissection** • Examining the parts of a flower
142	324–27	296–99	195–96	Quiz 12-A	• Seeds in cones • Life cycle of a conifer • Spores • Life cycles of ferns and mosses
143	328–31	300–303	197		• Animal reproduction • Placental development • Marsupial development • Eggs • Parental care
144	332–33		198		**Exploration: What Value Does God Place on Life?** • Recognizing the value God places on life
145	334–37	304–7	199–202	Quiz 12-B Rubric	• Asexual reproduction **Activity: It's a Race** • Comparing the rate of growth of a seed and a plant cutting
146	338	308	203–4		**Chapter Review** • Apply knowledge to everyday situations
147	338			Test	**Chapter 12 Test**
Chapter 13: Heredity and Genetics					
148	339	309	205		• Chapter opener • Preview the chapter content
149	340–42	310–12	206–8	Rubric	• Heredity **Activity: It's All in the Genes** • Surveying about inherited traits
150	343–44	313–14	209–12	Quiz 13-A	• Structure of DNA • Patterns of DNA
151	345	315	213–14	Rubric	**Exploration: DNA Extraction** • Extracting DNA from organic matter
152	346–49	316–19	215		• Mendel's experiments • Dominant and recessive genes
153	350–53	320–23	216–18	Quiz 13-B	• Punnett squares • Pedigrees • Sex-linked traits
154	354–55	324–25	219–20	Rubric	**Activity: Paper Pet Genetics** • Predicting genotypes
155	356–59	326–29	221	Quiz 13-C	• Genetic disorder and diseases • Sickle cell anemia, cystic fibrosis, Down syndrome • Genetic engineering
156	360–61	330–31	222		**Technology: A Useful Weed** • Recognizing that scientists still use the same basic methods that Mendel used • Recognizing that a simple weed can be useful to scientists
157	362	332	223–24		**Chapter Review** • Apply knowledge to everyday situations
158	362			Test	**Chapter 13 Test**

Weblinks
The BJU Press website offers additional information and links you may find helpful throughout the unit.

www.bjupress.com/resources

Unit photos
The top photo shows a mother bear and her cubs in a pine forest in Finland.

Parent letter for sensitive topics
You may wish to alert parents about the topics discussed in this unit, especially for the material covered in Chapter 12. A sample parent letter is included with the Instructional Aids on the Teacher's Toolkit CD.

Objectives
- Understand the interrelationships of science concepts
- Recognize that man's inferences are sometimes faulty
- Preview the unit and chapter content

Unit Introduction

In Unit 5 students will learn about how God uses substances such as DNA to create unique offspring.

Chapter 12 discusses God's plan for reproduction. Both plant and animal sexual reproduction and asexual reproduction are presented.

Chapter 13 explains how an organism inherits traits from parents.

Both chapters use correct terminology but are tempered with an understanding of the sensitive nature of the topics.

Look through Unit 5. What are the topics of the chapters we will study in this unit? Possible answers: plant and animal reproduction, genetics, heredity

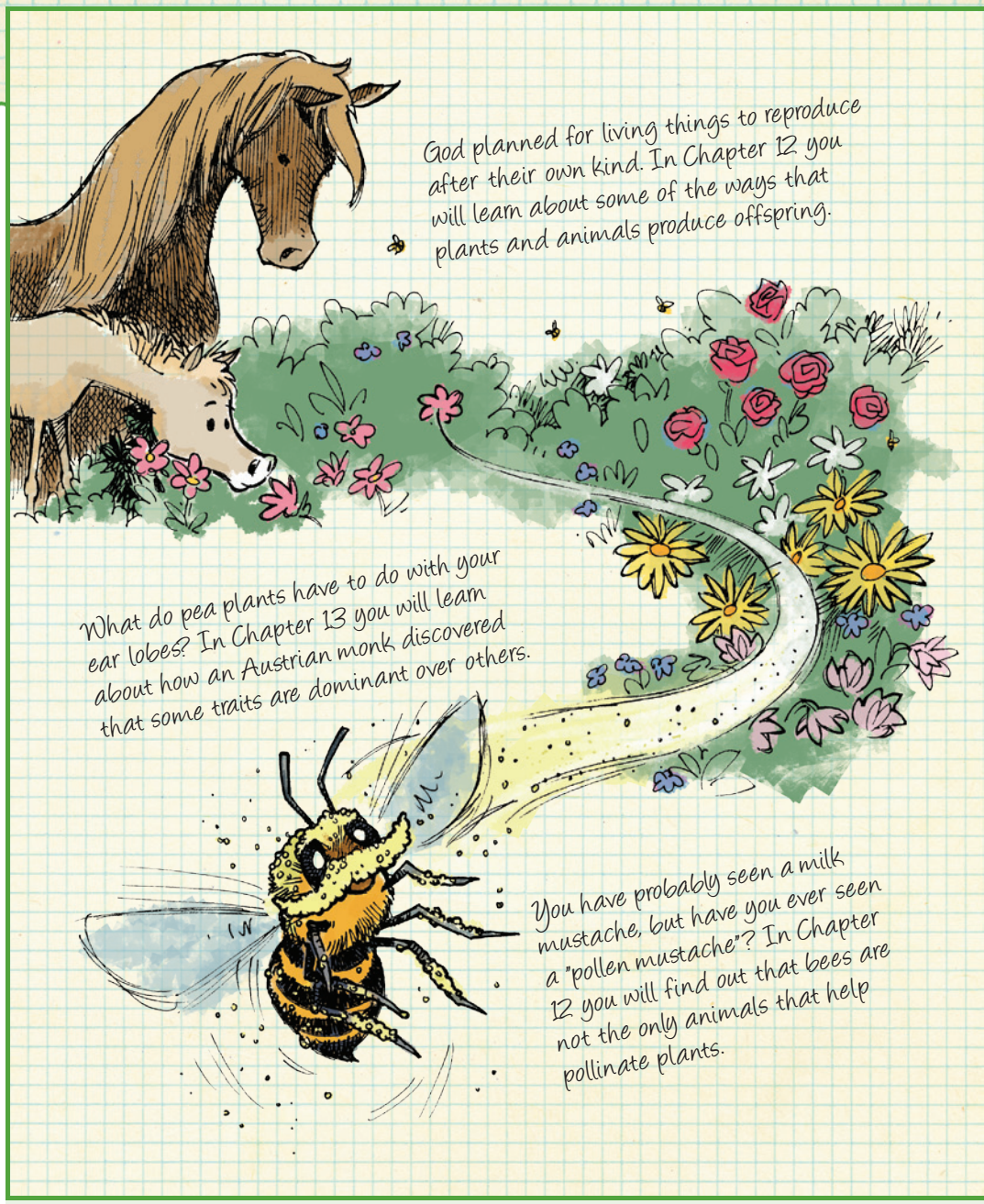
How do the chapters relate to each other? Answers will vary, but elicit that living organisms reproduce and possess characteristics inherited from their parents.

Project Idea

The project idea presented at the beginning of each unit is designed to incorporate concepts of each chapter as well as information gathered from other resources. You may choose to use the project as a culminating activity at the end of the unit or as an ongoing activity while the chapters are taught.

Unit 5—Fish Traits

Guide the student in setting up an aquarium that contains a variety of one species of fish. Choose fish that have distinctive markings, coloring, or fin shapes. For example, goldfish vary in color, size, body shape, and fin configuration. Discuss the similarities and differences between the fish. The student could research the dominant and recessive traits of the fish. Some fish hatcheries will also provide fish eggs, such as salmon or trout, which can be raised in the classroom and then released into their natural habitats. If animals cannot be in the classroom, allow the student to set up a pea plant experiment similar to Mendel's pea plants.



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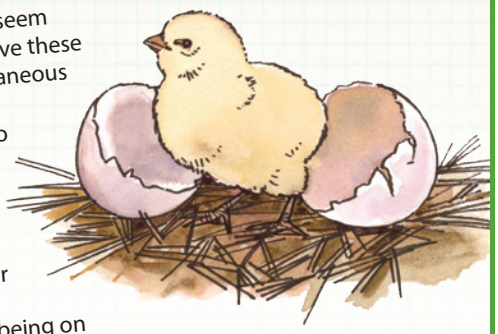
Plant and Animal Reproduction

A pile of dirty rags and wheat kernels turns into full-grown mice. Frogs come from slimy mud. Wormlike maggots develop from rotting meat. It may seem strange now, but many people used to believe these things. It was not until the 1600s that spontaneous generation, the belief that life comes from nonliving things, was questioned. Francesco Redi, an Italian doctor, proved that rotting meat does not create maggots. Through his experiments, he found that the maggots actually came from eggs that flies laid on the meat. In the 1800s, another scientist, Louis Pasteur, proved that even microscopic organisms do not come into being on their own. Life can only come from preexisting life. Living things cannot create themselves, but depend on God, Who created all living things.



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TEACHER HELPS

Chapter preview
Other preview and prereading activities may include using a K-W-L chart, a probe, or an anticipation guide.

Student Text diagrams
Diagrams from the Student Text are included on the Teacher's Toolkit CD.

SCIENTIST

Francesco Redi
Francesco Redi, an Italian physician and poet, was among the first to show that spontaneous generation was not true. In 1668 he performed a series of tests that showed that maggots come from the eggs of flies rather than from rotting meat. In his experiments he controlled the variable of meat's exposure to flies. Through this structured method he was able to show the relationship of flies and maggots and whether or not meat was involved.

BIBLE

God's plan
One of the most well-loved expressions in the Bible is the expression "born again." Christ used this expression in John 3 when He spoke with Nicodemus to emphasize that true believers have a new life similar to when a baby is born. In this passage, Christ did not fully explain the analogy but made it clear that no one will see God unless he has new life from the Spirit of God. This eternal life is given to all who believe in the only begotten Son (John 3:16).

Introduction

God created living organisms and commanded them to be fruitful and multiply. Even the plants were commanded to bring forth seed (Gen. 1:11). In each case, God said that the organism would bring forth "its kind."

Learning how animals and plants reproduce can be very important for people's health. For example, flies can carry pathogens (germs) that cause disease. Understanding how flies reproduce and sometimes limiting their reproduction may slow or stop the spread of certain diseases. Plants are essential for both food and human health. Understanding how plants and animals reproduce allows man to better fulfill his role in managing God's creation wisely (Gen. 1:28).

Teach for Understanding

Provide time for the student to complete Looking Ahead, Activity Manual page 191. For part B, encourage the student to think of things he would like to learn about cotyledons and different kinds of animal eggs. He should write his answers in question form, such as, "Which kinds of animals lay eggs in water?"

Provide the answers for part A and allow the student to check his work. After the chapter is finished, you may choose to have him look back at this page and check his understanding of the items he missed.

As time allows, discuss student questions from part B about cotyledons and animal eggs. You may choose to provide trade books or other resources to help answer questions that are beyond the scope of this chapter.

Allow the student to leaf through the chapter, looking at the headings, pictures, captions, charts, etc., and discuss the things he thinks he will be learning about.

Activity Manual

Preview, page 191
The Looking Ahead page is intended to assess the student's prior knowledge before beginning the chapter.

Lesson 140

Student Text pages 290–93
Activity Manual page 192

Objectives
- Identify each part of a flower and describe its function
- Differentiate between pollination and fertilization
- Explain how scientists classify fruits
- Describe the process of germination

Materials
- Assorted fruits, such as tomatoes, squash, acorns, maple tree seeds, or plums
- ⅛ tsp measuring spoon

Vocabulary
sepal
stamen
anther
pistil
ovary
ovule
style
stigma
cross-pollination
self-pollination
fertilization
zygote
embryo
fruit
germinate
cotyledon
seed coat

Introduction
Display the collection of fruit.

Sort these items into categories. Possible answers: fruit, vegetables, seeds

After each fruit is placed into a category, explain that scientists would classify all of these as fruit.

Teach for Understanding
Purpose for reading
How is a flower pollinated?

How would a scientist classify a fruit?

