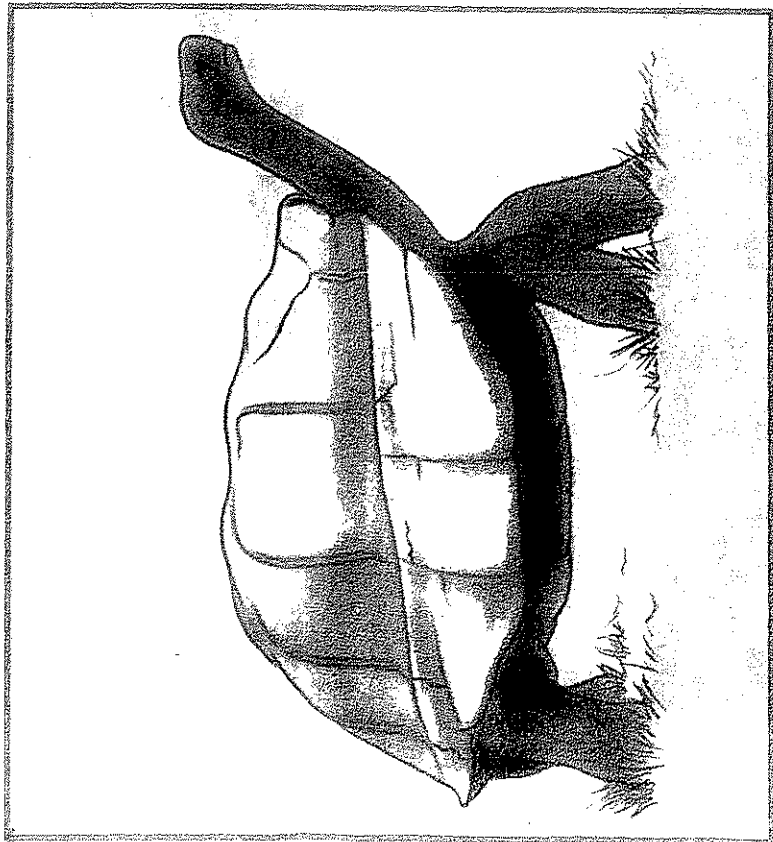


What is natural selection?



KEY TERMS

fossils remain objects or impressions of organisms that have become extinct over time
evolution a process by which organisms change over time
natural selection a way that organisms best adapted to their

LESSON | What is natural selection? 10

Have you ever visited a natural history museum? If you have, you probably saw some **fossils**. Fossils are the remains of organisms that lived in the past.

Until the 19th century, most scientists believed that organisms had not changed since the time they first appeared on the earth. However, by the late 1700s, scientists had found and studied many fossils. Fossils show interesting things about living things.

Fossils show that organisms have changed. They show that the earliest living things on the earth were simple organisms. In the billions of years that passed, living things became more complex.

Fossils show that many **species**, or kinds of organisms, died out. These organisms are **extinct**.

Most scientists believe that new species develop from old species as a result of gradual change or **evolution** (ev-ah-LOO-shun). Evolution is the process by which organisms change over time.

How and why have living things changed? Different theories of evolution have been given over the years. However, over 100 years ago, an English biologist named Charles Darwin suggested a theory of evolution. Darwin's theory is accepted by most scientists today.

DARWIN'S THEORY OF EVOLUTION

According to Darwin's theory:

1. **OVERREPRODUCTION** Organisms produce more offspring than the environment can support. There is not enough food or living space for all of the offspring.

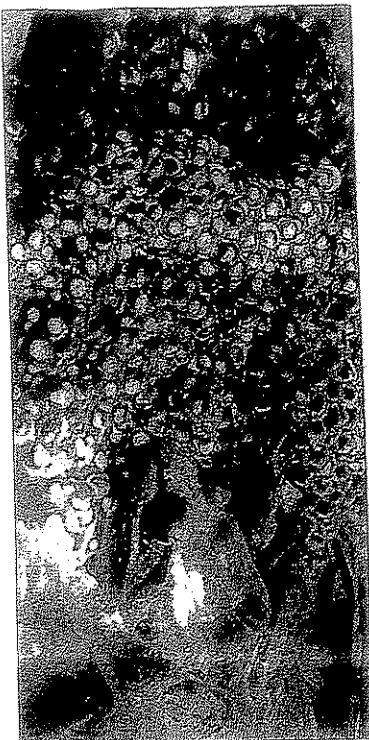


Figure A

2. **COMPETITION** Overproduction leads to a struggle. All the organisms compete for food, water, and the other necessities of life. Only those organisms that are well suited to their surroundings survive and reproduce. The rest die.



