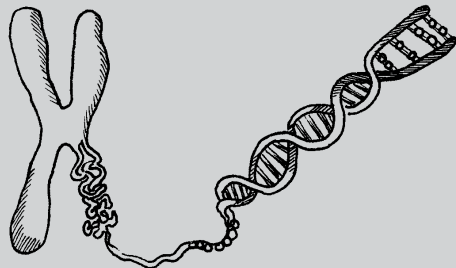


FOCUS
ON
SCIENCE

Reproduction and Inheritance

Advanced Level



Life Science
Reproduction, Heredity, and Evolution

FOCUScurriculum

Reproduction and Inheritance

Scientific Inquiry

The central purpose of scientific inquiry is to develop explanations of natural phenomena in a continuing, creative process.

Represent, present, and defend their proposed explanations of everyday observations so that they can be understood and assessed by others.

Life Science

The continuity of life is sustained through reproduction and inheritance.

Some organisms reproduce asexually. Other organisms reproduce sexually. Some organisms can reproduce both sexually and asexually.

There are many methods of asexual reproduction, including division of a cell into two cells, or separation of part of an animal or plant from the parent, resulting in the growth of another individual.

Methods of sexual reproduction depend upon the species. All methods involve the merging of sex cells to begin the development of a new individual. In many species, including plants and humans, eggs and sperm are produced.

Fertilization and/or development in organisms may be internal or external.

The male sex cell is the sperm. The female sex cell is the egg. The fertilization of an egg by a sperm results in a fertilized egg.

In sexual reproduction, sperm and egg each carry one-half of the genetic information for the new individual. Therefore, the fertilized egg contains genetic information from each parent.

In humans, the fertilized egg grows into tissue which develops into organs and organ systems before birth.

Another type of cell division accounts for the production of egg and sperm cells in sexually reproducing organisms. The eggs and sperm resulting from this type of cell division contain one-half of the hereditary information.

English Language Arts

The following is a selective listing of the competencies and indicators addressed in this book.

Word Recognition

- Use word recognition skills and strategies quickly, accurately, and automatically when decoding unfamiliar words

Background Knowledge and Vocabulary Development

- Use self-monitoring strategies to identify specific vocabulary difficulties that disrupt comprehension, and employ an efficient course of action, such as using a known word base or a resource such as a glossary to resolve the difficulty

Comprehension Strategies

- Use a variety of strategies (e.g., summarizing, forming questions, visualizing, and making connections) to support understanding of texts read



Reproduction and Inheritance

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How to Help Your Students Make the Best Use of This Book

Encourage students to develop nonfiction literacy skills by completing the Active Reader activities. Also encourage them to . . .

- Underline main ideas in paragraphs.
- Circle details that support the main ideas.
- Write down questions as they read.
- Circle key words as well as unfamiliar words.

Printing Instructions

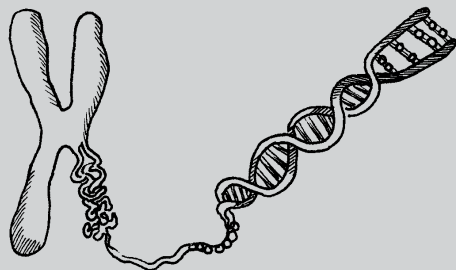
Student Book: print pages 5–28

Assessments: print pages 29–32

Answer Key: print pages 33–36

**FOCUS
ON
SCIENCE**

Reproduction and Inheritance



**How does life on Earth
continue to adapt in response
to environmental change?**

If you have siblings—brothers or sisters—you have probably heard other family members make comparisons like these:

“Jamal is going to be tall like his grandfather.”

“Amy is just like Aunt Jane. She’s usually shy, but comes alive when she plays the piano.”

Where do we get such characteristics as our height, our eye color, and our musical talent? Just like all living things, we inherit these characteristics from our ancestors, family members who came before us.

In the same way, we will pass on some of these characteristics to our children and grandchildren.

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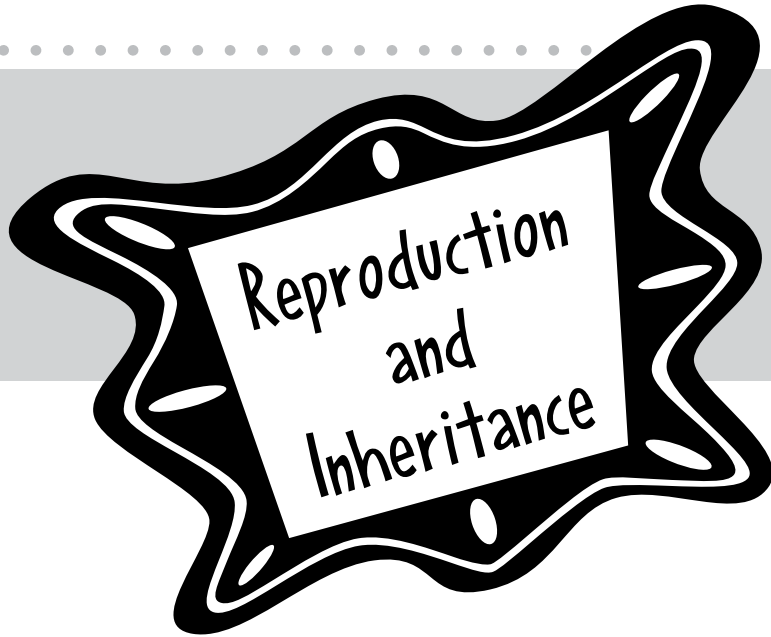