Discussion
What is an angiosperm? a plant that produces seeds enclosed in a fruit

What is the main purpose of flowers? to produce seeds

Why else might God have designed flowers? Possible answers: Flowers provide food for some of God's creatures (Gen. 1:29–30). God provided their beauty for our enjoyment (Eccles. 3:11). **[Bible Promise: H. God as Father]**

Point out each part of the flower and discuss its characteristics and function.

Why is the stigma sticky? The stickiness traps the grains of pollen.

Plant Reproduction

From the very beginning of Creation, God planned for all living things to reproduce. In Genesis 1:11–13, the Bible tells us that God created plants on the third day of Creation. Just by His word, all the grasses, trees, shrubs, and bushes came into being. Genesis 1:29–30 also tells us that God planned for the plants to be food for mankind and for the animals. To fulfill God's plan each plant must have a way to reproduce, or make a copy of itself. God's design for most plants is to reproduce through either seeds or spores.

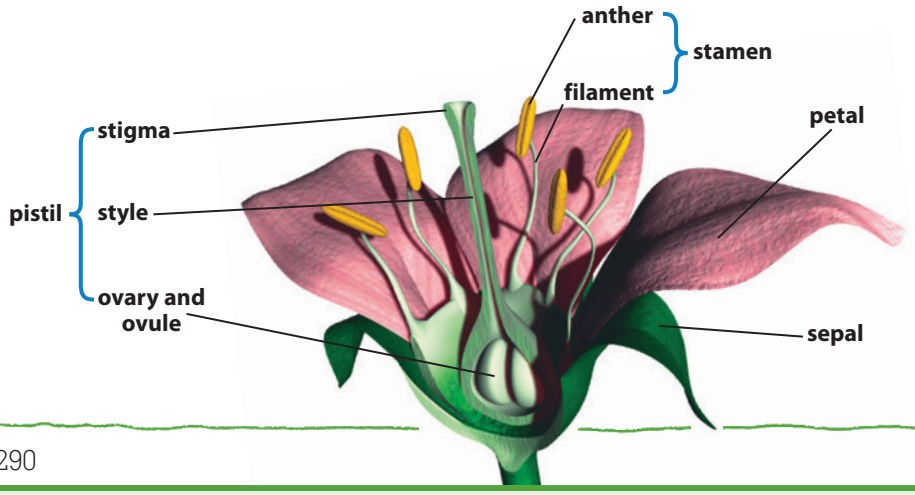
Seeds in a Fruit

Angiosperms are plants that produce seeds enclosed in a fruit. These fruits develop from pollinated flowers. Though plant flowers vary in size, color, and odor, each flower has the same function—to produce seeds.

Parts of a flower

The **sepals** (SEE pulz) of a flower protect a developing flower bud by enclosing the bud until it is ready to open. Usually the sepals are green, but in some plants they look just like the petals of the flower. The **stamen** (STAY mun), the male part of the flower, usually has a thin stalk called a filament. The knoblike structure, or **anther** (AN thur), at the top of the filament produces the pollen.

In the center of the flower is the **pistil** (PIS tul), the female part of the flower. The pistil has three main parts. The bottom of the pistil is called the **ovary** (OH vuh ree), and it has one or more **ovules** (OH vyoolz), or places where the eggs are produced. A long, slender stalk called a **style** connects the ovary to the top of the pistil. The **stigma** (STIG muh) is the sticky tip of the pistil. It traps the pollen grains that fall from the anthers or that are carried into the flower by insects or other animals.



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TEACHER HELPS

Fruits for introduction
Include some that the student would not normally classify as fruit.

Vocabulary
Several vocabulary words in this lesson should already be familiar to the student. They review concepts from earlier grade levels.

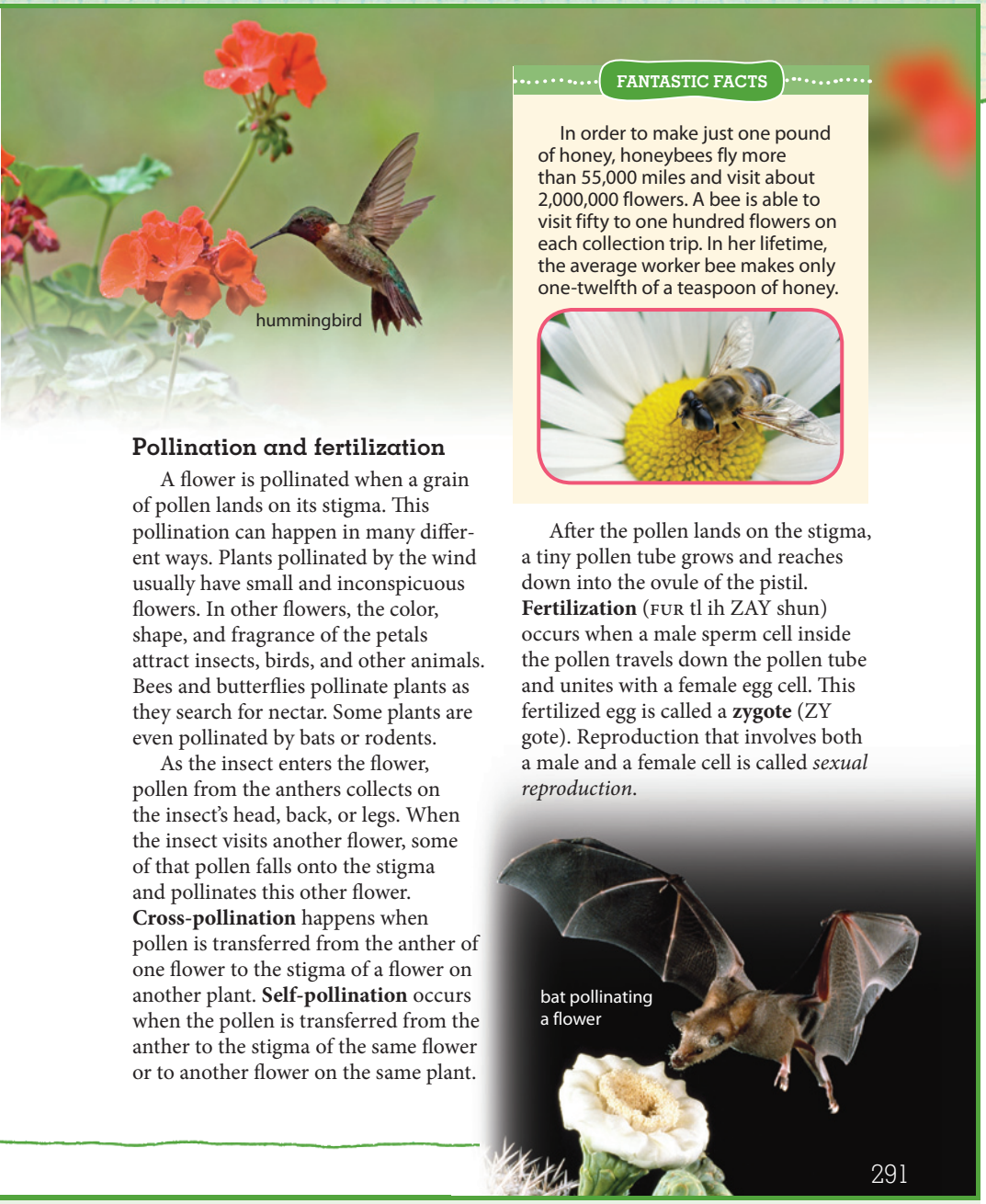
SCIENCE BACKGROUND

Flowers and pollination
The color, shape, and markings of flower petals, as well as the flower's scent, serve to attract the insects or animals that help pollinate that plant. Bees cannot see the color red and are usually attracted to blue, purple, or yellow flowers. Butterflies are often attracted to orange, yellow, pink, or blue flowers. Red or orange flowers usually attract birds, and bats and moths that pollinate at night are attracted to white or cream-colored flowers.

Flowers pollinated by bats often have a strong, musky odor. Other flowers may have an odor that is unpleasant to people but is very attractive to the beetles and flies that pollinate those plants. The markings and color patterns of the flower help the animals or insects locate the nectar.

Tepals
Sepals are called *tepals* when the sepals and petals are similar in color and shape.

Carpels
Some flowers have more than one pistil. These pistils are often fused together into a compound pistil. The individual pistils of a compound pistil are often referred to as carpels.



Pollination and fertilization

A flower is pollinated when a grain of pollen lands on its stigma. This pollination can happen in many different ways. Plants pollinated by the wind usually have small and inconspicuous flowers. In other flowers, the color, shape, and fragrance of the petals attract insects, birds, and other animals. Bees and butterflies pollinate plants as they search for nectar. Some plants are even pollinated by bats or rodents.

As the insect enters the flower, pollen from the anthers collects on the insect's head, back, or legs. When the insect visits another flower, some of that pollen falls onto the stigma and pollinates this other flower. **Cross-pollination** happens when pollen is transferred from the anther of one flower to the stigma of a flower on another plant. **Self-pollination** occurs when the pollen is transferred from the anther to the stigma of the same flower or to another flower on the same plant.

FANTASTIC FACTS

In order to make just one pound of honey, honeybees fly more than 55,000 miles and visit about 2,000,000 flowers. A bee is able to visit fifty to one hundred flowers on each collection trip. In her lifetime, the average worker bee makes only one-twelfth of a teaspoon of honey.

After the pollen lands on the stigma, a tiny pollen tube grows and reaches down into the ovule of the pistil. **Fertilization** (FUR tl ih ZAY shun) occurs when a male sperm cell inside the pollen travels down the pollen tube and unites with a female egg cell. This fertilized egg is called a **zygote** (ZY gote). Reproduction that involves both a male and a female cell is called *sexual reproduction*.

Discussion

How are flower petals important to the flower? The petals attract the insects and animals that pollinate the flower.

What kinds of plants are usually pollinated by wind? plants that have small, inconspicuous flowers

How do insects pollinate flowers? As an insect visits a flower, pollen collects on its body. When it visits another flower, that flower is pollinated when some of the pollen falls off the insect and onto the stigma of the flower.

What is necessary for cross-pollination to occur? The pollen must be transferred to another plant.

When does self-pollination occur? when pollen is transferred from the anther of a flower to the stigma of the same flower or to another flower on the same plant

What happens to a flower after it is pollinated? A pollen tube grows into an ovule and fertilization occurs. A male sperm cell travels down the pollen tube and unites with a female egg cell.

What is the difference between pollination and fertilization? Pollination involves the transfer of pollen from flower to flower. Fertilization is the joining of an egg cell and a sperm cell to produce a zygote.

Discuss *Fantastic Facts*.

How many flowers do honeybees have to visit to make one pound of honey? 2 million

How much honey does the average bee make in a lifetime? 1/12 of a teaspoon

Display the 1/8 teaspoon and explain that it would be only 3/8 full.

SCIENCE MISCONCEPTIONS

Pollination
Insects are only one group of animals that pollinate flowers. Birds and small animals, such as bats and the Australian honey possum, also pollinate flowers.

Fruit
Be sure that students understand that scientists use the term *fruit* to describe the part of any flower (the ovary) that contains the seeds.

LANGUAGE

Angiosperm
The term *angiosperm* comes from two Greek words meaning "seed in a vessel" (ovary). This term is introduced in Chapter 6, *Plant Classification*.

Discussion

What happens to a flower after fertilization? The petals fall off, and the zygote begins to grow.

What is another name for the tiny new plant that develops from the zygote? embryo

What does the ovule become? the seed coat

What part of the flower will become the fruit? the ovary

What is the purpose of a fruit? to contain and protect the seeds

How is the way we commonly use the word *fruit* different from the scientific definition of *fruit*? We commonly think of fruit as something that is eaten. The scientific definition means the protective covering around a seed, whether or not the covering is edible.

