

Life Cycles of Animals and Plants

1-2
40- to 50-minute sessions



ACTIVITY OVERVIEW

Students read about the life cycles of different animals and plants. The reading describes the structures involved in reproduction, and compares the stages of development in the life cycles of amphibians, insects, reptiles, birds, mammals, and seed plants.

KEY CONCEPTS AND PROCESS SKILLS

(with correlation to NSE 5–8 Content Standards)

1. Reproduction is a characteristic of all living systems; because no individual organisms lives forever, reproduction is essential to the continuation of many species. (LIFE SCIENCE: 2)
2. In many species females produce eggs and males produce sperm. An egg and sperm unite to begin development of a new individual. (LIFE SCIENCE: 2)
3. Plants can also reproduce sexually. The egg and sperm are produced in the flowers of flowering plants. (LIFE SCIENCE: 2)

KEY VOCABULARY

angiosperm
complete metamorphosis
cotyledon
dicot
egg
fertilization
germination
gymnosperm
metamorphosis
monocot
ovule
seed
seed plants
simple metamorphosis
sperm
tadpole

MATERIALS AND ADVANCE PREPARATION



For the teacher

- 1 Transparency LC.1, "Procedure for Extension 2: Flower Dissection"



For each pair of students

- * 1 simple flower
- * 2 sheets of white paper
- * 1 set of colored pencils
- * 1 hand lens

**Not supplied in kit*

TEACHING SUMMARY

Getting Started

1. Prepare students for the reading, including how to respond to the Stopping to Think questions.

Doing the Activity

2. Students complete the reading.

Follow-Up

3. Review the similarities and differences between the processes of reproduction and development in animals and plants.

BACKGROUND INFORMATION

There are three types of mammals: placental, marsupials and monotremes. The processes of reproduction and development of marsupials and monotremes differ from those of placental mammals. Marsupial embryos develop with a type of yolk sac instead of a placenta. Monotremes, including the platypus and the spiny anteater, do not give birth to live young. Instead, they lay soft-shelled eggs, inside of which the embryos develop. Monotremes and marsupials both nurse milk from the mother, which is one of the characteristics of mammals.

Most species of reptiles, including the ones discussed in this activity, lay calcified eggs that develop and hatch outside the mother. Species that lay eggs that develop and hatch outside the mother are called oviparous. However, some species bear live young. These species that bear live young can be subdivided into two groups. Most of the species that bear live young are ovoviviparous, which means that they form a calcified egg that develops and hatches inside the female. An example of an ovoviviparous reptile is a boa. A smaller group of reptiles that bear live young are viviparous: they bear live young that do not develop inside a calcified egg, but are instead nourished by a placenta. An example of a viviparous reptile is an armadillo lizard.

TEACHING SUGGESTIONS

■ GETTING STARTED

1. **Prepare students for the reading, including how to respond to the Stopping to Think questions.**

Begin by reviewing the stages of human development. Once the egg is fertilized by a sperm, it becomes a zygote. After the zygote has begun to divide and has implanted on the uterine wall, it is called an embryo. After eight weeks, the embryo is called a fetus. After nine months, the human fetus is born. This begins a process of independent development from infancy through childhood, adolescence, and adulthood.

Instruct students to review the Stopping to Think questions. This strategy was introduced in the “Human Reproduction” reading. Consider having students share their responses in their groups. You may wish to use metacognition or reciprocal teaching strategies with this reading.

■ DOING THE ACTIVITY

2. **Students complete the reading.**

Have students work in small groups to complete the reading and the Stopping to Think questions.

Stopping to Think 1

What are the three main stages of the amphibian life cycle?

The three stages are egg, tadpole and adult.

Stopping to Think 2

What are the differences between simple and complete metamorphosis?

In simple metamorphosis, the changes in the organism from stage to stage are not as dramatic as they are in complete metamorphosis. Also, in complete metamorphosis, the insect looks very different from the adult at each stage. Simple metamorphosis has three developmental stages: egg, nymph and adult. Complete metamorphosis has four stages: egg, larva, pupa and adult.

Stopping to Think 3

What structures allow flowering plants to reproduce?