Figure B

3. **VARIATIONS** Organisms of the same species are very similar. But they do have individual differences among traits, or variations. These differences are important in the "struggle for survival." For example, extra speed can mean the difference between life and death. A fast wildebeest may escape an attacking lion. A slower neighbor may become the lion's next meal.

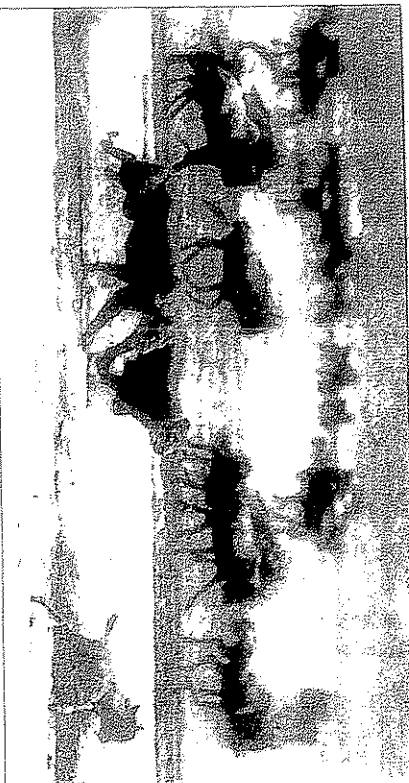


Figure C

4. **SURVIVAL OF THE FIT** Organisms with traits that make them well adapted, or suited to the environment, survive and reproduce. Darwin used the term natural selection to describe the survival of organisms with favorable traits. They, in turn, pass their favorable traits to their offspring. The offspring are then more likely to survive. As the process of natural selection goes on over many generations, species change. These changes can result in the appearance of a new species. Evolution by natural selection occurs.

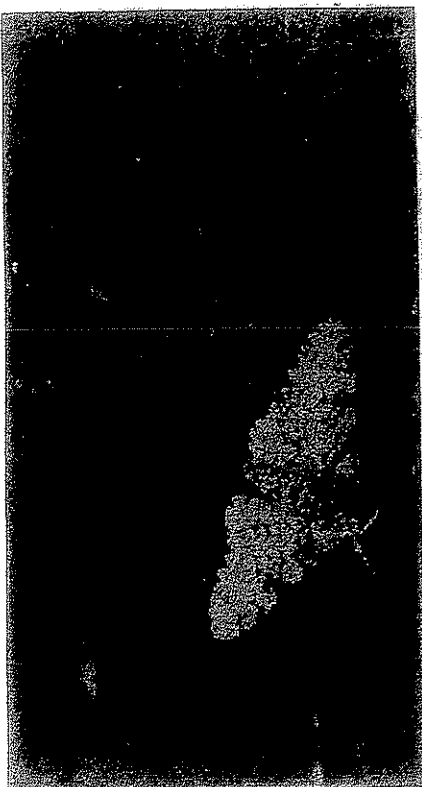


Figure D

UNDERSTANDING THE THEORY OF NATURAL SELECTION

Study the diagrams. Then answer the questions.

1. According to Darwin, did all ancient giraffes have long necks?

2. _____-necked giraffes were better able to reach food far off the ground.

3. _____-necked giraffes were better suited to the environment.

4. The _____-necked giraffes died out.

5. Which giraffes survived and reproduced?

The _____-necked giraffes.

6. What important adaptation did the surviving giraffes pass on to their offspring?

7. Describe the necks of all giraffes living today (HINT: One word will do).

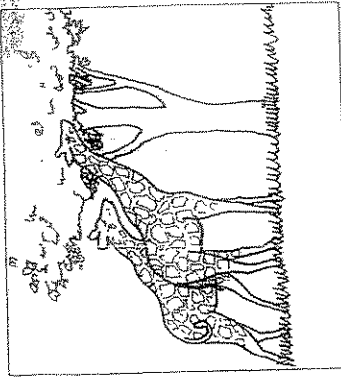


Figure E

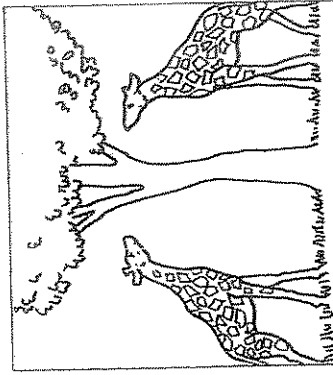


Figure F

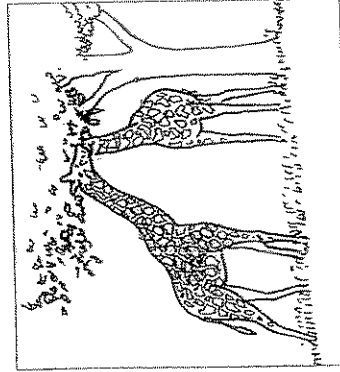


Figure G

FILL IN THE BLANK

Complete each statement using a term or terms from the list below. Write your answers in the spaces provided.