In which two categories do scientists usually group fruits? dry and fleshy

What are some common dry fruits? Possible answers: nuts, corn, grains, seeds from some shrubs, trees, and grasses

Give some examples of fruits that have seeds embedded in the outside of their flesh. strawberries and pineapples

Give some examples of fruits that have several seeds inside a core that is surrounded by a fleshy layer. Possible answers: apples, pears

Give some examples of fruits that do not have a core, are mostly fleshy, and have seeds that are scattered throughout the flesh. Possible answers: oranges, watermelons, cucumbers

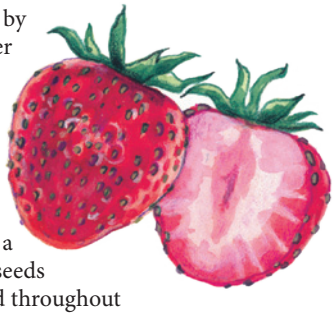
Why do some fruits have many seeds and other fruits have only one? Fruits with many seeds develop from flowers that have more than one ovule in the pistil. Fruits with one seed develop from flowers that have only one ovule in the pistil.

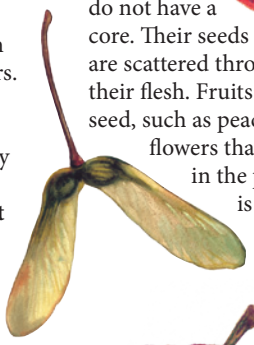
Types of fruit

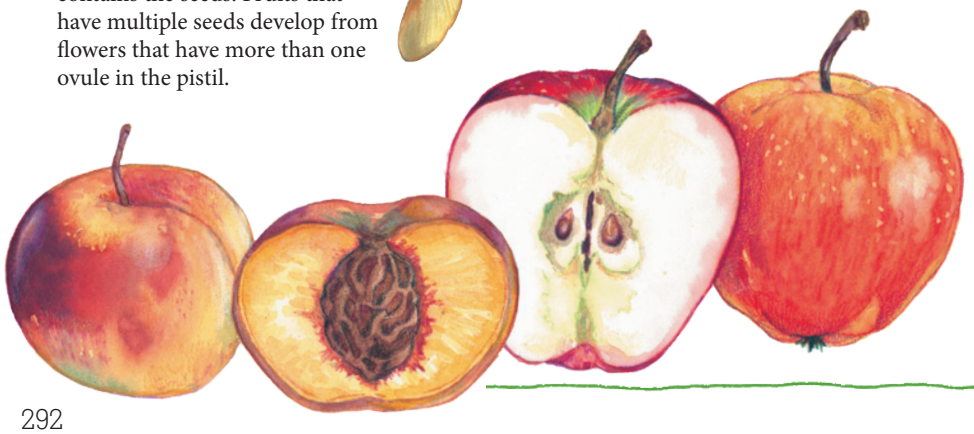
After fertilization, the petals of the flower fall off, and the zygote begins to grow. The zygote develops into an **embryo** (EM bree oh), a tiny new plant. The ovule that surrounds it becomes the seed coat, or outer covering of the seed. The ovary also grows larger and eventually develops into the fruit of the plant.

When you think of fruit, you probably think of edible fruits such as apples, oranges, peaches, or pears. However, not all fruits are edible. The protective covering around a maple tree seed or a mistletoe berry would not be good for humans to eat, but these are still fruits. A **fruit** is simply the part of the plant that contains the seeds. Fruits that have multiple seeds develop from flowers that have more than one ovule in the pistil.

Scientists often classify fruits as either dry or fleshy. *Dry fruits* include nuts, corn, and other grains, as well as seeds from some shrubs, trees, and grasses. Some *fleshy fruits*, such as strawberries and pineapples, have many seeds embedded in the outside of their flesh. Apples and pears have several seeds inside a core that is surrounded by a fleshy outer layer. Other fruits, such as oranges, watermelons, and cucumbers, do not have a core. Their seeds are scattered throughout their flesh. Fruits that have only one seed, such as peaches, develop from flowers that have only one ovule in the pistil. This one seed is usually enclosed in a hard pit or stone.







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SCIENCE BACKGROUND

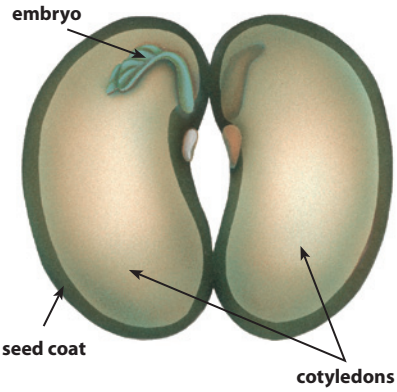
Name of fruit by seed type

Fruits such as watermelons, oranges, and grapes that have seeds embedded in their flesh are called *berries*. Many fruits that we would normally consider berries, such as strawberries and blackberries, are actually *compound fruits*. Fleshy fruits with a single seed, such as cherries and peaches, are called *drupes*. *Pomes* are fleshy fruits, such as apples, that have more than one seed enclosed in a core.

Seed leaves

Cotyledons, or seed leaves, do not usually look like the true leaves of the plant. For example, the cotyledons of a carrot resemble tiny, straight blades of grass, but the leaves of a carrot are circular with ruffly edges.

Parts of a Seed



The seed has food stored inside one or two **cotyledons**, or special seed leaves. The **seed coat** is the outer covering that protects the embryo and food. It also helps to keep the seed from drying out.

Germination begins when the seed absorbs water and swells. The seed coat splits open, and the embryo begins to grow. The root starts to grow first, and then the stem grows. As the stem grows, the cotyledons stay attached to it so that the new plant can use the stored food. When the first leaves start to grow and the plant is capable of making all of its own food, the cotyledons drop off.

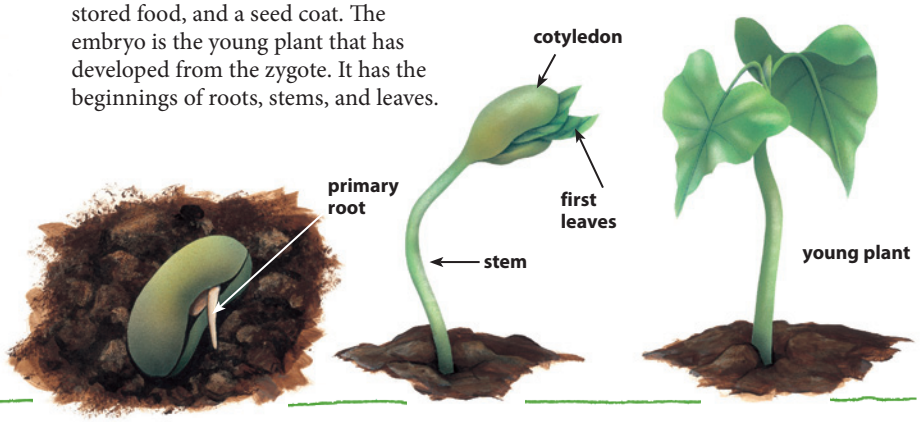
Germination

Seeds cannot **germinate** (JUR muh NATE), or sprout, without the right conditions. Seeds need water, oxygen, and the proper temperature to be able to sprout. If conditions are not right, seeds may lie dormant, or inactive, for long periods of time. When conditions are suitable, the seeds begin to germinate.

Seeds have three parts: an embryo, stored food, and a seed coat. The embryo is the young plant that has developed from the zygote. It has the beginnings of roots, stems, and leaves.

QUICK CHECK

1. Identify the male and female parts of a flower.
2. What is a fruit?
3. Explain the difference between pollination, fertilization, and germination.



DIRECT A DEMONSTRATION

Identify the parts of a seed

Materials: lima bean seeds

Open a lima bean seed and show the student the embryo and cotyledons. Identify the parts of the seed. If dry lima bean seeds are used, they will open more easily if they have been soaked in water overnight.

BIBLE

Taking root and producing fruit

In Mark 4:3–8, the Bible compares the response to the hearing of the Word of God to seed that is sown in different types of soil. In the Bible example some seed fell on stony ground and could not grow. Some seed fell where birds could find it and eat it. Some seed fell among thorns and was choked out. But some fell on good ground, grew, and yielded a crop. Just as seeds require the right conditions for growth, the Word of God can take root and yield fruit in the life of a person whose heart is prepared to obey God. [BATs: 6a Bible study; 6c Spirit-filled]

Discussion

What is another word for germinate? sprout

What basic conditions do most seeds need for germination? water, oxygen, and the proper temperature

Why do you think some plants produce many seeds? Possible answers: Not all of the seeds produced will land in a place where conditions are suitable for germination. Some seeds may not reach maturity.

Discuss *Parts of a Seed* and the stages of plant growth diagram.

What are the three parts of a seed? embryo, stored food (cotyledon), and seed coat

What are cotyledons? special seed leaves where food is stored for the plant embryo

Why does a seed need cotyledons? Cotyledons provide food for young plants until the plants are able to make food on their own.

What is the purpose of the seed coat? to protect the embryo and food inside the seed and to help prevent the seed from drying out

Do all seeds look like the one pictured? no **Would all seeds have two cotyledons?** no **What do we call seeds with two cotyledons?** dicots

Which part of a plant begins to grow first? the roots

How do germination, pollination, and fertilization work together as a cycle for plant reproduction? In germination, the seed sprouts and a young plant develops. As the plant matures, flowers are produced. Insects and animals pollinate the flowers so that fertilization can take place. After fertilization, the seed develops.

Answers

1. The female part of a flower is called a pistil. The male part is called a stamen.
2. Possible answers: the part of a flowering plant that contains the seeds; the ripened, seed-containing ovary of a flowering plant
3. Pollination involves the transfer of the pollen (containing sperm cells) from the stamen to the egg cells in the pistil. Fertilization occurs when the sperm cell unites with the egg cell. Germination occurs when the seed formed through fertilization sprouts and begins to grow.

Activity Manual

Reinforcement, page 192

Lesson 141

Student Text pages 294–95
Activity Manual pages 193–94

Objectives
- Measure the parts of a flower
- Identify the parts of a flower

Materials
- See Student Text page

Introduction

When you think of flowers, which kinds of flowers do you think of first?

Record student answers. Most of the flowers named are probably ones that have obvious petals and/or bright colors.

You may have noticed some of these flowers because of their petals. God designed petals to help attract animals to the flowers for pollination. In this activity, you will take a closer look at a flower and its parts.

Because this activity is designed for the student to observe and identify the parts of a flower, it does not include a problem or hypothesis. It does include a purpose.

Teach for Understanding

Purpose for reading

The student should read all the pages before beginning the activity.

ACTIVITY

Flower Dissection

Process Skills
- Measuring
- Observing
- Recording data
- Defining operationally

A honeybee has three simple eyes that detect light and darkness and two compound eyes. Working together, these eyes provide a very detailed picture of the honeybee's environment. Honeybees cannot see the color red, but they can see some ultraviolet colors that humans cannot see. Many of the flowers that honeybees pollinate reflect these ultraviolet colors. Because of their job as pollinators, honeybees get an up-close view of a flower. In this activity you will be getting a "bee's-eye view" of the inside of a flower.

Purpose

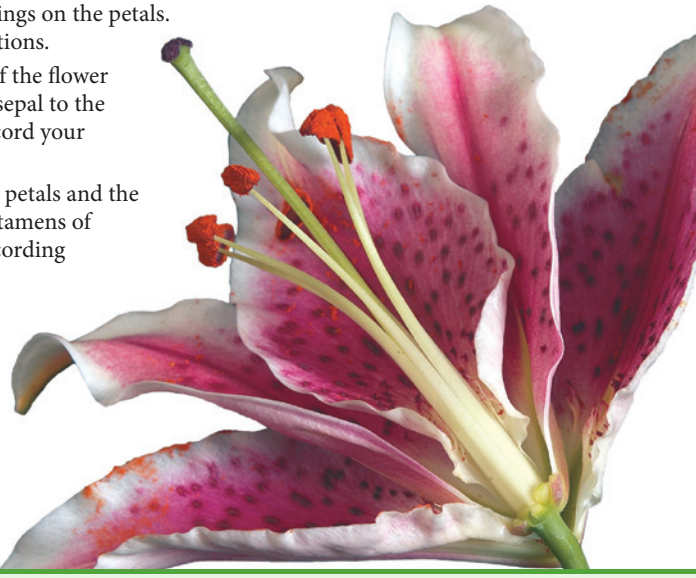
Dissect a flower and identify its parts.