The pollen grains contain the “male” sperm and are found in the anther of the flower. The “female” cells are in the ovule, which is found in the ovary.

Stopping to Think 4

Describe three differences between monocots and dicots.

Monocots have one cotyledon that grows from the seeds; dicots have two. Monocot flower parts are in multiples of three; dicot flower parts are in multiples of four or five. Leaf veins in monocots are parallel, leaf veins in dicots are branched.

Stopping to Think 5

What are the reproductive structures in gymnosperms?

The reproductive structures are small cones that contain pollen and large cones that contain ovules.

■ FOLLOW-UP

3. **Review the similarities and differences between the processes of reproduction and development in animals and plants.**

Review with students that the reproductive process in all of the animals and plants in this reading begin with an egg that is fertilized by a sperm. In most species, the female produces eggs and the male produces sperm. From there, the developmental process varies among different groups of species. In amphibians, development proceeds through two distinct stages: tadpole and adult. The tadpole looks very different from the adult. In insects, the fertilized egg develops through either two or three distinct stages, depending on the species. In some species, such as the praying mantis, development continues to the nymph stage, and then adult. In other insect species, such as houseflies, the fertilized egg continues to the larva, pupa, and adult stages. In most mammals the fetus develops inside the female, and is then born.

Plants may also reproduce sexually. Seed plants are made up of two groups: angiosperms (flowering plants) and gymnosperms. In flowering plants, the

reproductive structures are found in the flowers. Fruits form to protect the developing embryo. In gymnosperms, the reproductive structures are found in cones, not flowers. Small pollen cones contain the male reproductive structures, and larger ovulate cones contain the female reproductive structures.

■ EXTENSION 1

Have students germinate seeds of corn (a monocot) and beans (a dicot) and compare their early development. The seeds should be placed between moist paper towels and the towels should be kept moist for 3 to 5 days.

Students will need to dissect the germinated seeds. For the dissection, you may wish to provide forceps for students to gently tear off the skin of one seed. The two halves can then be separated and observed with a hand lens. Instruct students to draw one of the halves of the seed and the developing plant parts they observe inside. Instruct them to label the seed half and the developing plant.

■ EXTENSION 2

Have students dissect a flower and locate the male and female reproductive structures. A procedure for dissecting flowers is provided on Transparency LC.1.

Gather flowers for the dissection by contacting local florists at least 7-10 days in advance. Ask florists to set aside dead/dying flowers that are going to be discarded. This investigation works best if you obtain a variety of simple flowers, rather than just one kind of flower. Some flowers that work well include the tulip, daffodil, lily, freesia, ranunculus, alstromeria, gladiolus, delphinium, and snapdragon.

Garden flowers that work include camellias (the ones with fewer petals work well but the more tightly whorled ones are difficult for students to dissect), fuschia, pansies, climbing roses and dog roses, blossoms from an apple, plum, and cherry trees. Morning glory and hibiscus are good choices. Honeysuckle flowers work well but they wilt quickly.

Flowers that do not work well include very tightly whorled flowers such as carnations, some camellias and chrysanthemums, composite flowers such as gerbera daisies, sunflowers, flowers made of tiny, multiple flowers like hyacinths and wisteria, flowers with fused or complex petals such as irises, and single sex flowers like magnolias and begonias.

Be sure to determine if any students are allergic to flowers. You may wish to provide photographs of flowers for these students to examine.

SUGGESTED ANSWERS TO QUESTIONS

1. *Compare the development of amphibians and insects.*

a. *Describe the similarities between the life cycles of these two groups of organisms.*

The life cycle of both groups starts with a fertilized egg. Then the organism goes through metamorphosis in both to become an adult.

b. *Describe the differences between the life cycles of these two groups of organisms.*

The differences are the number and type of stages in the development of the organisms. For example, insects have a larva or nymph stage, and a pupa stage. Also, insects have two types of metamorphosis depending on the type of insect, simple metamorphosis and complete metamorphosis.