changing
Charles Darwin
variations
extinct

favorable
adapted
different
reproduce

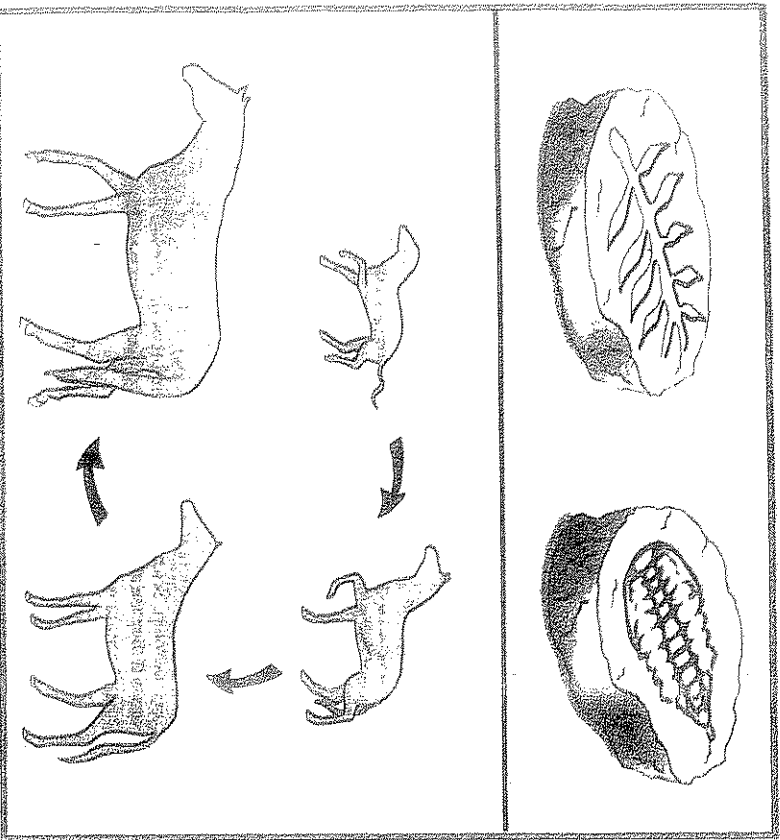
organisms
competition
limited number

1. An organism that is suited to its environment is said to be _____ to its surroundings.
2. Earth is always _____.
3. As the earth changes, the _____ that live on it also change.
4. A species that does not change as its environment changes may become _____.
5. The scientist who developed an important theory of evolution was _____.

ACCORDING TO DARWIN:

6. A favorable environment can support only a _____ of organisms.
7. Overproduction leads to _____.
8. Organisms belonging to the same species can have _____ traits.
9. Differences among traits are called _____.
10. Organisms that are adapted to their environment _____ and pass their _____ traits on to their offspring.

What evidence supports evolution?



KEY TERMS
anatomy / study of the parts or structures of living things
vestigial structures / body parts that are believed to have lost their original function

LESSON | What evidence supports

11 | evolution?

Imagine that you were a “spy” looking for clues to support evolution. Where would you look? There is evidence for evolution from the following different areas:

FOSSIL EVIDENCE Fossils are the remains, or traces, of organisms that lived long ago. The fossil record shows that organisms have changed over time. It shows that the earliest organisms were simple living things. They lived in water. Fossils show that these organisms evolved into more complex organisms over millions of years.

ANATOMY The study of the parts, or structures, of living things is called anatomy [uh-NAY-uh-nee]. By studying the parts of living things, we can find out how closely related they are. For example, the bones of a bat’s wing and a human hand are similar. This suggests the animals are related.

Can you wiggle your ears? It’s always good for a laugh, but nothing else, at least for modern humans. Ear movements are controlled by muscles. Human ear muscles are considered **vestigial** [ves-TIJ-ee-uhl] structures. Vestigial structures are “left overs.” They are usually reduced in size and serve no function. Scientists think vestigial structures had a function in the ancestors of the animals that now have them. Almost all animals have vestigial structures. Humans have more than 100. The appendix is another human vestigial structure.