Table of Contents

Starting Points

Build Background	8
Key Vocabulary	9
Key Concepts	10

Chapter 1 Reproduction

The Continuation of the Species	12
Asexual Reproduction	14
Sexual Reproduction	16
Stop and Think	19

Chapter 2 Inheritance

Parents and Their Offspring	20
Adaptation Over Time	21
<i>Hands On Science: All in the Family</i>	23
Adaptation and Asexual Reproduction	24
Natural and Artificial Selection	25
Stop and Think	26
Glossary	27
Assessments	29
Answer Key	33



Build Background

Use Your Knowledge

Biodiversity means biological diversity—the wide variety of living things on Earth. As you know, the continued existence of life on Earth depends on maintaining this variety. Explore what you know about the similarities and differences among living things. Read the passage then do the activity that follows.

How diverse and varied are the organisms that inhabit Earth? So far, ecologists have identified about 1.7 million different species. There are almost a million different insects, a quarter million different plants, and more than 4,000 different mammals. Populations of these organisms live in communities in varied habitats and ecosystems around the world. Many different types of organisms inhabit Earth. They can be as different as a mushroom, a jellyfish, and an elephant. But they are also alike in many ways.

Below are three organisms you might see in your backyard. Think about their physical and behavioral characteristics. List some ways they are alike and ways they are different.



Similarities

Differences



Key Vocabulary

Rate Your Knowledge

The words listed below have to do with reproduction and inheritance. Some of them may be new to you. Rate your knowledge of each by putting a check or a few words in the appropriate column. After completing this book, come back to this page and write the definitions of words you did not know.

	I don't know it.	I've seen it, but I'm not sure what it means . . .	I know it well. It means . . .
biogenesis			
binary fission			
budding			
DNA			
fertilization			
gametes			
genes			
mimicry			
parthenogenesis			
runners			
trait			
vegetative propagation			
zygote			



Key Concepts

The Diversity of Life

People have pondered for centuries the question of where Earth’s diversity of life comes from. Many used to believe that life could arise from non-living matter. For example, when people found maggots on rotting meat, they thought that the maggots had formed naturally out of the meat itself. They figured that worms came from the earth itself. And when they saw that fish appeared in ponds that had previously dried up, they assumed that the mud at the bottom of the pond had given rise to the fish. A theory, called spontaneous generation, was developed as a way to explain where new life came from.

Francesco Redi, an Italian scientist and poet who lived in the seventeenth century, was the first to study the question of spontaneous generation scientifically. He designed a series of experiments that showed that maggots came from the eggs of living flies that landed on the rotting meat, not from the meat itself. Redi’s work leads to another important idea about life, the theory of **biogenesis**. This theory states that living things come only from other living things.



Some plants, like this star cactus, develop flowers that smell like rotting meat to attract flies. Flies lay their eggs on the flowers, maggots hatch, turn into adult flies, and spread the plant’s pollen.

ACTIVE READER

1 Extend From which two words was the term biogenesis made? What is the meaning of each?

Good to Know

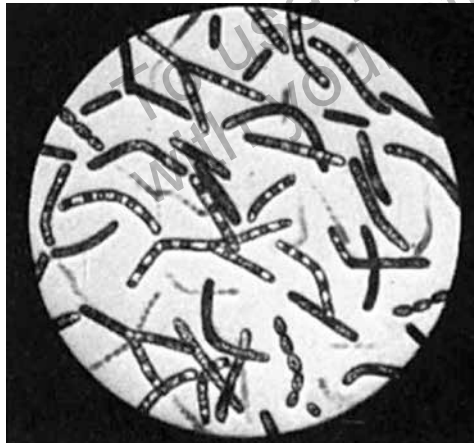
The relationship between flies and star cacti is called a commensal relationship because both organisms benefit. The fly gets a good safe place to lay its eggs, and the Star Cactus gets a way to spread its pollen.

Starting Points

Key Concepts *continued*

Life on today's Earth takes many forms. Look around you and you'll see tiny insects, towering trees, beautiful flowering plants, feathered birds, scaly fish, and hairy mammals such as deer, raccoons, and beaver. Look a little closer and you'll discover everything from weird-looking jellyfish to creepy-crawly centipedes to flesh-eating bacteria. However, the fossil record shows that life forms in Earth's past were sometimes very different from those with which we are familiar. Life has existed on this planet for more than 3.5 billion years. The first organisms to populate the planet were single-celled creatures floating in the sea. Since those early days, life forms have changed, evolved, and proliferated.

The environment in which we live is inhabited by living and non-living things. What do the great variety of living things around us have in common? How are they different from non-living things? First, they respond to their environment. They move. Chemical reactions within their bodies maintain their lives. They have a life span: they are born, they grow and develop, and they die. They reproduce and pass on traits to their offspring.



Scientists think that the first living thing on Earth was a single-celled organisms like the bacteria on the left. Today's world is filled with a great diversity of species, like the grasshopper on the right.

ACTIVE READER

1 Extend List some non-living things that living things depend on to stay alive.

Good to Know

Scientists used to think that almost all single-celled creatures were microscopic. Only a few types of large bacteria could be seen by the naked eye. But recently, a single-celled ocean creature has been discovered that grows to a width of 10 centimeters or more. It's called *Syringammina fragilissima*, which means "very fragile sand pipe." Others call it a living beach ball because of the way it looks underwater.