2. *The process of fertilization in reptiles, birds, and mammals results in the development of an egg.*

a. *Describe how the process of fertilization and the resulting egg is similar for these three groups of organisms.*

For all, the egg is fertilized inside the female by the male sperm.

b. *Describe how the process of fertilization and the resulting egg is different for these three groups of organisms.*

Reptile eggs are rubbery and bird eggs are hard. This protects them from weather and things in the environment like predators. In

reptiles and birds, development happens inside the egg after it is laid by the female. Then the young hatches. A mammalian egg develops into an embryo inside the female, where it is protected. Then the young is born.

3. In animal development,

- a. which groups of organisms produce young that look very similar to adults?

Only in mammals, reptiles, and birds do the young often look like the adults when they are hatched or born.

- b. which groups of organisms produce young that look very different from adults?

Amphibians and insects produce young that look very different from adults.

- c. For each group of organisms in your answer to b, describe the stages of young that look different than adults.

In amphibians, the tadpole stage looks different from the adult. In insects, the larva/nymph and pupa stages all look different from the adult.

4. Copy the following table in your notebook. Then, complete the table by

- Marking which structures are found in flowering plants and gymnosperms in the appropriate column
- Writing the function of each structure in the last column

Structure	Flowering Plants (angiosperms)	Gymnosperms	Function
Flower	X		Reproductive structure that contains sperm in pollen and female cells in ovules
Cone		X	Reproductive structure: small pollen cones contain male sperm and large cones with ovules for female cells
Pollen grains containing sperm	X	X	Contain male sperm in stamen of flower and small cones
Embryo	X	X	Found within the seed
Seed	X	X	Contains embryo and nutrients for embryo
Fruit	X		Forms around embryo to protect it.

Procedure for Extension 2: Flower Dissection

MATERIALS

For each pair of students

- 1 simple flower
- 2 sheets of white paper
- 1 set of colored pencils (optional)
- 1 hand lens

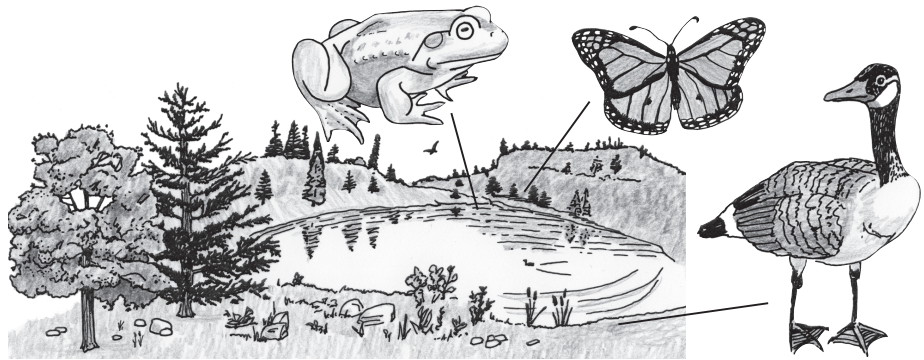
PROCEDURE

1. Remove the petals on one side of your flower so you can see what is in the center (keep the petals).
2. Look at the picture of the flower in the Student Book. Try to find similar parts on your flower.
3. Gently shake your flower to see if any pollen comes off. Touch the anthers to see if any pollen comes off. Record your observations in your science notebook.
4. Draw your flower from the side on a sheet of white paper. Observe your dissected flower carefully, and draw what you see. Label the parts of the flower.

Life Cycles of Animals and Plants



If you go outside to a nearby park and look around, you are likely to notice many different types of plants and animals, from dandelions and mosquitoes to pine trees and geese. These different types of plants and animals have a variety of sizes, shapes, and colors. If you look at these plants and animals over time, you will also observe that they do not all develop from youth to adulthood in the same manner. The **life cycle** of an organism begins when the organism is a single cell and continues as it develops into an adult and reproduces offspring. In the last activity, you learned about the human reproductive system and the early stages of the human life cycle. In this activity you will read about the life cycles of other animals and plants.



CHALLENGE

How do the structures and patterns of development compare among different animals and plants?