EMBRYOLOGY An embryo is an organism in its very early stages of development before it is born. Embryology is the study of embryos as they develop. Scientists compare the embryos of different living things to see if they are alike. Organisms with similar embryos probably evolved from a common ancestor.

BIOCHEMISTRY All living things are made up of chemicals called proteins. There are many kinds of proteins. Each has its own chemical “print” or structures. Scientists can identify the chemical make-up of proteins. They have discovered that the blood of certain animals have particular kinds of proteins. They compare the blood proteins of different animals. In this way, they can tell how closely the organisms are related.

MORE ABOUT FOSSIL EVIDENCE

- Most fossils are found in layered rocks.
- Lower layers were laid down first. They are older than the layers above them.
- Fossils found in the lower layers are older than fossils found in the upper layers.

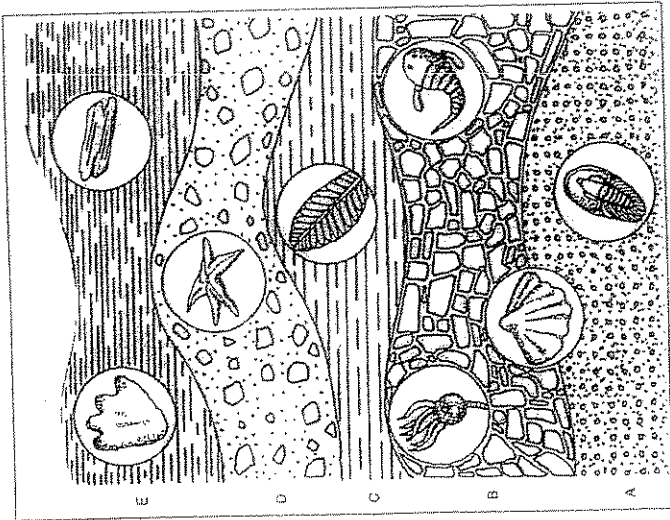


Figure A

Figure A shows five rock layers. Each contains fossils.

Study the layers and then answer the questions.

- Which rock layer is the oldest? _____
- Which rock layer is the youngest? _____
- Which layer has the oldest fossils? _____
- Which layer has the youngest fossils? _____
- Fossils found in layer C are _____ than fossils found in layers D and E.
older, younger
 - Fossils found in layer C are _____ than fossils found in A and B.
older, younger

EVOLUTION OF THE HORSE

The first horse appeared about 60 million years ago. Since that time, it has been changing. Study Figure B. What changes do you see? Fill in the correct answers.

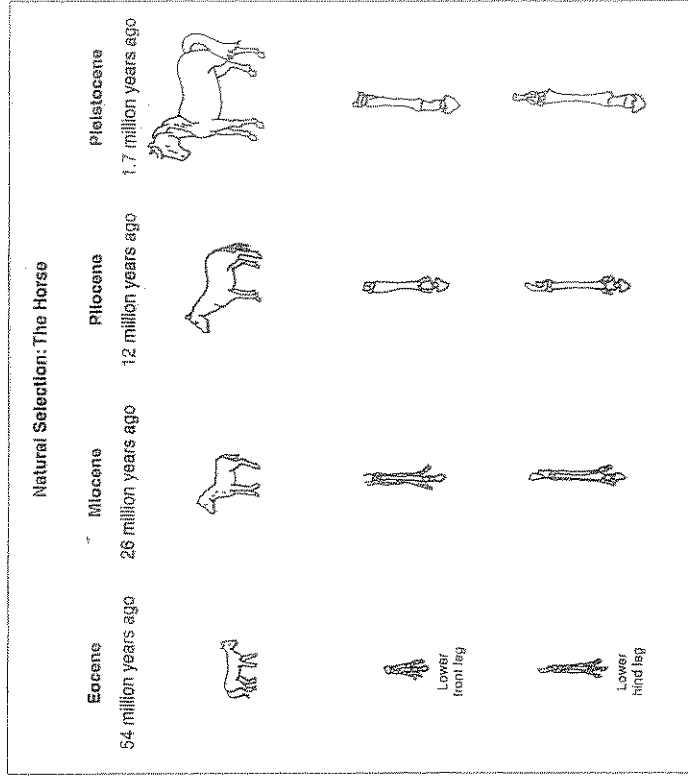


Figure B

- What happened to the size of the horse? _____
- The earliest horse had _____ toes.
one, many
- How many toes does a modern horse have? _____ What is it called?
(Use your own experience.) _____