Chapter 1 Reproduction

FOCUS

The underlined sentences provide important ideas about reproduction. As you read this section, look for information about the two ways living things reproduce.

The Continuation of the Species

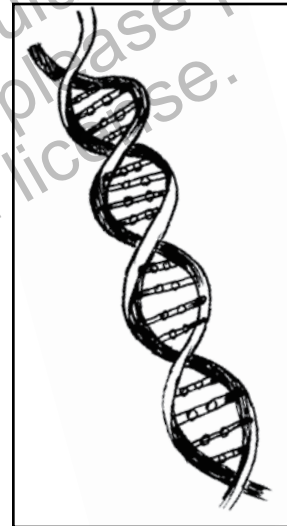
All living things have a limited life span. Since individuals don't live forever, the various species of plants, animals, and other life forms have developed strategies that allow their species to continue. If new individuals do not replace older individuals in a species, extinction will result."

Reproduction is the process by which living things give rise to the same type of living things. There are basically two reproductive strategies: asexual reproduction and sexual reproduction. All living things employ at least one of these strategies; some species employ both.

During reproduction, organisms pass on certain characteristics to their offspring. Another word for the characteristics of an organism is **trait**. These traits are encoded in genetic material within each cell. This material is a long molecule called deoxyribonucleic acid, or **DNA**. The DNA molecule is built from short segments, called **genes**, each of which contains a chemical code that governs a specific trait or characteristic.

There are millions of different types of organisms on Earth, ranging in size from single-celled bacteria to the huge blue whale. At the beginning of their history on Earth, single-celled creatures developed a way of reproducing by splitting into two cells, called **binary fission**. Each new cell is an exact copy of the original and contains all the same structures and genetic information that the original cell contained.

Many single-celled organisms still employ this form of asexual reproduction today. Asexual reproduction is a good way for these one-celled creatures to take advantage of favorable surroundings and populate a habitat quickly.



This segment of a DNA molecule is a gene that governs a specific trait. It looks like a twisted ladder.

ACTIVE READER

1 Identify According to the information on this page, what is one way single-celled creatures reproduce asexually?

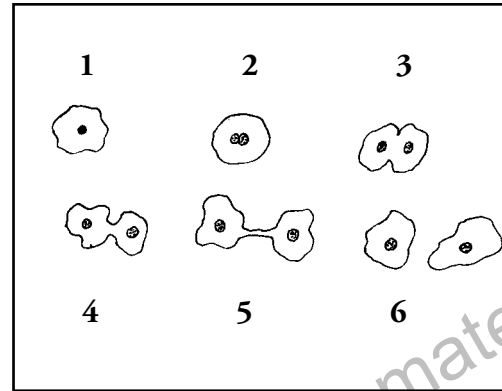


Search for and watch a video showing binary fission in a single-celled organism. Write a few sentences describing the process you observe.

The drawing at the right shows how an amoeba reproduces using binary fission. An amoeba's genetic material is contained in its nucleus.

The organism first stops moving and becomes round. The nucleus begins to split and then the body of the organism splits creating two organisms each with its own nucleus.

In sexual reproduction, special cells from two parents combine to form a new organism that inherits genes from each parent. Unlike asexual reproduction, sexual reproduction results in offspring that are genetically different from either of their parents. They inherit some traits from one parent and some from the other.



The process of binary fission produces two individuals from one.

ACTIVE READER

1 Identify Underline the sentence that explains where genetic material is contained in a single-celled organism like an amoeba.

FOCUS QUESTIONS

1. What is genetic material made of?

2. What will happen to a species if the reproductive cycle for the species is stopped?

FOCUS

Read this section to find out more about asexual reproduction. Look for the different ways asexual reproduction can occur.

Asexual Reproduction

Asexual reproduction is a strategy used by many different types of living things. Bacteria, yeasts, some plants, such as African violets, and some other invertebrate animals employ this strategy for reproduction. Sea stars, for example, use asexual reproduction to pass on traits to their offspring.

Asexual reproduction can happen in several ways. For example, prokaryotes are simple single-celled creatures that lack an organized cell nucleus. Prokaryotes reproduce by binary fission, much the way amoebas do, although amoebas have an organized cell nucleus. During binary fission, the cell grows in volume over its entire surface. Its DNA molecule replicates itself. Finally, it divides in half to yield two identical daughter cells, each of which can continue to grow at the same rate as the parent cell.

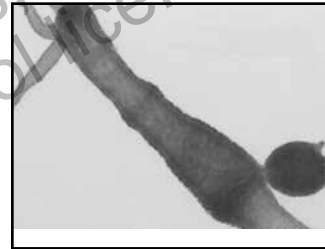
Sea stars reproduce asexually in a different way. They have five arms that radiate from a central body. They can actually release an arm, which will then grow into a complete adult sea star. A new arm will then regenerate on the body of the parent.

Hydra are small creatures that live in fresh water. They have a tubelike body and a crown of tentacles. Hydra reproduce by **budding**. A small bud forms at a point on the cell wall and grows until it splits off. This bud then grows into a new adult hydra. In this way, the mother cell lives on, and a new daughter cell is created.