Materials

large flower	small knife or other cutting tool
black paper	toothpick
centimeter ruler	Activity Manual
magnifying glass	

Procedure

1. Write the type of flower you are observing in the materials list in your Activity Manual.
2. Lay a piece of black paper on your desk for a work surface.
3. Observe the petals and sepals of your flower. Notice the number of petals and if there are any markings on the petals. Record your observations.
4. Measure the length of the flower from the base of the sepal to the tips of the petals. Record your measurement.
5. Carefully remove the petals and the sepals. Observe the stamens of your flower. After recording your observations, carefully remove the stamens without damaging the other parts of the flower.



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TEACHER HELPS

Flower choice
Not all flowers have separate stamens. The stamens of some flowers are fused to the pistil and may be harder to dissect. Flowers that work well for this dissection include lilies, daffodils, snapdragons, and tulips.

Extra flowers
Have extra flowers on hand in case of accidental damage.

Allergies
Be aware of any students who may have severe reactions to pollen.

Monocot review
The stargazer lily, shown on this page, has three petals and three sepals (tepals) that have the same color and markings. If you use this or any type of lily or tulip, you could review the monocot characteristics since they have flower parts in multiples of three and parallel leaf venation.

SCIENCE BACKGROUND

Classifying flowers
Flowers are classified as either complete or incomplete. Complete flowers have petals, pistils, sepals, and stamens. Incomplete flowers are missing one or more of these parts.

Flowers are further classified as perfect or imperfect. Perfect flowers have both stamens and pistils, while imperfect flowers have either stamens or pistils but not both.

Both pecans and corn have imperfect flowers, with both male and female flowers on the same plant. Asparagus, holly, ginkgo, and pistachio have separate male and female plants. In order to bear fruit, these plants must grow close enough to each other for pollination to occur.

6. Study one of the stamens under your magnifying glass. Draw a picture of the stamen and label the anther and filament.
7. Measure and record the length of each stamen.
8. Brush one of the stamens gently over the black paper so that some pollen grains are visible on the paper. Use your magnifying glass to observe the pollen grains.
9. Measure the length of the pistil, observing the stigma, style, and ovary. Record your measurement. See if the sticky tip of the stigma is able to pick up any pollen grains from the black paper. Examine the pistil with your magnifying glass and draw a picture of it.
10. Lay the pistil on your paper. Carefully cut the widest part of the pistil in half from top to bottom. Separate the two parts and observe the inside of the ovary. Record your observations.

Conclusions

- Why is it important to follow a specific procedure when dissecting a flower?
- How could inaccurate measurements affect the results of this activity?

Follow-up

- Try dissecting other flowers.

295

SCIENCE PROCESS SKILLS

Measuring/Using Numbers
Discuss the accuracy of the measurements used in the activity.

What are some problems that may cause inaccurate measurement? Possible answers: not starting at the ends of the pieces; misreading the ruler; not accurately removing the pistil or stamen

Which measurement is more accurate, centimeters or millimeters? millimeters

Procedure

Guide the student through each step of the dissection. Examine and discuss each flower part before going on to the next step.

Direct the student to use the diagram on Student Text page 290 to help with identifying the flower parts.

How does the length of a stamen compare to the length of the pistil?

Does your flower have all the parts pictured in the diagram?

What color is the pollen of your flower?

Direct the student to use the toothpick to move the plant parts as they are examined. Remind him to record his observations in his Activity Manual.

Adjust the procedures if your flowers do not have all the parts shown on Student Text page 290.

Demonstrate procedures as necessary. In step 10, you may choose to cut the ovary rather than have the student cut it.

Conclusions

If several of the same type of flowers are used, calculate the average size of each flower part measured. The student can then compare his flower to the average.

Prepare a chart for recording flower measurements.

Studying details of God's organisms helps us appreciate God's wonderful designs.

Provide time for the student to answer the conclusion questions in his Activity Manual.

Use the questions in the Science Process Skills to discuss measuring and using numbers.

Activity Manual

Activity, pages 193–94

Assessment

Rubrics

Select the prepared rubric, or design a rubric to include your chosen criteria.

Objectives
- Explain how conifers reproduce
- Compare and contrast seeds and spores
- Identify some organisms that reproduce by spores

Materials
- fruit that has seeds such as an apple or an orange, sliced so that seeds show

Vocabulary
spore
fruiting body

Introduction
Display the slices of fruit and seeds.

What do we call plants that produce seeds enclosed in a fruit? angiosperms

The seeds you will study today are not protected by a fruit. These seeds do not have a protective covering, and they often develop inside cones.

Teach for Understanding
Purpose for reading
How are the seeds of conifers different from the seeds of fruit-bearing plants?

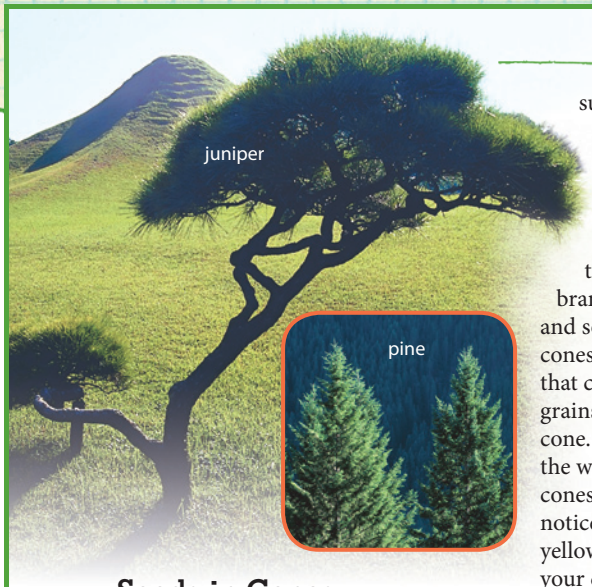
How do plants without seeds reproduce?

Discussion
What are gymnosperms? plants without flowers whose seeds are produced in cones

What are the most common gymnosperms? conifers

What are some examples of conifers? Possible answers: evergreen trees or shrubs, pines, junipers, spruce, fir

How are gymnosperm seeds different from angiosperm seeds? Angiosperm seeds develop in a fruit. Gymnosperm seeds do not have a protective covering. They develop in cones or have a fleshy seed coat.



Seeds in Cones
Some seeds are not protected by fruits. Instead, they develop inside cones or are sometimes protected by a fleshy seed coat that looks like a berry. Plants that have seeds like these are conifers, some of the most common gymnosperms.

Conifers are usually evergreen trees or shrubs. They can range in height from 8 cm (3.1 in.) to over 91 m (300 ft) tall. Many conifers, such as pines, have woody cones. However, some conifers, such as junipers, have softer, fleshier cones.

Conifers usually produce male and female cones on the same tree. The male cones usually grow in the lower branches of the tree or out at the tips of the branches. They are generally smaller and softer than the female cones. These cones produce tiny grains of pollen that contain the sperm cells. The pollen grains often overflow the scales on the cone. Though the pollen is dispersed by the wind, not all of it reaches the female cones on other conifers. You may have noticed some of this pollen as fine yellow dust on the ground or even on your car in the spring. After the male cones lose their pollen, they usually disintegrate and fall off the tree.

Each species of conifer has a uniquely textured pollen grain. Some pollen grains have smooth surfaces, but others have rough and bumpy surfaces. Even though the pollen of many different trees might be in the air at any one time, each conifer can be pollinated only by pollen from its own species.

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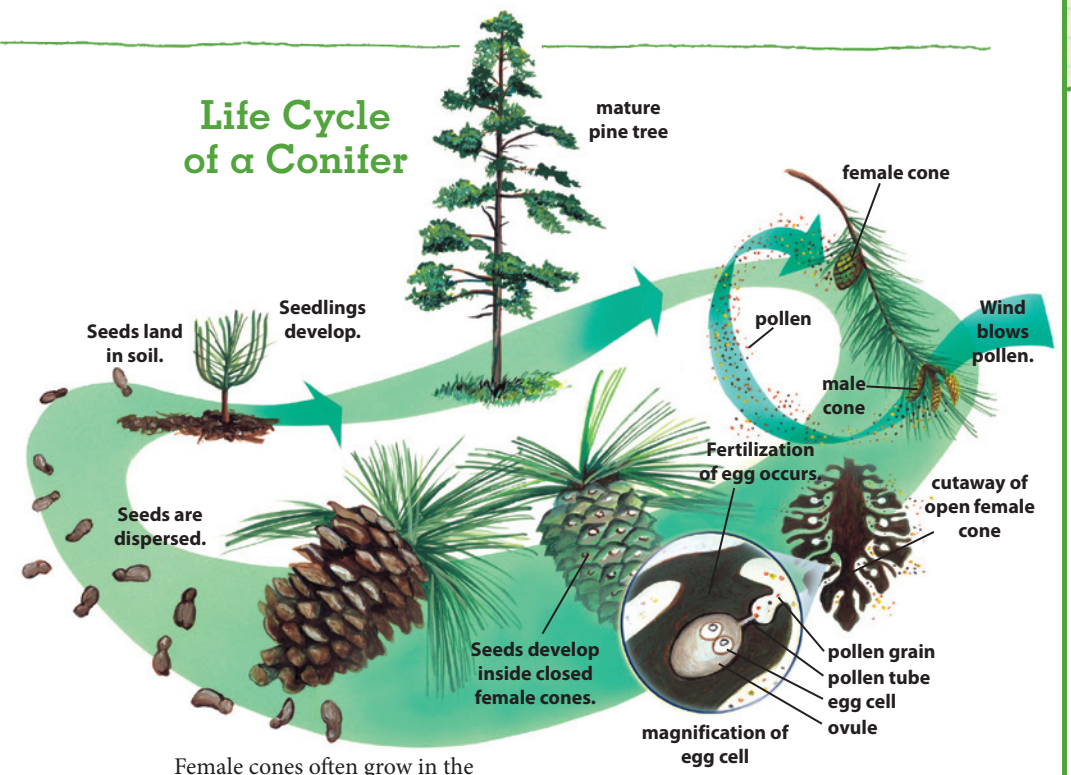
Samples for display
You may choose to have samples of male and female pinecones and fern fronds with visible spore cases to show during the discussion. Refer to Student Text page 296 for help in identifying cones.

SCIENCE MISCONCEPTIONS

Students may confuse the seeds of yews and junipers with fruits. Remind them that since yews and junipers are conifers, the berrylike flesh is the seed coat and not a fruit. If you were to open a juniper berry, you would not find a seed inside it.



Female cones often grow in the upper branches of the tree. For some pine trees, the female cones are small and green or brown. Other conifers have purple or reddish cones. Before pollination, these cones have their scales slightly open. Each cone has at least one ovule at the base of each scale. The wind blows the pollen into the slightly opened scales of the female cones. After the pollen enters, the scales close. The pollen grain begins to slowly grow a long tube down toward the egg cell in the ovule. The sperm cell then travels down the tube and fertilizes the egg cell, forming a zygote.

After fertilization, the ovule develops into a seed. The zygote becomes the embryo of the seed. The rest of the ovule develops into the seed coat and the stored food for the seed. As the seed matures, the female cone grows larger. The scales of the cone open, and the fully developed seed is carried away by the wind. Many conifer seeds have a winglike structure that causes them to spin in the air as they drop to the ground. This slows their descent and allows the breeze to spread them farther away from the parent plant.

Discussion

How are male cones different from female cones? Male cones are often found in the lower branches of the tree or out at the tips of the branches. They are usually smaller and softer than female cones.

How is the pollen from the male cones scattered? by the wind

Why do you think conifers produce such large quantities of pollen each spring? Not all the pollen gets into the female cones.

Why do pollen grains from different conifers have different textures? Each type of cone can be pollinated only by pollen from its own species.

Emphasize God's design as you discuss the unique textures of pollen grains.

How are conifers pollinated? The wind blows the pollen into the slightly open scales of a female cone. The scales close, and the pollen grain begins to grow a long tube down toward the egg cell.

What happens to the ovules inside the cone after fertilization? They develop into seeds.