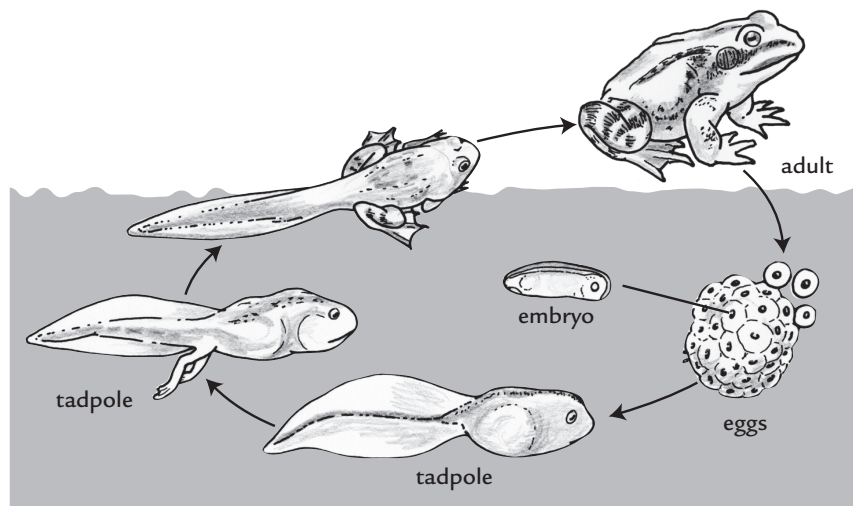
READING

The Life Cycle of Amphibians

Unlike humans and other mammals, some types of animals have a number of distinct stages of development. One example you might be familiar with is the amphibians, such as salamanders and frogs. Amphibians go through three main stages of development: egg, tadpole, and adult. The adult female lays thousands of unfertilized eggs

in or near water. Development starts after the eggs are fertilized by the male's sperm. The eggs are often surrounded with a jelly-like coating that provides protection and nutrients.

After one to four weeks, the eggs hatch and release tadpoles. Tadpoles are young amphibians that live in water and have some features in common with fish. Tadpoles have gills and tails for swimming. Tadpoles look very different from the adult amphibian that they will become, almost like a different animal. Depending on the type of amphibian, the tadpole stage lasts from one week to several months.



In the next stage of development, called metamorphosis, the tadpoles become young adults. **Metamorphosis** (met-ah-MORE-foh-sis) is a sudden physical change that occurs long after the animal has hatched. During metamorphosis, the tadpole develops lungs and four legs. The eyes change to allow for better vision. At the end of metamorphosis, the tail disappears. The adult amphibian will either remain in the water or move onto land. This depends on the type of amphibian.

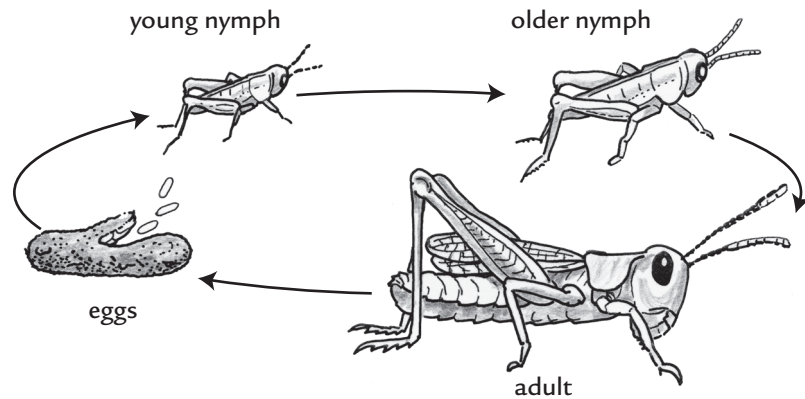
STOPPING TO THINK 1

What are the three main stages of the amphibian life cycle?