Geraniums and African violets grow new plants from part of a stem, root, or leaf of a single parent. This is called **vegetative propagation**. If you put a leaf from a geranium into the soil, roots will grow to form a new plant.



starfish regrowing
a lost limb



hydra budding

ACTIVE READER

1 Identify Underline the sentence that lists different organisms that employ asexual reproduction.

2 Question A question about asexual reproduction I still need to answer is . . .

Some plants have special structures that, like buds, are responsible for the propagation of new individuals. The eye of a potato is essentially a bud that will sprout a new potato plant that is identical to its parent plant. Strawberry plants send out **runners**, stem-like structures from which new plants grow.

Sometimes even large multi-cellular animals use asexual reproduction. Termites, female sharks, and komodo dragons have this ability. They use a process called **parthenogenesis**, in which a genetically identical offspring is created from the egg cells of the mother.

One of the advantages of asexual reproduction is that species who use it are more efficient at making more offspring. Each individual can reproduce. It doesn't take a male and female, as it does in sexual reproduction. Genes are not combined so that a new individual receives some traits from each parent. All traits are passed on from the parent without alteration.



New potato plants sprout from eyes.



Strawberry plants send out runners.

FOCUS QUESTIONS

1. **Prokaryotes and amoebas are single-celled organisms that reproduce asexually. How is a prokaryote different from an amoeba?**

2. **What are two techniques for asexual reproduction besides binary fission?**

ACTIVE READER

1 Infer Is an organism born by way of parthenogenesis a male or a female? How do you know?

2 Analyze Which paragraph(s) on this page summarize or describe?

1 2 3

Which paragraph(s) on this page explain importance or significance?

1 2 3

FOCUS

Read this section about sexual reproduction to learn the differences between DNA, genes, and chromosomes.

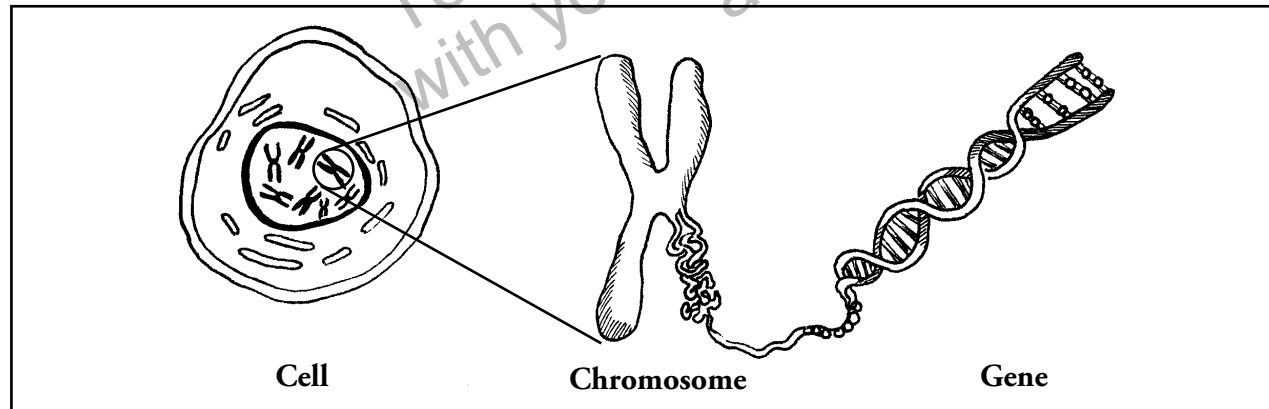
Sexual Reproduction

You have learned that sea stars can reproduce asexually. If a piece of one of a sea star's arms falls off, it can grow into a new sea star. But sea stars can also reproduce sexually. Both the male and female of the species produce special cells that are responsible for reproduction. These cells are called **gametes**. A gamete is a cell that has the ability to fuse with another cell during **fertilization**.

Genetic Information

Cells contain genetic information. Every cell in the body contains all the information the individual needs to grow and mature into a complete member of its species. This information is encoded in a molecule called DNA (deoxyribonucleic acid). A DNA molecule is long and twisty. A gene is a distinct portion of the DNA molecule, one that contains the instructions for a specific trait. Genes are packed in bundles called **chromosomes**. Humans have 23 pairs of chromosomes, for a total of 46.

Of all the cells in an individual's body, gametes are unusual. Instead of containing all of the chromosomes found in other cells, gametes contain only half the chromosomes.



Chromosomes contain the long, twisty DNA molecule that consists of genes linked together.

ACTIVE READER

1 Identify Underline the sentence that best states the main idea of the second paragraph.

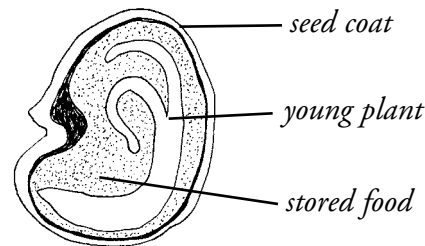
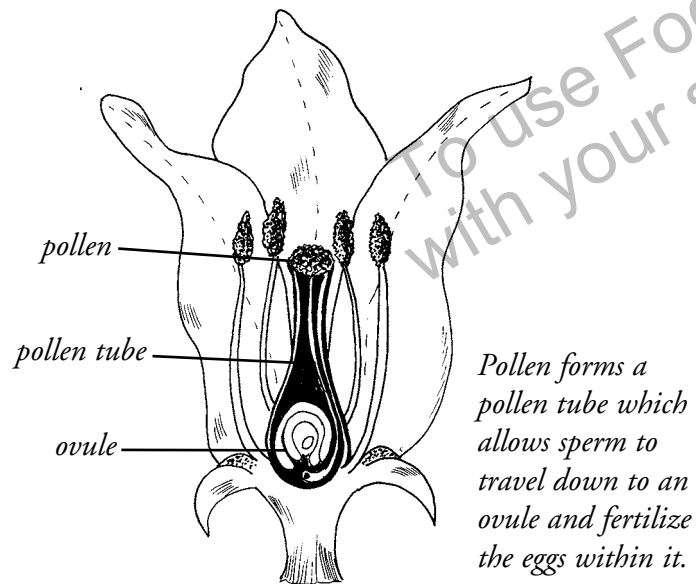
2 Explain What makes a gamete different from other cells in the body?