What happens to the cone as the seed develops? The cone grows larger.

How are the seeds dispersed? by the wind

Why is it an advantage for the seeds to land farther away from the parent plant? to allow the new plants more room to grow and develop without competing for resources (light, moisture, nutrients) with the established parent plant

Discuss the steps shown in the *Life Cycle of a Conifer* diagram.

DIRECT A DEMONSTRATION

Examine types of cones

Materials: assorted male and female cones of various ages

Display the cones and discuss the similarities and differences among them.

What difference do you see between young male and female cones? Possible answer: If the cones are from the same tree, the male cones would be smaller and softer.

What differences do you see between young and mature female cones? Possible answer: The scales of young cones are closed and the scales of mature cones are open.

Break a scale off the mature female cone.

The seeds of gymnosperms, such as this conifer, develop inside the cone on each scale that is pollinated. These seeds have only a seed coat. They do not have a fruit.

Discussion

How is a spore different from a seed? A spore is smaller than a seed, is made of only one cell, and does not have any stored food.

What are two kinds of plants that reproduce by spores? ferns and mosses

Where do spores develop on a fern? in tiny spore cases on the undersides of certain fronds

How are spores dispersed? by wind and water

What kinds of conditions are best for a fern spore to germinate? Fern spores develop best in shaded, moist areas.

Each spore case of a fern can contain thousands of spores.

How is the heart-shaped plant that develops from a spore related to an adult fern? This plant produces the male and female cells necessary for fertilization. After fertilization, the zygote develops into an adult fern.

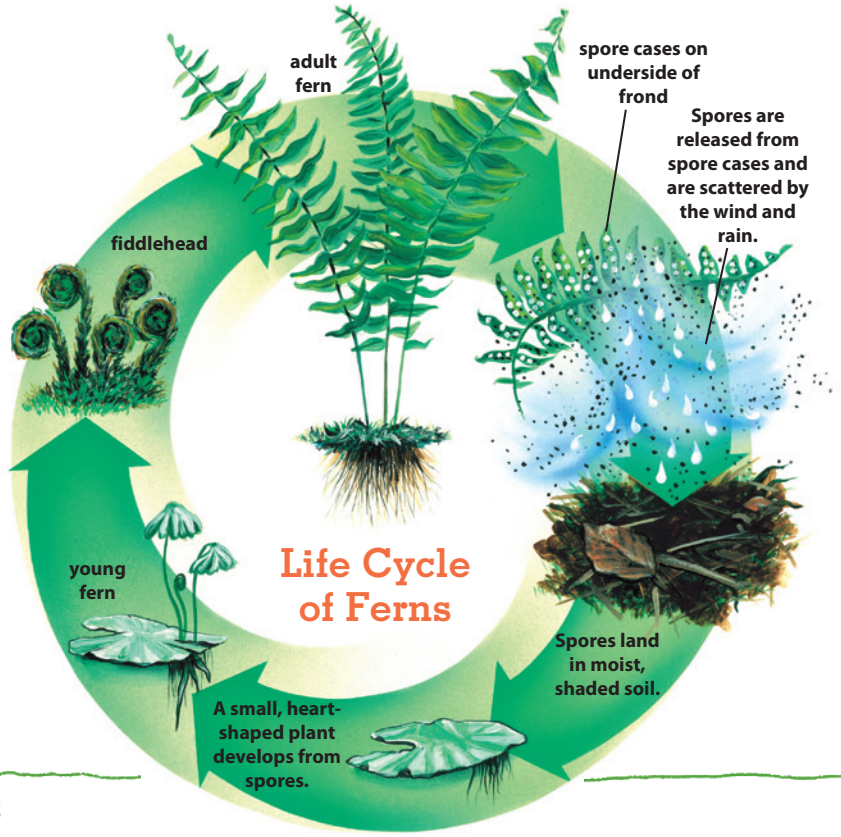
Ferns produce and release thousands of spores. Why does a plant need to release so many spores? Not all the spores land in a place suitable for germination.

Discuss the steps of the *Life Cycle of Ferns* diagram.

Spores

Although many plants reproduce by seeds, some plants reproduce by spores. A **spore** is much smaller than a seed and consists of only one cell. Spores do not have any stored food available for the new plant to use. Plants that reproduce by spores usually need more water than seed-bearing plants. Ferns and mosses are two types of plants that reproduce by spores.

Ferns are vascular plants that have underground stems as well as underground roots. Spores develop in tiny spore cases on the undersides of certain fronds, or leaves, of the fern. When the spores are released, they are carried away from the parent plant by wind or water. If a spore lands in moist, shaded soil, it begins developing into a small, flat, heart-shaped plant. This small plant produces both the male and female cells for the fern. The male and female cells unite to form the zygote. An adult spore-producing fern will eventually develop from this zygote.



298

SCIENCE BACKGROUND

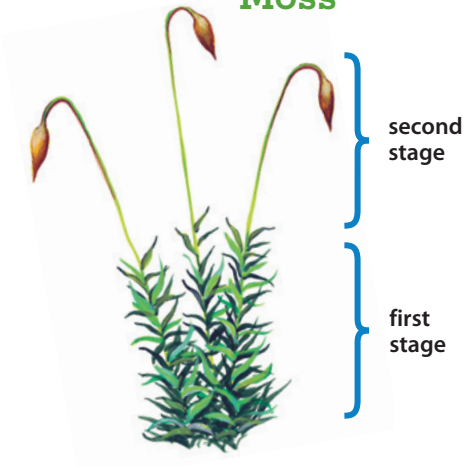
Fern gametophyte
This is the part of the fern life cycle that includes the germination and fertilization of the fern. A young fern plant at this stage of the life cycle is very small and inconspicuous, often much smaller than a straight pin. The heart-shaped growth gradually dissolves as the mature plant develops.

Fern sporophyte
This is the part of the fern life cycle that includes the fiddleheads and mature fronds that produce spores. This is the stage most often seen and recognized as a fern plant.

Moss gametophyte
This first stage of the moss life cycle includes the lush part of the plant most often seen. The short, closely packed stalks are all made of *haploid* cells, the reproductive cells formed through meiosis that have only half the number of chromosomes normally found in an organism's cells. Some of the stalks are male and some female. When conditions are just right, they release either male or female reproductive cells that join to form a single cell that has a full set of chromosomes. This cell is called a *diploid* cell.

Moss sporophyte
During this stage the diploid cell attaches to the top of the stalk and begins to divide, forming a slender stalk with a capsule at the end. Within this capsule, diploid spores develop.

Moss



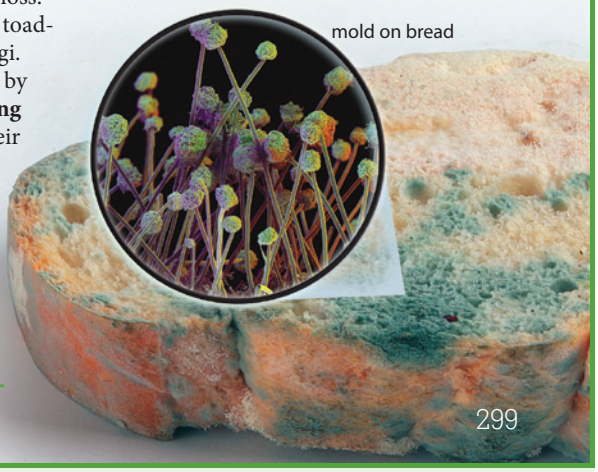
Moss is another plant that reproduces by spores. Like ferns, mosses undergo two stages of reproduction. In the first stage, small, fuzzy, stemlike structures grow, often looking like a soft, green carpet. These plants produce the male and female cells. After fertilization, a slender stalk grows up out of the moss plant and produces the spores that will become new moss.

Molds, yeast, mushrooms, and toadstools are not plants. They are fungi. However, they also can reproduce by spores. Most fungi produce **fruiting bodies**, structures that contain their spores. Fruiting bodies differ in appearance from one type of fungus to another. The cap of a mushroom is its fruiting body, and spores are released from narrow slits underneath the cap. Most bread and fruit molds, however, send up little clublike structures that contain their spores. Other fungi, such as yeast and truffles, form their spores in tiny sacs.

The methods of forming and releasing spores vary from one kind of fungus to another, but when the fruiting body opens, the spores scatter. Spores that land near food, warmth, and moisture germinate and develop into new fungi. Spores are able to travel great distances and are capable of remaining in the air for years. Perhaps you know someone who is allergic to mold spores. That person may need a special filter in his home to capture the spores and keep them from germinating.

QUICK CHECK

1. How are conifers pollinated?
2. How is a spore different from a seed?
3. What structures in fungi contain the spores?


mold on bread

DIRECT A DEMONSTRATION

Demonstrate how to make spore prints

Materials: large mushroom cap, white paper, black paper, container big enough to cover the mushroom

Lay the mushroom cap on the sheet of white paper with the gill side down. You may want to put another mushroom cap on black paper. Spores can be different colors, and light-colored spores will not show up well on white paper.

Cover the cap with the container and leave it in a place where it will not be disturbed for two days.

Carefully remove the container and cap. Examine the spore print with a hand lens.

Discussion

How are the reproduction methods of mosses and ferns similar? Possible answers: Both reproduce through two stages. Both have spores.

What are the two stages of moss reproduction? The fuzzy green growth of moss produces both the male and female cells. After fertilization, a slender stalk that contains spores grows up out of the moss plant. These spores are then released to form new moss.

Molds and mushrooms used to be classified as plants. In what kingdom do scientists now classify them? fungi

How do fungi reproduce? by spores

What are fruiting bodies? fungus structures that contain the spores

What are three examples of fruiting bodies? Possible answers: the cap of a mushroom, clublike structures on molds, and tiny sacs on yeast and truffles

What conditions must be met for fungus spores to germinate? food, warmth, and moisture

Answers

1. The wind carries pollen from the male cone into the slightly open scales of the female cone.
2. A spore is smaller than a seed and consists of only one cell. It also does not have any stored food.
3. fruiting bodies

Activity Manual

Review, pages 195–96

These pages review Lessons 140 and 142.

Assessment

Quiz 12-A

The quiz may be given any time after completion of this lesson.

Lesson 143

Student Text pages 300–303
Activity Manual page 197

Objectives

- Recognize that animals begin as a single cell
- Compare and contrast placental and marsupial development
- Generalize characteristics of eggs and where they are laid
- Explain benefits of the laying of many eggs by some animals

Vocabulary

placental mammal
gestation
marsupial

Introduction

God planned for plants to reproduce from seeds or spores. He also planned for animals to reproduce.

Today we will look at some of the ways that baby animals develop.

Teach for Understanding

Purpose for reading

What are three different ways that baby animals develop?

How are amphibian eggs different from reptile eggs?

Discussion

What common beginning do all animals have? a single cell

What is unique about reproductive cells? They have only half the number of chromosomes of a regular body cell.

Think back to what you learned in Chapter 4 about cell division. Which process of cell division forms reproductive cells? meiosis

How do reproductive cells allow a baby animal to be different from its parents? Each parent gives half of the necessary chromosomes for the baby animal. The baby has characteristics of both parents, but it is not exactly like either.

What is the difference between an embryo and a zygote? A zygote is the fertilized egg cell, or the beginning cell. After the cell divides for the first time, it is called an embryo.

How does the embryo continue to develop? inside the mother's body, in a pouch outside the mother's body, or in an egg

Discuss *Science & the Bible*.

What are some ways farmers use their knowledge of how animals reproduce? to better care for the animals, to provide what they need, to breed animals to produce desired results

Read and discuss Proverbs 12:10 as time allows.

Animal Reproduction

Kittens, pups, fawns, fry, and tadpoles are all names we give to baby animals. Each of these babies will grow and develop into a different adult animal. However, in one way, all of these animal babies are similar. After God created each animal, He declared that each would reproduce after its own kind (Gen. 1:24). Each animal begins its life as a single cell. That single cell divides and grows, eventually becoming an adult animal.