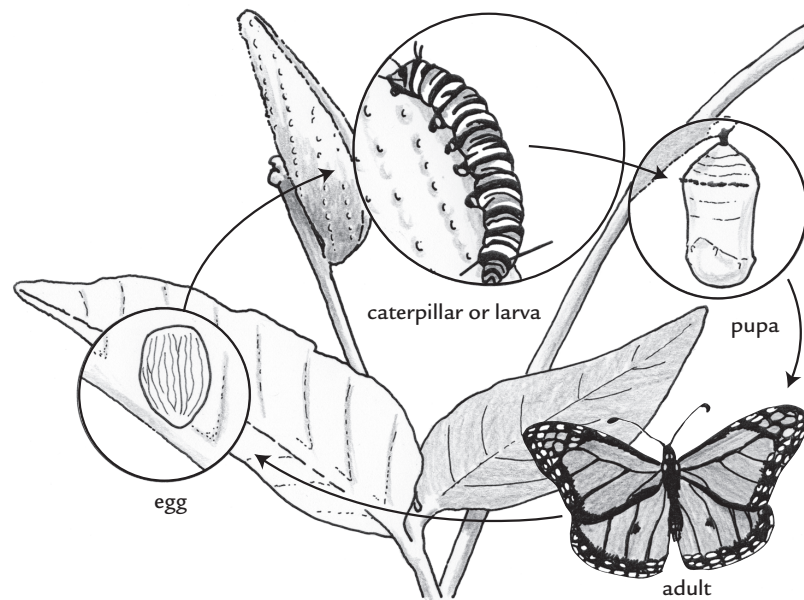
The Life Cycle of Insects

Insects go through a different pattern of fertilization and development than amphibians. In insects, eggs are fertilized inside the female by male sperm. The female lays the fertilized eggs along with a liquid. If the egg is laid out of water, the liquid hardens and attaches the eggs to a plant or the ground. Then the embryo's development begins.

Some insects, such as the praying mantis and grasshopper, go through three main stages in their development: egg, nymph, and adult. This pattern of development is called simple metamorphosis. In **simple metamorphosis**, the changes in the different stages of development are not dramatic. The nymph is very similar to the adult, except that it has no wings and cannot reproduce. The nymph may also be a different color than the adult. The nymph molts, or sheds its hard skin covering, several times. Each time it molts, it looks more like an adult. With the final molt the insect reaches full size, develops wings, and can reproduce.



Other insects go through four main stages of development: egg, larva, pupa, and adult. This type of development is called **complete metamorphosis**. During complete metamorphosis, the insect goes through more dramatic changes. During each stage of development, the insect looks very different from an adult. An example is the monarch butterfly. After about five to ten days, a fertilized butterfly egg hatches and develops into the larva, which is a caterpillar. After two weeks in the larval stage, the caterpillar spins a cocoon and becomes a pupa. The pupa hangs on a twig or leaf for two to three weeks. After several molts, the mature adult butterfly emerges from the cocoon.



STOPPING TO THINK 2

What are the differences between simple and complete metamorphosis?

Table 1 below compares the developmental stages and times for a variety of insects.

Table 1: Insect Development				
Insect	Egg	Larva or nymph	Pupa	Adult
Housefly	12-24 hours	4-6 days (larva)	3-6 days	2-3 weeks
Monarch butterfly	5-10 days	2-3 weeks (larva)	2-3 weeks	3-9 months
Beetle	1-2 weeks	2-5 weeks (larva)	5-10 days	4-5 weeks
Mayfly	1-3 weeks	1-3 years (nymph)	None	1 day
Cockroach	6-7 weeks	6-9 months (nymph)	None	6-9 months
Grasshopper	3-4 weeks	3-4 weeks (nymph)	None	12 months

The Life Cycles of Reptiles, Birds, and Mammals

Just as in amphibians and insects, the development of reptiles, birds, and mammals begins with a fertilized egg. However, in reptiles, birds, and mammals, the developing embryo is protected by membranes. A membrane is a very thin covering that serves a specific function. For example, reptile, bird, and mammal embryos have a membrane called the amnion, or amniotic sac. The amnion is a sac filled with fluid. Reptile and bird embryos have additional membranes that remove waste and provide oxygen.