Gamete + Gamete = Zygote

The female gamete is the egg. The female's eggs are fertilized by the male gamete, or sperm. Egg and sperm fuse to create a **zygote**, a cell that has a complete set of genetic information. Half comes from the male and half from the female. Now the cell can start to divide. It divides over and over until it develops, eventually, into a new individual capable of creating its own gametes.

Gametes are created through a complicated process called meiosis in which the number of chromosomes in a cell is cut in half. During this process, some interesting and important things happen. Sometimes, a gene is altered during meiosis. This means that the new individual who develops from the zygote after fertilization will have some genes that are slightly different from its parent's genes. The new individual will be a lot like its parents, but different in some ways.

Seed plants reproduce sexually. The reproductive structures are called cones or flowers. Female cone and flower parts contain ovules. Male cone and flower parts produce pollen. Ovules contain structures that develop into eggs. Pollen contains structures that develop into sperm. A zygote forms when sperm fertilizes an egg. After fertilization, the ovule becomes a seed.



The fertilized ovule becomes a seed.

ACTIVE READER

1 Explain Explain in your own words what happens during fertilization to create a zygote.

Because genes can be altered spontaneously and randomly during meiosis, those species that reproduce sexually have an advantage in the fight for survival. The advantage is that new traits can evolve that never existed in the species before. Parents who survive get to pass on their genes and their traits to their offspring. But, if the environment changes, or something else threatens the species with extinction, there are likely to be a few members of the species around with just the right new traits needed to handle the threat. Those individuals will survive and live on to pass on their genes to their offspring.



Climate change could spell disaster for the polar bear unless some members of the species have the traits they need to adapt to the new environment.

ACTIVE READER

1 Recall *What is the difference between a gamete and a zygote?*

FOCUS QUESTIONS

1. Which word or phrase means the same or almost the same as zygote?

- (1) trait
- (2) gamete
- (3) fertilized egg
- (4) vegetative propagation

2. How many chromosomes do human cells have? _____

Stop and Think

This page will help sum up what you have read so far.

1. Which list is arranged from smallest to largest?

- (1) chromosome, gene, egg cell, zygote
- (2) egg cell, gene, chromosome, zygote
- (3) zygote, gene, egg cell, chromosome
- (4) gene, chromosome, egg cell, zygote

2. Which of these processes results in an individual with different traits than its parents?

- (1) budding in hydra
- (2) parthenogenesis in fish
- (3) binary fission in bacteria
- (4) zygote formation in insects

3. What are the two types of gametes?

4. What happens during the formation of a zygote?

Dear Ms. Understanding,

I think I understand the differences between asexual and sexual reproduction. In asexual reproduction, one individual creates an offspring. In sexual reproduction, it takes a male and a female. And, offspring from sexual reproduction are bigger, stronger, and healthier, right?



Got It Down in Delphi

Dear Got It Down,

Well, the first part of your statement is correct, but not the second. Offspring that result from asexual reproduction can be just as big, strong, and healthy as offspring produced by sexual reproduction.



Ms. Understanding

Chapter 1 Inheritance

FOCUS

The underlined sentences below tell important ideas about heredity. Read this section to find out more about how organisms acquire their traits.

Parents and Their Offspring

The passing on of traits from parents to their offspring through asexual and sexual reproduction is called heredity. In sexual reproduction, physical traits, such as hair color and eye color, are passed on through chromosomes during the formation of the zygote. So, at a very early stage in the development of an individual, physical traits have been established and are coded by way of the individual's genes.

However, an individual's traits are also affected by the environment in which the individual develops. Height is a good example of a trait that is affected by both heredity and environment.

An individual may have tall parents and inherit the tendency to be tall. But the quality of the food that individual eats during childhood also affects his or her height.

Another example of a trait that is affected by both heredity and environment is friendliness. A person may have an inherited tendency to be talkative and interested in other people. If you are interested in others you are probably also cooperative, generous, and helpful. These are traits that often lead a person to be friendly toward others. However, life experiences may also lead a person to be shy and less likely to talk with people in a friendly way.

How an animal gets its food may depend on its environment. If food is plentiful, the animal may stake out and defend a territory. If food is scarce, the animal may travel widely to find food.

Most traits are affected by both heredity and environment. One may play a larger role than the other, but both are important in determining the traits of an individual.



Traits are affected by heredity and environment.

ACTIVE READER

1 Analyze Which best describes how paragraph 2 is organized?

- a sequence of events
- a statement followed by an example
- a list of related items
- a comparison of two things

2 Recognize Write a *G* in front of traits that might be mostly affected by genes. Write an *E* before traits that might be mostly affected by environment.