This beginning cell is formed when a male sperm cell joins with a female egg cell to form a zygote. Each of these reproductive cells has only half of the number of chromosomes found in an ordinary body cell. When the egg and sperm cells unite, fertilization occurs. The newly formed zygote receives half of its chromosomes from each parent. This division ensures that the baby animal will have the same number of chromosomes as its parents. It also allows the new animal to be a unique individual, a mixture of both parents and not an exact copy of either one.

After the zygote cell divides for the first time, it is called an embryo. The embryo's cells divide again and continue to grow through the process of mitosis. The embryo continues to develop either inside or outside the mother's body. Some animals develop completely inside their mothers' bodies. Other animals develop in a pouch outside their mothers' bodies or in eggs.

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SCIENCE & THE BIBLE

Many animals, such as farm animals, have been domesticated, or tamed, by man. By learning how these animals reproduce, farmers have been able to better care for the animals and provide what they need. Farmers can also use that knowledge to breed animals to produce more food or to produce other desired characteristics, such as fine wool or physical strength. Proverbs 12:10 tells us man should learn about and care for his animals' needs.

TEACHER HELPS

Review terms
Students may need to review mitosis, meiosis, and chromosomes from Chapter 4, *Cells and Classification*.

Mitosis is the process of cell division in which the cell makes an exact copy of itself. The chromosomes duplicate once, and the cell divides once.

Meiosis is the two-stage process of cell division in which the chromosomes duplicate once, but the cell divides twice. Each new cell has half the chromosomes of the parent cell.

Chromosomes are the genetic structures of a cell that contain the DNA, or chemical code, that gives the cell directions about what it should do.

Chromosomes are also mentioned in Chapter 13, *Heredity and Genetics*.

BIBLE

Man not an animal
Emphasize that although humans are often classified biologically as a type of mammal, man is not an animal, because he is created in the image of God. God created man to have dominion over the animals.

SCIENCE MISCONCEPTIONS

Placenta
The placenta is not the fluid that surrounds the embryo. It is a separate tissue that connects the amniotic sac (the fluid that surrounds the embryo) and the mother's blood supply.

puppies

Placental Development

Mammals whose young develop inside the mother's body are called **placental** (pluh SEN tul) **mammals**. The period of time during which a mammal develops inside its mother's womb is called **gestation**. A fluid-filled sac surrounds the embryo, or developing baby. The embryo receives food and oxygen from the mother's blood through a placenta. The placenta connects the embryo's sac to the mother's blood supply. It allows the embryo to receive nourishment from the mother until it is completely developed. The placenta also empties the embryo's wastes into the mother's blood.

The length of gestation is different for each animal. A mouse embryo develops in about twenty days. However, an elephant takes almost two years to develop. When placental mammal babies are born, they are no longer dependent on their mothers for life. Though they are often helpless and need parental care, their body systems can function independently.

Marsupial Development

Some mammals carry their young in their bodies for only a short time. These **marsupial** (mar SOO pee ul) mammals have a pouch on the mother's body where their young finish developing. The gestation period for marsupials is very short. For example, baby opossums are born after only thirteen days. Newborn marsupials are also very tiny. Just one teaspoon can hold about twenty baby opossums! Even the largest marsupials are less than 2.5 cm (1 in.) long when they are born.

The newborn marsupial uses its front legs to crawl to its mother's pouch. Some marsupials have deep and roomy pouches. Other pouches are just loose flaps of skin. Some pouches are lined with fur, and others are not. All pouches protect the babies and provide milk for them as they continue to grow.

baby opossums

Discussion

What is a placental mammal? a mammal whose young develops inside the mother's body

What term describes the period of time during which that mammal is developing? gestation

How does the embryo receive food and oxygen? from its mother's blood through the placenta

What happens to the embryo's wastes? The placenta empties them back into the mother's blood.

Which has a longer gestation time—a mouse or an elephant? an elephant

What is true about all placental mammals after they are born? Although they may still need parental care, their body systems can function independently.

How are marsupial mammals different from placental mammals? Their young are only in the mother's body for a short time. They finish developing in a pouch on the outside of the mother's body.

How does a newborn marsupial get to its mother's pouch? After birth it uses its front legs to crawl to the pouch.

Why is the gestation time for marsupial mammals so short? Marsupial young are born before they are fully developed. They finish their development in their mother's pouch.

What does the marsupial's pouch provide for the young? protection and milk

SCIENCE BACKGROUND

Womb

The womb is the hollow organ where the young develop inside the mother's body.

Mammal classifications

Mammals can be divided into two main groups: those that lay eggs (*monotremes*) and those that bear live young. Most mammals are *placental mammals*—their young develop inside the mother's womb. Other mammals are *marsupials*, whose young finish developing in a pouch. Marsupial mammals do have a placenta; however, the marsupial mammal's placenta is more like an egg yolk and develops from the union of the sperm and egg. In a very short time, the nutrients are used up and the embryo must leave the uterus to make its way to the pouch.

Discussion

Which kinds of animals lay eggs? birds and many species of fish, amphibians, and reptiles

What are some of the purposes for eggs? to provide protection, nutrients, food, and waste removal for the developing embryo

What are some possible reasons eggs are different shapes? Possible answer: to fit the types and locations of various nests

Where are most amphibian and fish eggs laid? in water

How are most eggs laid in water protected? They are usually covered in a clear, jellylike fluid.

What do these eggs usually look like? transparent with a dark spot where the embryo is developing

Discuss any times that students may have seen eggs in water.

What causes most eggs laid in freshwater rivers to sink? They are sticky, so they pick up grains of sand that make them heavier and cause them to sink.

Why would eggs laid in fresh water need to sink? Possible answer: Freshwater eggs need to sink so that they do not float with the current into salt water where they cannot survive.

Why is this not a problem for saltwater eggs? Possible answer: Saltwater eggs will not float into an environment unsuited for their development.

Where are most saltwater eggs located? at or near the surface of the water

What are some characteristics of eggs laid on land? They usually have either leathery or brittle shells.

What kind of shells do bird eggs have? brittle

Allow students to share experiences they have had with eggs and nests.

Why are reptile eggs often white but bird eggs are usually colored? Reptile eggs are usually buried, but bird eggs need coloring for camouflage.

Discuss how the shape, texture, and color of eggs are suited to the environment and the instincts of the parents. Even though we may sometimes interpret animal parents' caring for their young as a loving or tender emotion, animals feed and protect their young through instinct. For example, the cuckoo lays her eggs in the nests of other birds. Young cuckoos are then cared for because the bright orange color of their open mouths acts as a stimulus for the foster parent birds to feed them.

Eggs

Numerous other animals develop inside eggs that have been laid on land or in water. All birds lay eggs, as do many species of fish, amphibians, and reptiles. Eggs vary in size, shape, texture, and appearance from animal to animal. But all eggs provide protection, nutrients, food, and waste removal for the developing animal.

robin eggs

The shape of the egg often varies to suit the type of nesting place. The guillemot (GILL uh MAHT), a bird that usually lives near rocky seashores, lays her eggs on the bare rock of narrow cliff ledges. Her eggs are sharply tapered, causing them to roll in a tight circle if bumped. This makes them less likely to fall off the ledge. Other birds lay wedge-shaped eggs. Since this shape allows the eggs to lie closer together in the nest, it is easier for the parent bird to keep them all at an even temperature. Reptile eggs are usually round or oval.

Most amphibians and fish lay their eggs in water. Eggs laid in water are often covered in a clear, jellylike fluid that protects them in the water. These eggs are usually transparent with a dark spot where the embryo is developing. Eggs laid in freshwater rivers are usually sticky. They pick up grains of sand, which make the eggs heavier and cause them to sink. Eggs that are laid in salt water often float on or near the surface of the water.

frog eggs

Land eggs usually have either leathery or brittle shells. Some reptiles have soft, leathery eggs, but other reptiles, such as crocodiles, have hard-shelled eggs. Reptile eggs are white, and the reptile mothers usually bury or cover their eggs. Other eggs, especially bird eggs, are often camouflaged to match their nesting environments. These colorings and markings help protect the eggs from predators.

northern pine snake eggs

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SCIENCE BACKGROUND

Land eggs

Eggs laid on land have leathery or brittle shells that can hold in water. This allows the embryo inside the egg to develop on land.

midwife toad with eggs

Parental Care

Some animals lay thousands of eggs, and other animals lay only one or two. Most fish, amphibians, and reptiles lay their eggs and then leave, not returning to their eggs. A few fish, like salmon, die after their eggs are laid. When these eggs hatch, the young are already able to take care of themselves. However, many of these young, as well as many of the eggs, will become food for other animals.

Some animals, though, remain to guard and care for their eggs. Some species of fish take care of the eggs by fanning them with their fins to prevent silt from settling on them. Several species of frogs and toads carry their eggs around with them on their backs. Some even carry their eggs in their vocal sacs! Most parent birds share the responsibility of guarding their eggs and raising their young.

Species that do not provide any parental care often lay large numbers of eggs at a time. Usually species that provide more parental care lay fewer eggs. But lack of parental care is not the only reason that some animals lay many eggs. Why would animals that are lower on the food chain need to lay more eggs? Species lower on the food chain need to lay more eggs to help keep their populations balanced.

QUICK CHECK

1. How is marsupial development different from placental development?
2. What do all eggs provide for a developing animal?
3. Why do some animals generally lay more eggs than others?

WRITING

How an animal cares for its young

The student should research and write a paragraph about how an animal cares for its young.

Suggested animals:

beaver
Darwin frog
elephant
emperor penguin
kangaroo
koala
lion
platypus
spiny anteater
wolf

Discussion

Do you think most animals that lay eggs provide parental care? Answers will vary, but elicit that most do not.

What must be true of young animals that receive no parental care? They must be able to care for themselves as soon as they are hatched.

What happens to many eggs and newly hatched young? They become food for other animals.

Why do some fish fan their eggs with their fins? to keep silt from settling on them

What are other ways that some animals care for their eggs? Possible answers: Some frogs and toads carry their eggs on their backs, and some carry their eggs in their vocal sacs. Parent birds guard their eggs.

Why do animals that provide little parental care often lay so many eggs? Without parental protection fewer of the eggs and young survive to adulthood.

What is the food chain? Possible answer: The series of events in which organisms prey on one another.

At what position do you think animals that lay large numbers of eggs are on the food chain? Why? lower position because many of the eggs and young become food for other animals

Answers

1. Possible answers: Marsupial mammals finish developing in their mother's pouch outside her body. Placental mammals develop inside the mother's body until their body systems can function independently.
2. Eggs provide protection, nutrients, food, and waste removal for the developing animal.
3. Possible answers: Generally, animals that do not provide parental care lay more eggs. Animals that are lower on the food chain lay more eggs.

Activity Manual

Reinforcement, page 197

Objectives
- Recognize the value that God places on life
- Summarize how God provides eternal life

Introduction

This Exploration lesson is designed as an interactive Bible study using Activity Manual page 198. You may choose to omit the discussion and guide the student through completion of the page alone.

The discussion focuses on the value God places on life and His omniscient design of each of us before birth. The lesson ends with an emphasis on salvation for eternal life.

The terms *abortion* and *euthanasia* do not appear in the discussion, but you may choose to incorporate your own thoughts as appropriate for your student.

People have different opinions about when life begins and when it should end.

In this lesson we will look at the Bible to see what God says about life and death.

Teach for Understanding

Discussion

Guide the student in completing part A of Activity Manual page 198.

1. Read Genesis 1:27.
   How was man created different from the animals? God made man in His own image.

2. Read Genesis 4:8–12.
   What did Cain do to Abel? Cain murdered Abel.
   How did God respond to Cain's actions? God judged Cain and punished (cursed) him.

3. Read Exodus 20:13.
   What does this commandment say? We are not to kill anyone.
   Think about Genesis 4:8–12 and Exodus 20:13. Do you think God values the life of each person? yes

Exodus 21:12 states that the punishment for murder is death for the murderer.

4. Read Isaiah 44:2.
   Who formed each of us before we were born? God
   We are each designed and formed by God. He created us with exactly the hair color, eye color, height, and abilities that He wanted for us.

What Value Does God Place on Life?