Reptiles and birds lay eggs out of water. Their eggs have an outer shell to protect the egg from harsh temperatures, weather, and predators. The shell may be flexible or inflexible depending on the species. Reptile eggs have a rubbery covering, while bird eggs have a hard shell. These protective eggs are considered to be an important evolutionary change that made it possible for reptiles and birds to live and reproduce on land. Once hatched or born, young reptiles, birds, and mammals do not go through the dramatic life cycle changes that take place in the development of insects and amphibians. For most reptiles, birds, and mammals, the young resemble the adult. For example, as soon as an alligator hatches from the egg, it is obvious that it is an alligator.

Most mammals give birth to live offspring instead of laying eggs. After the egg is fertilized, the embryo develops inside the mother's uterus until it is ready for birth. These mammals can be divided into two groups—placental mammals and marsupials. In humans and other placental mammals, the embryo gets nutrients through a placenta. In the Human Reproduction reading, you learned that the amniotic sac is attached to the uterus by the placenta. The placenta allows nutrients and oxygen to pass from the mother's blood vessels to the fetus's blood vessels. After birth, the young mammal grows to a mature adult. In marsupials, such as kangaroos, koalas, and opossums, the embryo is born at an earlier stage of development. Once it is born, the young lives in a pouch for several weeks. It nurses in the pouch while it is developing. Table 2 on the next page compares the reproduction and development of reptiles, birds, and mammals.

Table 2: Animal Reproduction and Development

	Egg Shell	Where development occurs	Placenta present/absent	Offspring
Reptiles	Rubbery	Outside female; inside egg	Absent	Hatch from egg
Birds	Hard	Outside female; inside egg	Absent	Hatch from egg
Most mammals	none	Inside female	Present (except in marsupials)	Born alive

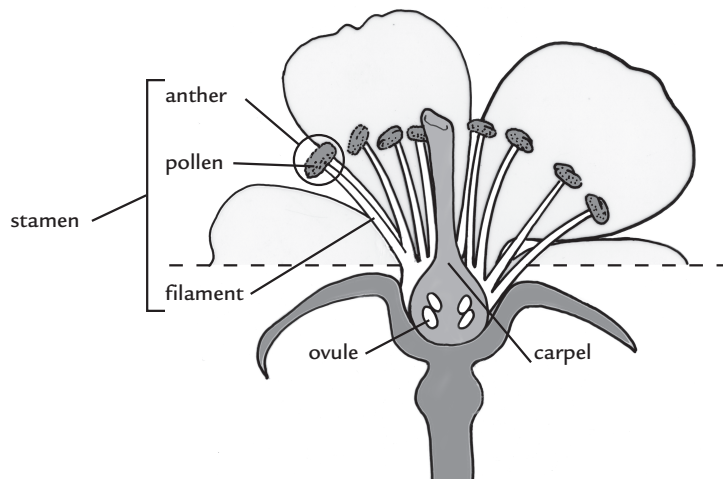
The Life Cycles of Plants

Plants live in many different areas in a variety of environments on Earth. During sexual reproduction, an egg from the female structure of the plant is fertilized by sperm produced in the male structure of the same or another plant. Once the egg is fertilized it goes through different stages of development. The plant embryo will grow into a young plant. The young plant will continue to grow and change into an adult plant. At first, this adult plant does not have the male and female structures needed in order to reproduce. Once it develops these structures, it is able to produce offspring. Unlike animals, plants continue to grow taller throughout their entire life.

Seed plants are one of the largest groups of plants on land. A **seed** contains an embryo and nutrients, which are enclosed inside a protective covering called a seed coat. Development of a new plant begins with the seed. There are two main subgroups of seed plants: angiosperms and gymnosperms.

Angiosperms (Flowering Plants)

The flowering plants, called **angiosperms**, are the largest group of plants that live on land. The reproductive structures in flowering plants are the flowers. Flowers contain both the female and male structures. There are two kinds of cells that are involved in reproduction in flowering plants. The pollen grains contain the “male” sperm cells, and are found in the anther of the flower. The “female” cells are found within the ovule. The ovule is housed inside the ovary of the flower. The color and smell of the flowers attract insects and birds which help bring the pollen in contact with the carpel.



When the pollen reaches the carpel, fertilization of the ovule takes place. After fertilization, the seed is formed. The seed contains the embryo along with nutrients for its development. As development continues, the fruit forms around the embryo. The fruit protects the embryo as it develops. If the fruit is eaten by an animal, the seed passes through its digestive system. When the seed falls on the ground, it may begin to grow. This early stage of growth is called **germination** (jer-mih-NAY-shun).