EVIDENCE FROM ANATOMY

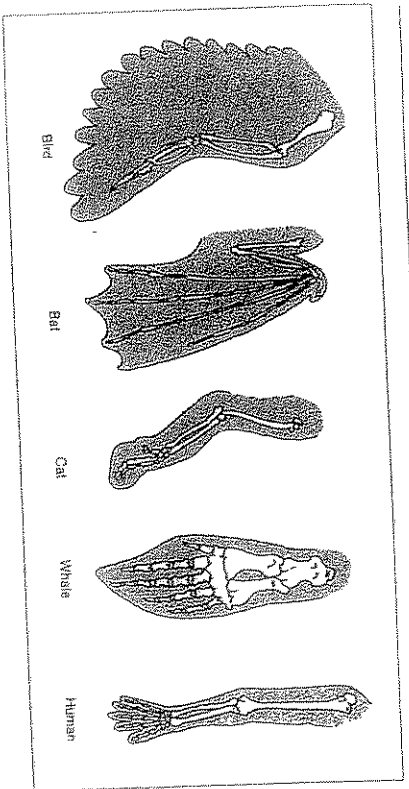


Figure C

Figure C shows the wing of a bird, the wing of a bat, the foreleg of a cat, the flipper of a whale, and the hand and arm of a human. On the outside, they look very different. Inside the bones are very similar. The bones are arranged in similar ways. They develop in much the same way.

1. Anatomy shows that these animals _____ do, do not _____ have a close ancestor.

The wings of a bird and the wings of a bat have the same function. Both are used for flying. However, their anatomy shows that their wings are very different. They develop in totally different ways.

2. Anatomy shows that birds and bees are _____ distant, close _____ relatives.
3. Birds and bees _____ did, did not _____ develop along the same evolutionary "branch."

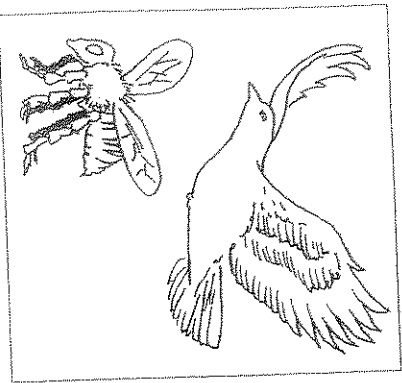


Figure D

EMBRYOLOGY

The similarity of some organisms shows that they probably evolved from a common ancestor.

Figure E shows the development of a fish, a turtle, a chicken, a pig, and a human. Study the pictures and then answer the questions.

	Fish	Turtle	Chicken	Pig	Human

TRUE OR FALSE

In the space provided, write "true" if the sentence is true. Write "false" if the sentence is false.

1. Fossils found in upper rock layers are older than fossils found in lower layers.
2. Structure means how something is used.
3. Function means how something is used.
4. Different animals with parts that have similar structure and function are probably distant relatives.
5. Embryology is the study of adult organisms.
6. Closely related embryos look more alike—and for a longer time—than embryos of distant relatives.
7. The wings of bees and birds are very similar.
8. Vestigial organs have no functions.
9. Blood proteins can show evolutionary relationships.

NOW TRY THIS

Read each statement. Indicate whether each statement uses anatomy (A), biochemistry (B), or embryology (E) as evidence of evolutionary relationships among organisms. Write the correct letter in the space provided.

1. The forelimbs of a penguin and an alligator have similar bone structures.
2. The early stages of development in a fish, a rabbit, and a gorilla look alike.
3. In the wing of a bat and the arm of a human, you find bones called the radius, humerus, and ulna.
4. Some blood proteins are found in almost all organisms.
5. The finger bones in mammals have the same structure.

FILL IN THE BLANK

Complete each statement using a term or terms from the list below. Write your answers in the spaces provided. Some words may be used more than once.

fossil
blood
four

layered
vestigial
proteins

function
development
ancestor

1. In humans, the tailbone is a _____ structure.
2. An embryo is an organism in its early stages of _____.
3. All living things have chemicals called _____.
4. The wings of birds and bats show that these organisms probably have a common _____.
5. Most fossils are found in _____ rocks.
6. Organisms with similar embryos probably evolved from a common _____.
7. The _____ of certain animals has particular kinds of proteins.
8. Vestigial structures have no _____.
9. The earliest horse had _____ toes.

REACHING OUT

The appendix is a small outgrowth at the lower part of the large intestine. In some plant-eating animals, it is much larger and is important in digestion.

Sometimes, a person's appendix becomes infected and is removed. Surgeons have removed millions of appendixes. No bad side effects have been noted after its removal.

What does this prove?