Name _____

A. Read the verses and complete the statements about God's value on life.

Genesis 1:27 1. Man is a special creation made in God's own _image_.

Genesis 4:8–12 2. After Cain killed his brother Abel, God _cursed_ him.

Exodus 20:13 3. One of the Ten Commandments says, "Thou shalt not _kill or murder_."

Isaiah 44:2 4. God made me and formed me in the _womb_.

Jeremiah 1:5 5. God knew who Jeremiah would be and what he would do _before_ Jeremiah was even born.

Exodus 4:10–12 6. Regardless of man's imperfections, or disabilities, God made each person for a specific purpose. He made the dumb (mute), the _deaf_, the seeing, and the _blind_.

Job 12:9–10 7. God controls the soul of every living thing and the _breath_ of all mankind.

Matthew 10:30–31 8. God knows all about me. He knows the _number_ of hairs on my head, and my life is valuable to Him.

Job 33:4 9. God made me, and His _breath_ gave me life.

Psalm 139:13–14 10. The Bible tells us to praise God, for we are fearfully and wonderfully made. Marvelous are His _works_.

B. Match the description and the verse.

_E_ 11. Life and death are controlled by the Lord.
_A_ 12. Physical life is a gift from God.
_C_ 13. Death is a result of sin.
_B_ 14. Every man has an appointed time to die.
_D_ 15. God provides eternal life through Jesus Christ.

A. Acts 17:25
B. Hebrews 9:27
C. Romans 5:12
D. Romans 6:23
E. 1 Samuel 2:6

SCIENCE BACKGROUND

Abortion
The definition of *abortion* is the act of killing a baby before it is born.

Euthanasia
The term *euthanasia* is used to describe the act of ending a person's life because of illness, old age, or physical disability. Euthanasia is practiced and accepted in many countries. The guidelines for using euthanasia vary from country to country. Some countries allow it only for people over the age of eighteen, but some countries have proposed legislation to allow euthanasia for disabled individuals under the age of eighteen.

Assisted suicide
As of 2012 in the United States, Oregon, Washington, and Montana are the only states to legally allow assisted suicide. However, this does not mean that euthanasia and assisted suicide are not issues for other states. Some states are currently hearing court cases about terminating the lives of spouses who have suffered strokes, are in comas, or have other long-term health problems. Cases have also been cited where the laws allowing assisted suicide have failed to protect the patients the way they should.

Discussion

5. Read Jeremiah 1:5.
   God formed the prophet Jeremiah before he was born. What else did God plan for Jeremiah before he was born? God planned that Jeremiah would be a prophet.

   What attribute of God tells you that He has a plan for your life? God is omniscient, or all-knowing.

   God has a specific plan for each person's life. Each person is born for a purpose.

6. Read Exodus 4:10–12.
   What does Exodus 4:11 say about people born with disabilities? God made them.

   God created Moses exactly as He needed for Moses to be able to lead the Israelites. God creates each person with the abilities that he needs to fulfill God's purpose for his life.

7. Read Job 12:9–10.
   Do we have control of whether we live and breathe? no
   Who does? God

8. Read Matthew 10:30–31.
   What does Matthew 10:30–31 tell us about God? God knows exactly how many hairs we have on our heads, and our lives are valuable to Him.

9. Read Job 33:4.
   Who gives us life? God

10. Read Psalm 139:13–14.
    According to Psalm 139:13–14, why should we praise God? We are fearfully and wonderfully made.

Psalm 139:16–18 continues to tell the writer's marveling over God's knowledge and plan of the details of each life before birth and God's continued thought and care to sustain life.

Provide time for the student to complete part B, and then discuss the statements and verses in order.

11. Discuss 1 Samuel 2:6. Life and death are controlled by the Lord.
    Who controls life and death? the Lord

12. Discuss Acts 17:25. Physical life is a gift from God.
    What does God provide for all people? life, breath, and all things necessary to live

Other verses that support this truth include James 4:13–15 and Luke 12:16–21.

13. Discuss Romans 5:12. Death is a result of sin.
    How did death enter into the world? by the sin of one man, Adam

    Have all people sinned? yes

    What is the punishment for sin? death

    Do you think Romans 5:12 is talking about physical death, spiritual death, or both? both

14. Discuss Hebrews 9:27. Every man has an appointed time to die.
    What does Hebrews 9:27 say happens after a person dies? judgment

15. Discuss Romans 6:23. God provides eternal life through Jesus Christ.
    The payment for sin is death. What does God provide for each person? the gift of eternal life

    Not only did God provide each of us with physical life, but He also gives us the free gift of eternal life. After a person dies, he will continue to live eternally in either heaven or hell. When Jesus died on the cross, He took the punishment for our sins. Christ's death paid the penalty for sin. Although He died and was buried, Christ rose again, victorious over sin and death. Everyone who has accepted Christ's death as the payment for his sins will live forever in heaven. This gift of eternal life available through Jesus Christ is far more important than physical life. Have you chosen to accept God's free gift?

Activity Manual

Exploration, page 198

Lesson 145

Student Text pages 304–7
Activity Manual pages 199–202

Objectives
- Identify some methods of asexual reproduction
- Set up an experiment to observe and compare the rate of growth of a seed and of a plant cutting

Materials
- potato with sprouts

Vocabulary
asexual reproduction
binary fission
budding
fragmentation
regeneration
vegetative reproduction

Introduction

Included with this two-page text lesson is an activity. The activity, *It's a Race*, will not take long for the student to set up. However, he will need to spend at least one week observing his carrots. The setup can be done at the beginning or at the end of this lesson.

Have you ever tried to grow an African violet from a leaf or seen potatoes that have sprouted? Answers will vary.

Display the potato for the student to examine.

What are the white things growing on the potato? sprouts, roots

Sometimes pieces of a plant can grow into a new plant in unusual ways. Today's lesson will explain another type of reproduction.

Teach for Understanding

Purpose for reading

What are some different methods of asexual reproduction?

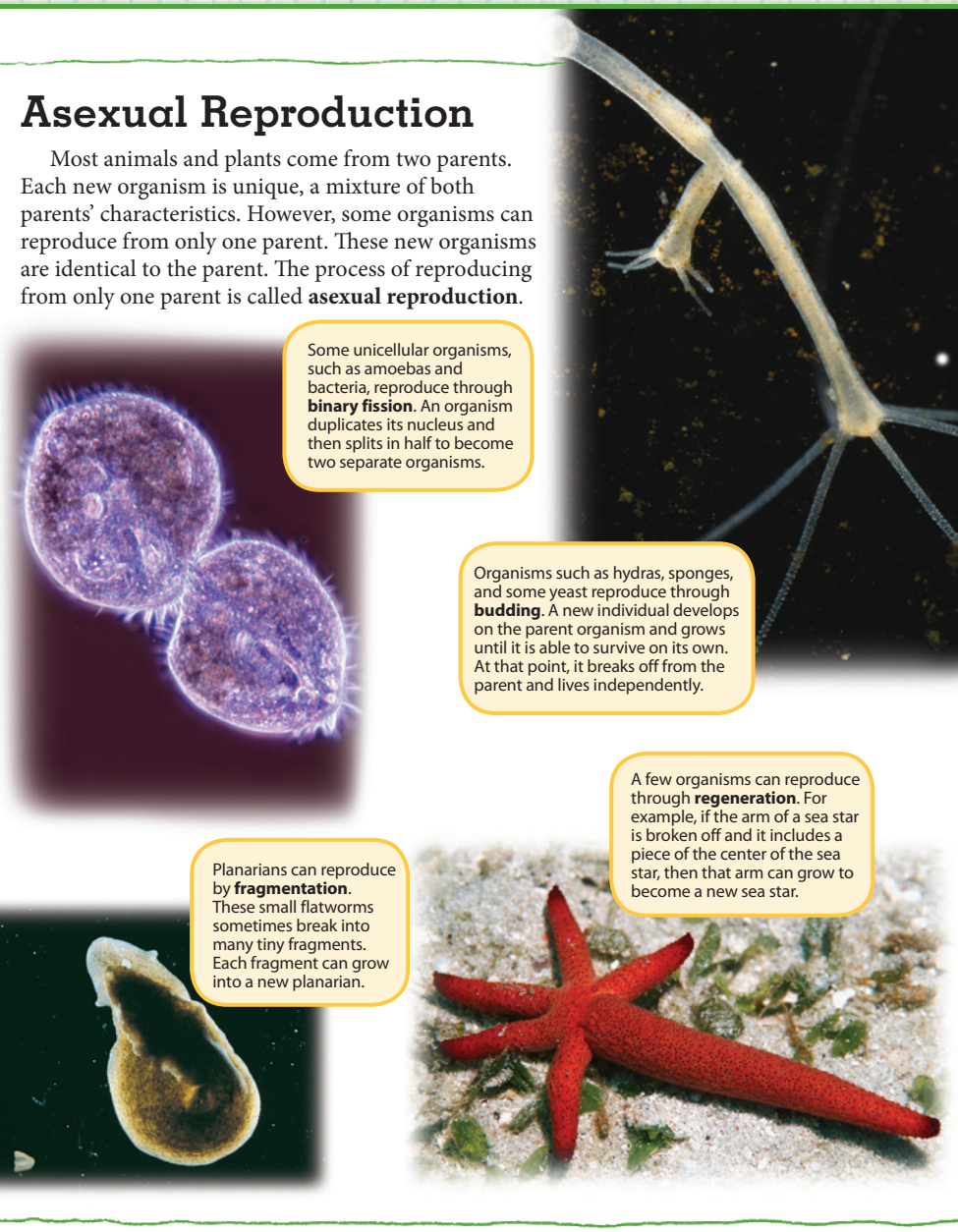
Discussion

Complete Activity Manual page 199 during the discussion.

What do we call reproduction that involves only one parent? asexual reproduction

How is an organism that is a result of asexual reproduction different from one that is the result of sexual reproduction? It is identical to its parent instead of being a genetic mixture of two parents.

What is binary fission? A unicellular organism duplicates its nucleus and then splits in half to form two separate organisms.



Asexual Reproduction

Most animals and plants come from two parents. Each new organism is unique, a mixture of both parents' characteristics. However, some organisms can reproduce from only one parent. These new organisms are identical to the parent. The process of reproducing from only one parent is called **asexual reproduction**.

Some unicellular organisms, such as amoebas and bacteria, reproduce through **binary fission**. An organism duplicates its nucleus and then splits in half to become two separate organisms.

Organisms such as hydras, sponges, and some yeast reproduce through **budding**. A new individual develops on the parent organism and grows until it is able to survive on its own. At that point, it breaks off from the parent and lives independently.

A few organisms can reproduce through **regeneration**. For example, if the arm of a sea star is broken off and it includes a piece of the center of the sea star, then that arm can grow to become a new sea star.

Planarians can reproduce by **fragmentation**. These small flatworms sometimes break into many tiny fragments. Each fragment can grow into a new planarian.

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SCIENCE BACKGROUND

Asexual reproduction
All methods of asexual reproduction involve mitosis rather than meiosis.

Fragmentation
This term is often more broadly defined as any form of asexual reproduction in which a portion of the parent organism, if separated, can survive on its own and develop into an adult. As such, regeneration and a number of types of vegetative reproduction could be called fragmentation.