Flowering plants are used by humans for many practical purposes. When you walk through the produce section of the grocery store or market, most of what you see is the product of a flowering plant. Examples are tomatoes, pumpkins, strawberries, potatoes, beans, and peppers. Flowering plants such as roses, daisies, and snapdragons have showy flowers and are popular garden plants.

STOPPING TO THINK 3

What structures allow flowering plants to reproduce?

Two Kinds of Flowering Plants: Monocots and Dicots

There are two types of flowering plants: monocots and dicots. The main difference is the structure of the cotyledon. A **cotyledon** (kot-uhl-EED-un) is a tiny “seed leaf” that emerges first from the seed as the embryo develops. The cotyledon absorbs nutrients for the embryo until the true leaves form.

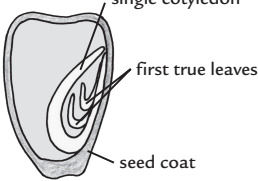
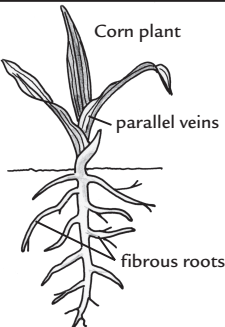

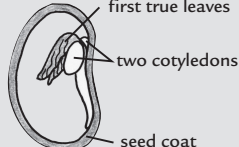
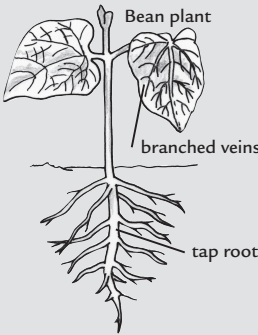
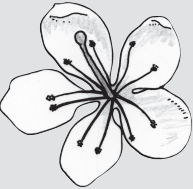
	Seed	Plant	Flower
Monocot	<p>Corn seed</p>  <p>single cotyledon first true leaves seed coat</p>	<p>Corn plant</p>  <p>parallel veins fibrous roots</p>	<p>Lily flower</p>  <p>flower parts in multiples of three</p>
Dicot	<p>Bean seed</p>  <p>first true leaves two cotyledons seed coat</p>	<p>Bean plant</p>  <p>branched veins tap root</p>	<p>Cherry blossom</p>  <p>flower parts in multiples of five</p>

Table 3 below shows some other differences between monocots and dicots.

Table 3: Monocots and Dicots	
Monocots (Example: Corn)	Dicots (Example: Bean)
Embryo has single cotyledon	Embryo has two cotyledons
Flower parts are in multiples of three	Flower parts are in multiples of four or five
Major leaf veins are parallel	Major leaf veins are branched

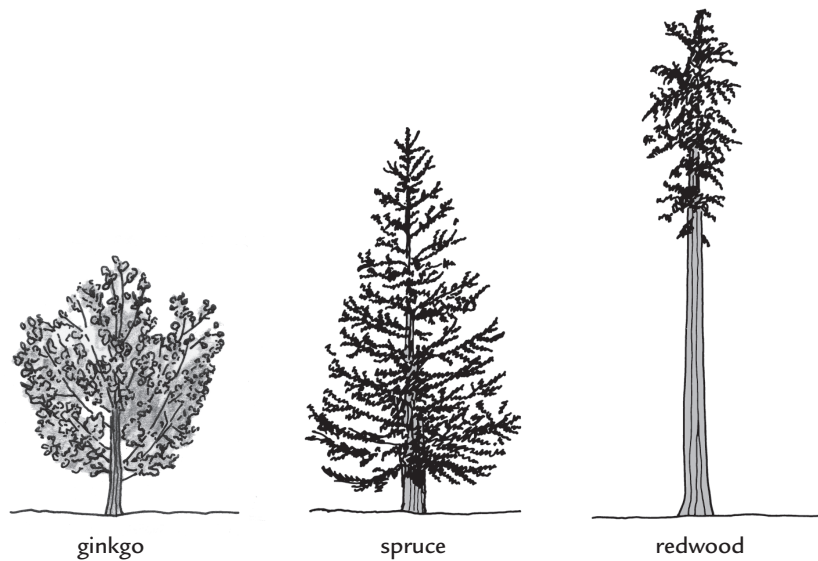
STOPPING TO THINK 4

Describe three differences between monocots and dicots.