- eye color
- strength
- 20/20 vision
- weight

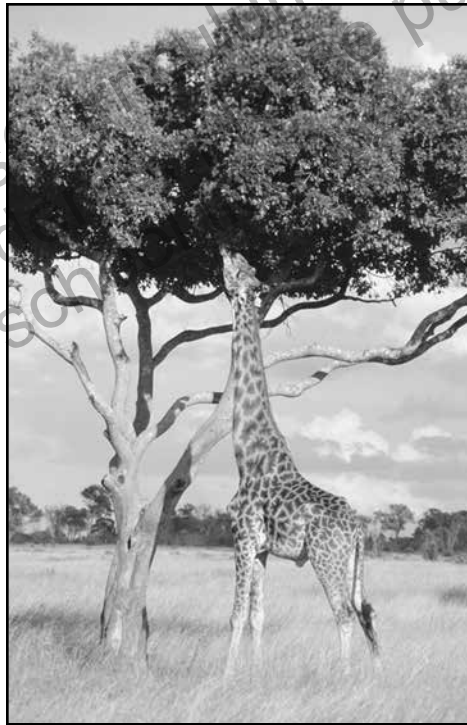
Adaptations Over Time

In Chapter 1, you read that genes can be altered during meiosis when gametes are formed. Genes can also change when DNA is not copied exactly. This second type of change is called a **mutation**. When a mutation occurs in a gamete, that mutation can be passed on to offspring. Any change in the DNA of offspring can cause new traits to appear in a population. These new traits are called variations.

Some variations are harmful, some have no effect, and some can be helpful to an organism. Helpful variations make an individual stronger in some way. They may be better at getting food or hiding from predators. They may be better able to handle a harsh climate. Because they are stronger, or more fit for their environment, their genes are more likely to be passed on to future generations of their species. In this way, a variation becomes an adaptation.

Over time, more and more offspring inherit this adaptation. Other adaptations occur within the group as they reproduce and pass on traits to even more offspring over time. Eventually a new species may evolve. Giraffes and horses, for example, both evolved from a species of animal that lived millions of years ago. Tall members of this species survived by eating the leaves at the tops of trees where others couldn't reach. Those individuals with long necks were more successful in reproducing and passing their long necks on to their offspring. Eventually, the giraffes became a separate species.

Camouflage is a good example of an adaptation that helps a species survive by protecting individuals from predators. The ability of an animal to blend into its surroundings increases its chance of survival and therefore its chance of reproducing. The giraffe's pattern of large spots helps it to blend into the background of its habitat.



Tallness in giraffes is an adaptation that allowed the species to survive.

ACTIVE READER

1 Recall *What can be the effect of a variation that is helpful to an organism?*

2 Order *Put these three in their proper sequence:*

variation
mutation
adaptation

Some animals, such as chameleons and cuttlefish, can change the way they look to match their changing surroundings. Others don't try to hide at all. They have evolved to look like another organism that is poisonous or otherwise dangerous to their predators. This type of camouflage is called **mimicry**. For example, the hawk moth caterpillar is harmless, but looks like a poisonous snake.



The appearance of the walking stick insect mimics that of a twig.



Animals have adapted to their environments in many unusual and interesting ways. Search the Web to find the most fascinating

examples. List them under headings such as these:

Adaptations for food gathering

Adaptations for reproduction

Adaptations for defense against predators

FOCUS QUESTIONS

1. How does a mutation occur?

2. Explain how a mutation in a gene can lead to an adaptation that affects an entire species.



All in the Family Do you look more like your mother, father, grandmother, or grandfather? Where do your traits come from? Fill in the chart below about yourself by circling the physical traits you have. Then choose two other family members and complete the chart about each of them. Write a sentence or two comparing your inherited traits with theirs.

Yourself	Family Member #1	Family Member #2	Comparison
curly hair	curly hair	curly hair	
straight hair	straight hair	straight hair	
hair on fingers	hair on fingers	hair on fingers	
no hair on fingers	no hair on fingers	no hair on fingers	
widow's peak	widow's peak	widow's peak	
no widow's peak	no widow's peak	no widow's peak	
can curl tongue	can curl tongue	can curl tongue	
can't curl tongue	can't curl tongue	can't curl tongue	
cleft chin	cleft chin	cleft chin	
smooth chin	smooth chin	smooth chin	
smile dimples	smile dimples	smile dimples	
no smile dimples	no smile dimples	no smile dimples	
attached earlobes	attached earlobes	attached earlobes	
free earlobes	free earlobes	free earlobes	

FOCUS

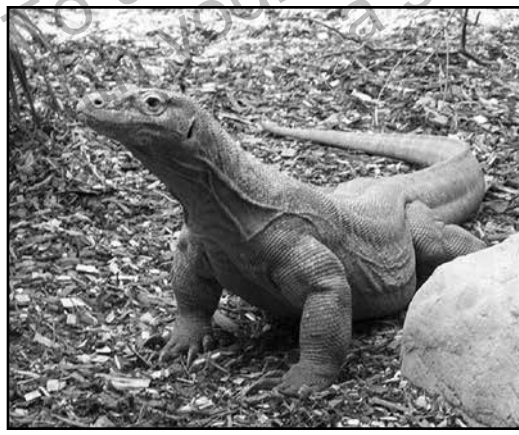
This section discusses how helpful adaptations develop in species that reproduce asexually.