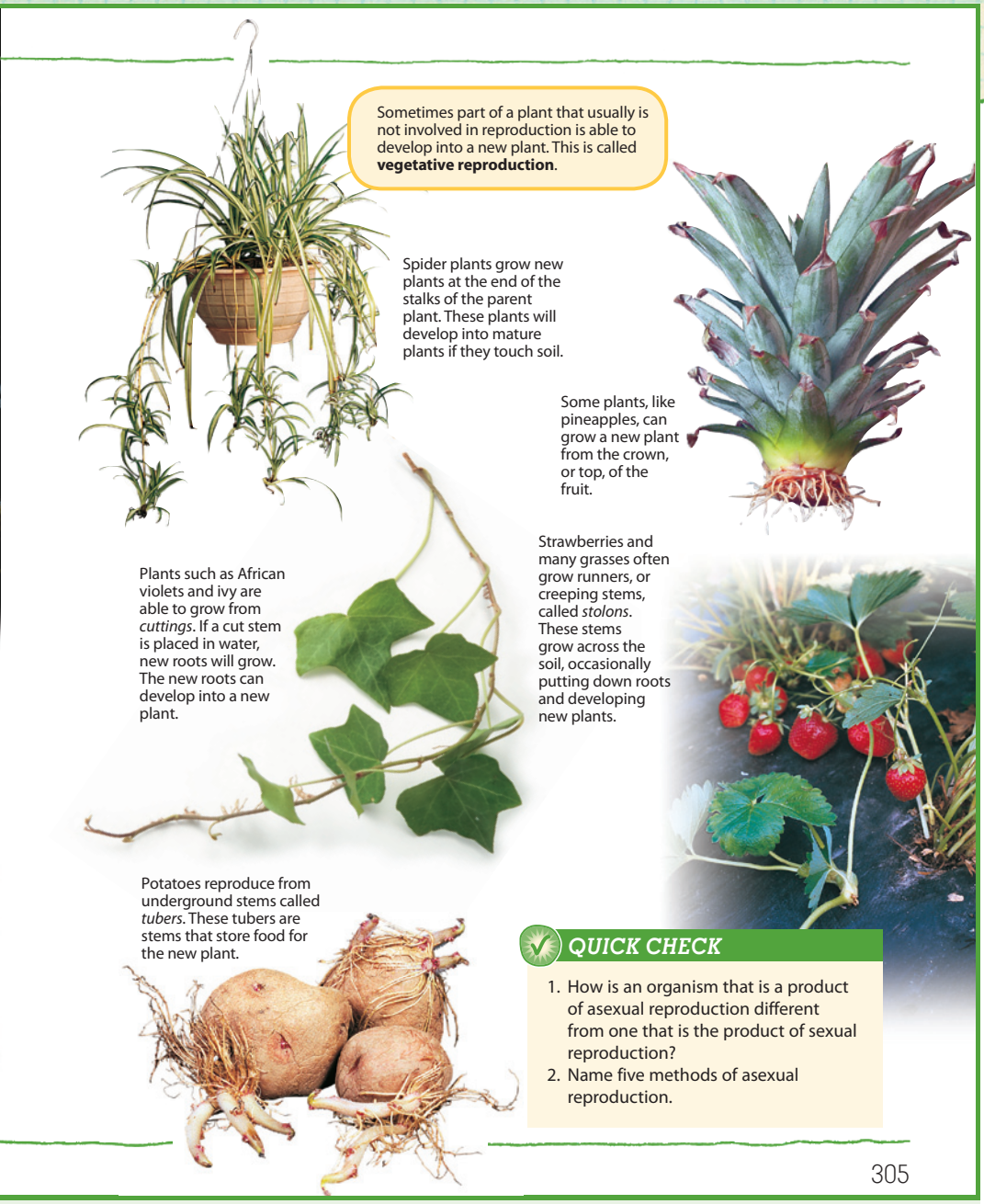
Layering
Another method of asexual reproduction is called *layering*. Some trees and bushes, such as the forsythia, may have branches that bend over and touch the ground. If left undisturbed, a new plant develops from where the branch touches the ground and roots itself.

Stem reproduction
There are many forms of stem reproduction, including bulbs (daffodils, tulips), corms (gladioluses, crocuses), rhizomes (irises, cattails), stolons (strawberries), and tubers (potatoes, artichokes). Unlike other potatoes, the sweet potato tuber is actually underground storage in a root rather than in a stem.

Vegetative reproduction
Plant asexual reproduction is called vegetative reproduction.

Root cuttings
Root cuttings from radishes, carrots, and sweet potatoes will sprout new greenery. The root usually does not regrow.

Stem and leaf cuttings
Stem and leaf cuttings will root faster if a rooting compound is applied before they are placed in water.



Discussion

What are some organisms that reproduce through budding? Possible answers: hydra, sponges, some yeast

What is a difference between budding and fragmentation? Possible answer: An organism that reproduces through budding does not separate from the parent until it is able to live on its own. If an organism that reproduces through fragmentation is broken into pieces, each piece develops into a new organism.

What must be included for an arm of a sea star to regenerate into a new sea star? The arm must include a piece of the center of the sea star.

Sometimes part of a plant that is not usually involved with reproduction develops into a new plant. What is this called? vegetative reproduction

What are some types of vegetative reproduction? Possible answers: cuttings; tubers; stolons; new spider plants growing at the end of the stalks of the parent plant; a new pineapple plant growing from the crown of the fruit

How do plants reproduce through cuttings? Possible answer: When stem or leaf cuttings are placed in water, the cuttings grow new roots. The cuttings can then be transplanted into soil to develop into new plants.

Potato plants can reproduce both sexually and asexually. Why might a potato plant or other organism need to be able to reproduce in both ways? Possible answer: When conditions are not right for seeds to develop, the plant can reproduce asexually.

Answers

1. The organism is identical to its parent instead of being a genetic mixture of two parents.
2. binary fission, budding, fragmentation, regeneration, and vegetative reproduction

Activity Manual

Reinforcement, page 199

Review, page 200

This page reviews Lessons 143 and 145.

Assessment

Quiz 12-B

The quiz may be given any time after completion of this lesson.

SCIENCE MISCONCEPTIONS

Regeneration

Be sure that students understand that when the arm of a sea star is broken off, that arm will regenerate into a new sea star only if it contains some of the center part of the original sea star. The original sea star can grow a new arm to replace the one that was broken off. This is also sometimes called regeneration, but it is not a form of asexual reproduction.

Teach for Understanding

Purpose for reading

The student should read all the pages before beginning the activity.

This activity is included as part of Lesson 145. The observation time for the activity is at least one week.

Materials

- See Student Text page
- copy of *Plant City Times* for each student (optional)

News reporters desire to be the first to have their breaking stories in print. They use observation and note-taking skills to provide the facts that will interest their readers. After you finish covering the big race, use information from your observations to write an exciting, yet informative, article for the front page of the *Plant City Times*.

ACTIVITY

It's a Race!

Process Skills
- Hypothesizing
- Measuring
- Observing
- Recording data
- Communicating

You are the newest reporter for the *Plant City Times*. It is your job to cover the big race—the race between a seed and a cutting. Public interest is high, so be sure that you provide all the details!

Problem

Which will grow greenery 6 cm high first—the carrot top or the carrot seed?

Procedure

1. Formulate your hypothesis. Under equal conditions, which plant do you think will reach 6 cm first? Record your hypothesis in your Activity Manual.
2. Fill each container with soil. Position the carrot top in one of the containers so that most of the top is under the soil. Be sure to leave part of the top above the soil. Add enough water to keep the soil damp.
3. Plant the carrot seeds about 1 cm deep in the soil. Add enough water so that the soil is damp.

Materials
2 cups or containers
potting soil
carrot top, greenery removed
2 carrot seeds
water
centimeter ruler
Activity Manual

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TEACHER HELPS

Carrot top preparation
Use a carrot that still has the greenery attached. Twist the greenery off the carrot. Then cut the carrot root 1.5 to 2 centimeters from the base of the top. Carrot tops can be cut and prepared the night before and kept refrigerated.

Containers
Tall, clear containers provide more depth for the carrot seeds' roots to grow. You may need to add gravel or put holes into the bottom of the containers for drainage.

Substitutions
Other root vegetables, such as radishes and beets, may be used.

SCIENCE MISCONCEPTIONS

Since the carrot top is a root cutting, the student should not expect the carrot top to grow a new carrot taproot. The top should, however, grow new stems, leaves, and small secondary roots.

4. Place the containers in a sunny place where they will not be disturbed or knocked over.
5. Observe the containers at the same time each day. Record your observations. When new greenery is visible, record the number of stems and leaves. Measure and record the length of the longest stem. Add water as needed to keep the soil moist.
6. Keep measuring each plant until one of them has greenery that is 6 cm long.
7. Write a newspaper article about the race. Include a catchy headline and all the important information.

Conclusions

- Did your results support your hypothesis? Why or why not?
- Gently remove the plants from the soil. How are the roots different?

Follow-up

- Try the activity with a different root vegetable. Compare the results.
- Plant the seeds of several different vegetables and graph their rates of growth.

SCIENCE PROCESS SKILLS

Observing
Discuss the importance of careful observation.

What information are you being asked to observe? number of stems visible and number of leaves visible

Do you think that you will be able to observe new information each day? Answers will vary. Elicit that it may take several days before any changes can be seen.

Why do you think it is important to observe the plants daily even if there is no new information to record? In order to maintain consistent, reliable records, observations must be done in a systematic way.

Procedure

Demonstrate how to plant the carrot top and seeds. Guide the student through Steps 2 and 3.

Allow the student to select a sunny spot in the classroom for his container. Set a time for the plants to be observed each day. If plants will not be observed over the weekend, be sure that the cuttings and seeds have enough water to last through the weekend. (The cuttings will require more water than the seeds.)

When green growth is visible, remind the student to handle his cuttings gently as he measures the greenery. Emphasize the importance of accurate measurements. Since carrot leaves are finely divided and feathery, you may need to help the student determine the best definition of a "leaf" for counting purposes.

Conclusions

Provide time for the student to evaluate his hypotheses and answer the questions.

Use the questions in the Science Process Skills to discuss observing.

Activity Manual

Activity, pages 201–2

Assessment

Rubrics

Select the prepared rubric, or design a rubric to include your chosen criteria.

Objectives
- Recall concepts and terms from Chapter 12
- Apply knowledge to everyday situations

Introduction
Material for the Chapter 12 Test will be taken from Student Text page 308 and Activity Manual pages 195–96, 200, and 203–4. You may review any or all of the material during the lesson. Questions similar to Solve the Problem or the ones in Thinking It Through, Activity Manual pages 203–4, may appear on the test.

You may choose to review Chapter 12 by playing "Busy Pollinators" or a game from the Game Bank on the Teacher's Toolkit CD.

Teach for Understanding
Diving Deep into Science
Information on this page reflects the vocabulary and concepts the student should know for the test.

Solve the Problem
In order to solve the problem, the student must apply material he has learned. The student should attempt the problem independently. The answer for this Solve the Problem is based on the material on Student Text pages 290–93. Answers will vary and may be discussed.

Activity Manual
Review, pages 203–4
These pages require written responses to application questions.

Lesson 147

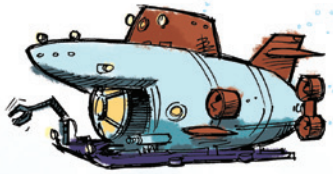
Objective
- Demonstrate knowledge of concepts taught in Chapter 12

Assessment
Tests, Chapter 12

DIVING DEEP INTO SCIENCE

Words to Know
sepals
stamen
anther
pistil
ovary
ovule
style
fertilization
zygote
embryo
fruit
germinate
cotyledon
fruiting body
placental mammal
gestation
marsupial
binary fission
budding
regeneration
fragmentation
vegetative reproduction

Key Ideas
Parts of a flower
Parts of a seed
How a seed develops
Difference between self-pollination and cross-pollination
Life cycle of a conifer
Difference between seeds and spores
Reproduction of ferns and mosses
Different ways animals develop
Characteristics and examples of types of reproduction



Solve the Problem
Your friend Brent planted some peach trees in his yard a few years ago. This year, just as the trees were starting to bloom, the weather turned cold, and there was a hard freeze. Most of the blossoms on the trees turned brown and fell off. Brent told you yesterday that he cannot understand why his trees have only a few peaches this year. Can you explain why?

If the blossoms fell before they could be pollinated and fertilized, no fruit will develop.

Review Game
Busy Pollinators

Draw two large flowers for display. Divide the class into two teams. The teams are bees gathering pollen and pollinating flowers. Ask review questions, alternating between teams. A tally mark is made on the team's flower for each correct answer. The team with the most tallies at the end of the game wins.

Variation: Prepare paper flowers. Each time a team member answers a review question correctly, he receives a paper flower. The team with the most flowers wins.