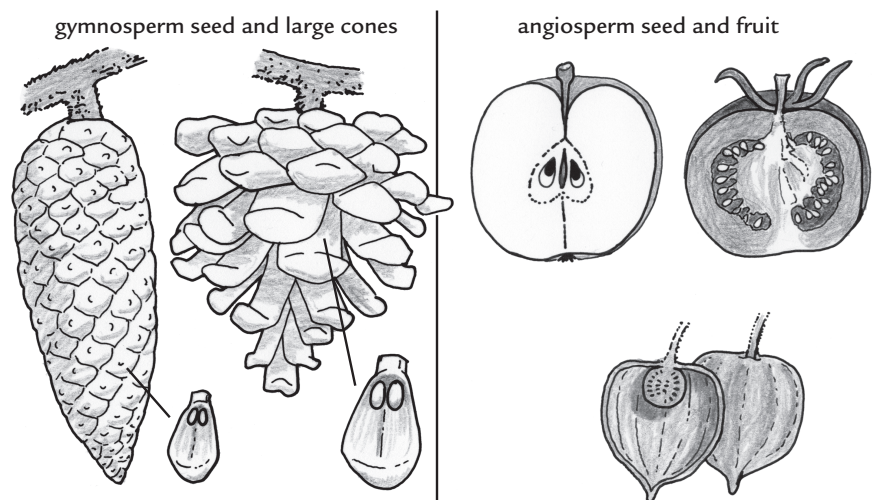
Gymnosperms (cone-bearing plants)

The term **gymnosperm** comes from a Greek word meaning “naked seed.” The term refers to the seeds that form naked on the scales of cones. Examples of gymnosperms are pines, spruces, and ginkgoes. Humans use gymnosperms for various purposes such as construction

of houses and buildings, and for making products such as soap, paints, and perfumes.



Gymnosperms have cones and do not have flowers or produce fruit around the seed. This is why the seeds are referred to as naked seeds. The male pollen grains develop in small cones. The female cells develop in the ovules in large cones.



STOPPING TO THINK 5

What are the reproductive structures in gymnosperms?

Just as in flowering plants, the pollen grains fertilize the cells in the ovule. After fertilization, the seed is formed. Once the seed is released from the cone scale, it travels in the wind until it drops to the ground. If the seed lands in a nutrient-rich place, it will germinate into a seedling. The seedling will grow into a new tree.

EXTENSION 1

Germinate seeds of corn (a monocot) and beans (a dicot) and compare their early development.

EXTENSION 2

Dissect a complete flower. Identify the following structures:

- Stamen • Anther
- Pollen • Ovary
- Ovule

ANALYSIS

1. Compare the development of amphibians and insects.
 - a. Describe the *similarities* between the life cycles of these two groups of organisms.
 - b. Describe the *differences* between the life cycles of these two groups of organisms.
2. The process of fertilization in reptiles, birds, and mammals results in the development of an egg.
 - a. Describe how the process of fertilization and the resulting egg is similar for these three groups of organisms.
 - b. Describe how the process of fertilization and the resulting egg is different for these three groups of organisms.
3. In animal development,
 - a. Which groups of organisms produce young that look very similar to adults?

- b. Which groups of organisms produce young that look very different from adults?
 - c. For each group of organisms in your answer to b, describe the stages of young that look different than adults.
4. Copy the following table in your notebook. Then, complete the table with the following:

Structure	Angiosperms (Flowering Plants)	Gymnosperms (Cone-bearing plants)	Function
Flower			
Cone			
Pollen grains containing sperm			
Embryo			
Seed			
Fruit			

- Mark with an “X” which structures are found in flowering plants and gymnosperms in the appropriate column
- Write the function of each structure in the last column