Adaptation and Asexual Reproduction

Since there is no mixing of genes in organisms that reproduce asexually, adaptations don't occur in the same way as they do in sexual reproduction. Traits that are inherited come from genes that are exact copies of a single parent's. Beneficial mutations sometimes occur and lead to variations. But with asexual reproduction, it takes a long time for these genes to spread through the population. Asexual reproduction works well for species that live in a stable environment. It is a way for them to reproduce quickly and build a large population in a short period of time. Bacteria, sponges, and some plants are examples of organisms that reproduce asexually, or mostly asexually.

However, because asexual reproduction generates less genetic diversity in the population, it carries a greater risk of extinction. If all members of a species have the same genes and therefore the same traits, environmental changes, such as a new bacterial infection, could wipe them all out.

Some organisms, even large ones, can reproduce either asexually or sexually. Because of this ability, their species can benefit from the advantages both systems offer. Aphids, certain bees, some sharks, and komodo dragons are all creatures that have this ability.



What do strawberries and komodo dragons have in common? Both can reproduce sexually and asexually.

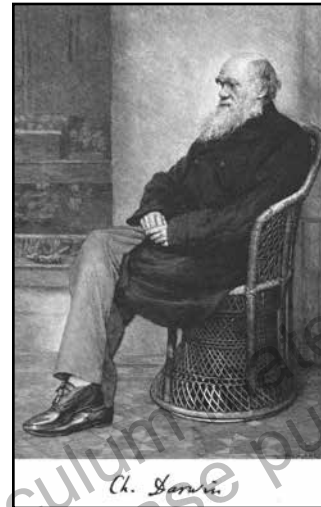
ACTIVE READER

1 Identify Underline two sentences that list examples of organisms that can reproduce asexually.

Natural and Artificial Selection

Natural selection is a theory developed by Charles Darwin in the mid-1800s by observing different types of finches on the Galapagos Islands off the coast of South America. The theory states that organisms with the traits best suited to their environment are more likely to reproduce and pass on these traits to their offspring. Natural selection is the process that drives evolution.

Artificial selection is a process used by humans to produce plants and animals that have particular traits. The many breeds of dogs, from sheepherding collies to bird-fetching retrievers to racing greyhounds, have been developed by humans who needed dogs to perform specific tasks. Similarly, the many varieties of apples, some sweet and some tart, have been developed by humans who controlled the way apple plants were allowed to reproduce.



Charles Darwin developed the theory of natural selection.

ACTIVE READER

1 Explain Give an example of a physical trait and a behavioral trait.

physical trait _____

behavioral trait _____

FOCUS QUESTIONS

1. Female hammerhead sharks usually reproduce sexually, but they can also reproduce asexually. When might this be an advantage?

2. List the terms below in sequence.

gene mutation

adaptation

new species

variation

Stop and Think

This page will help sum up what you have read so far. Keep the tip in mind as you study for tests.

Tip:

Study for tests over a few days or weeks, and continually review class material. Don't wait until the night before and try to learn everything at once.

1. Which two factors directly affect an individual's traits?

- (1) interests and education
- (2) mutations and species variation
- (3) inherited genes and environment
- (4) adaptations and natural selection

2. During which process do changes in a gene occur?

- (1) adaptation
- (2) fertilization
- (3) zygote formation
- (4) gamete formation

3. Which of the following processes drives evolution?

- (1) parthenogenesis
- (2) natural selection
- (3) sexual reproduction
- (4) asexual reproduction

Dear Ms. Understanding,

I have red hair, just like my grandfather. But my mom and dad both have dark brown hair. So whose genes did I get?



Ruddy in Rensselaer

Dear Ruddy,

Remember that your genes came from both your mom and dad. Each gene from your mom paired up with its partner gene from your dad to produce a trait in you. In humans, hair color is actually determined by a variety of genes. So your red hair was produced by combinations of many genes from both your mom and dad. So why do you share red hair with your grandfather? Remember how heredity works. The genes that your parents passed down came from their parents. So, some of the genes that caused your grandfather's red hair could also be causing yours.



Ms. Understanding

Glossary

biogenesis – the theory that states that living things come only from other living things

binary fission – a type of asexual reproduction in single-celled organisms in which the original cell splits to produce two identical daughter cells

budding – a type of asexual reproduction in which a bud forms, grows, and splits from the parent to become a new individual that is identical to the parent

DNA – deoxyribonucleic acid; a molecule found in cells that contains the genetic instructions used by all living things

fertilization – the fusion of gametes to create a zygote, which develops into a new organism

gametes – special cells that are responsible for reproduction; a cell that has the ability to fuse with another cell during fertilization.

genes – the basic unit of heredity; genes are made of DNA and act as instructions to make proteins.

mimicry – a type of camouflage in which an organism exhibits the physical traits of another organism for its protection

parthenogenesis – a type of asexual reproduction in which offspring are produced by the female from unfertilized eggs

runners – stemlike parts of certain plants, such as strawberries, that send them arching out to touch the ground several inches away and propagate an identical daughter plant

trait – a characteristic of an organism

vegetative propagation – the propagation of a new plant from a part of an existing one

zygote – a cell created by sexual reproduction from the fusion of male and female gametes; a zygote can develop into a new organism

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**FOCUS
ON
SCIENCE**

Reproduction and Inheritance

Assessments

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Check Understanding



In the Answer Document on this page, mark your answer in the row of circles for each question by filling in the circle that has the same number as the answer you have chosen.

- Which reproductive strategy spreads new adaptations through a population most quickly?
 - budding
 - binary fission
 - sexual reproduction
 - asexual reproduction
- Where is DNA found in any multi-celled organism?
 - buds
 - pollen
 - bacteria
 - cell nucleus

The reproductive success of the walking stick shown below depends in part on its camouflage. Use the picture and your knowledge of science to answer questions 3 and 4.



- What type of camouflage does the walking stick employ?

- How could camouflage enhance the walking stick's reproductive success?

Answer Document

1. ① ② ③ ④ 2. ① ② ③ ④

Check Understanding



The arctic fox in the picture at the right has thick fur on its body and between the pads of its feet. Arctic foxes are nomadic, meaning that they move from place to place rather than living in an exclusive territory.



For items 5 and 6, identify if the trait is mostly due to heredity or environment. Then explain the advantage that the trait offers the animal.

5. Trait:
Thick fur, including between the pads of the feet.

Identify:

Explain:

6. Trait:
Moves from place to place.

Identify:

Explain:

**FOCUS
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SCIENCE**

Reproduction and Inheritance

Answer Key

Answer Key

Page 8: Starting Points:

Build Background

Use Your Knowledge: Sample answers:

Similarities: All have a body with four limbs, all are predators, all have two eyes.;

Differences: Each has a different body covering; each uses a different form of locomotion; birds live in the air, cats on the ground, and frogs in water.

Page 9: Starting Points

Key Vocabulary

Rate Your Knowledge: Answers will vary according to the student's prior knowledge.

Page 10: Starting Points

Key Concepts

Active Reader: 1. bio means life; genesis means beginning.

Page 11: Starting Points

Key Concepts

Active Reader: 1. air, water, shelter

Page 12: Chapter 1

Active Reader: 1. binary fission

Page 13: Chapter 1

Active Reader: 1. In the first paragraph, underline: An amoeba's genetic material is contained in its nucleus.

Focus Questions: 1. DNA; 2. Extinction will result.

Page 14: Chapter 1

Active Reader: 1. In the first paragraph, underline: Bacteria, yeasts, some plants, such as African violets, and some other invertebrate animals employ this strategy for reproduction.; 2. Responses will vary depending on the students' questions.

Page 15: Chapter 1

Active Reader: 1. An organism born by parthenogenesis is female because it is a clone of its parent, which is always a female.; 2. Paragraphs 1, 2, and 3 summarize or describe; paragraph 3 explains importance or significance.

Focus Questions: 1. A prokaryote doesn't have a well-formed nucleus.; 2. budding, vegetative propagation, sending out runners, parthenogenesis

Page 16: Chapter 1

Active Reader: 1. Underline: Cells contain genetic information; 2. Gametes contain only half the chromosomes of other cells.

Page 17: Chapter 1

Active Reader: 1. Sample answer: During fertilization, gametes join together, or fuse, to create a cell that has a complete set of chromosomes.

Page 18: Chapter 1

Active Reader: 1. A gamete is a male or female cell, a zygote is a fusion of two gametes, one male and the other female.; Focus Questions: 1. (3); 2. 46

Page 19: Chapter 1

Stop and Think: 1. (4); 2. (3); 3. There are two types of gametes: male and female.; 4. During fertilization they fuse to create a cell with a complete set of chromosomes that can develop into an adult organism.

Page 20: Chapter 2

Active Reader: 1. statement followed by example; 2. G-hair color; E-strength; G-20/20 vision; E-weight

Page 21: Chapter 2

Active Reader: 1. A helpful variation in an individual can develop into an adaptation across the entire species.; 2. mutation, variation, adaptation

Page 22: Chapter 2

Focus Questions: 1. Mutations occur when DNA is not copied exactly during the formation of a new cell.; 2. If a gene mutation occurs in a gamete, and it leads to a helpful trait in offspring, then that offspring will have a better chance of passing on the gene to its offspring. The more offspring who receive this helpful gene, the more widespread throughout the population the trait will become. Eventually, all individuals who are members of the species will have this gene and the associated trait.

Page 23: Chapter 2

Hands On Science: All in the Family: 1. Responses will vary.

Answer Key

Page 24: Chapter 2

Active Reader: 1. Underline these two sentences: Bacteria, sponges, and some plants are examples of organisms that reproduce asexually, or mostly asexually. Aphids, certain bees, some sharks, and komodo dragons are all creatures that have this ability.

Focus Questions: 1. This could be an advantage if there are no males around.;

2. gene mutation, variation, adaptation, new species

Page 25: Chapter 2

Active Reader: 1. Examples: Physical traits: hair color, eye color; Behavioral traits: fidgets, shy around new people

Focus Questions: 1. This could be an advantage if there are no males around.; 2. gene mutation, variation, adaptation, new species

Page 26: Chapter 2

Stop and Think: 1. (3); 2. (4); 3. (2)

Page 31: Assessments

Check Understanding 1. (3); 2. (4);

3. mimicry 4. The walking stick is very hard for its predators to detect because it blends so well with its background. It looks just like an unappetizing stick. In this way, it is likely to live longer and have a chance to reproduce.

Page 32: Assessments

Check Understanding 5. Thick fur, including between the pads of the feet is mostly due to genes. It keeps the animal warm in a harsh environment and helps it walk on slippery ice and snow. 6. Moving from place to place is mostly an environmentally-determined trait. It helps the animal by giving it a larger area to find food, which is scarce.

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