

16.2 Ideas That Shaped Darwin's Thinking

Lesson Objectives

-  Identify the conclusions drawn by Hutton and Lyell about Earth's history.
-  Describe Lamarck's hypothesis of evolution.
-  Describe Malthus's view of population growth.
-  Explain the role of inherited variation in artificial selection.

Lesson Summary

An Ancient, Changing Earth In Darwin's day, most Europeans believed that Earth and all its life forms were only a few thousand years old and had not changed very much in that time. Several scientists who lived around the same time as Darwin began to challenge these ideas. These scientists had an important influence on the development of Darwin's theory of evolution.

- ▶ Geologists James Hutton and Charles Lyell argued that Earth is many millions of years old.
- ▶ They also argued that the processes changing Earth today, like volcanism and erosion, are the same ones that changed Earth in the past.

Knowing that Earth could change over time helped Darwin realize that species might change as well. Knowing that Earth was very old convinced Darwin that there had been enough time for life to evolve.

Lamarck's Evolutionary Hypothesis Jean-Baptiste Lamarck was one of the first scientists to propose hypotheses about how evolution occurred.

- ▶ To explain evolution, Lamarck hypothesized that all organisms have an inborn drive to become more complex and perfect. According to Lamarck, an organism could gain or lose traits during its lifetime by using or not using certain organs.
- ▶ Lamarck also hypothesized that acquired characteristics could be passed on to an organism's offspring leading to evolution of the species.

Scientists now know that most of Lamarck's ideas about evolution are incorrect. However, he correctly suggested that life is not fixed and was the first to offer a natural and scientific explanation for evolution. Further, he recognized that an organism's traits are linked to its environment.

Population Growth Thomas Malthus thought that if the human population continued to grow unchecked, it would run out of living space and food. Darwin realized that this was true of all organisms, not just humans.

Artificial Selection Plant and animal breeders in Darwin's time used a process now known as artificial selection to improve their crops and livestock. In **artificial selection**, nature provides the variations, and humans select those they find desirable. Darwin experimented with artificial selection. The results from his experiments indicated natural variation was very important because it provided the raw material for evolution.

An Ancient, Changing Earth

1. In what two ways did an understanding of geology influence Darwin?

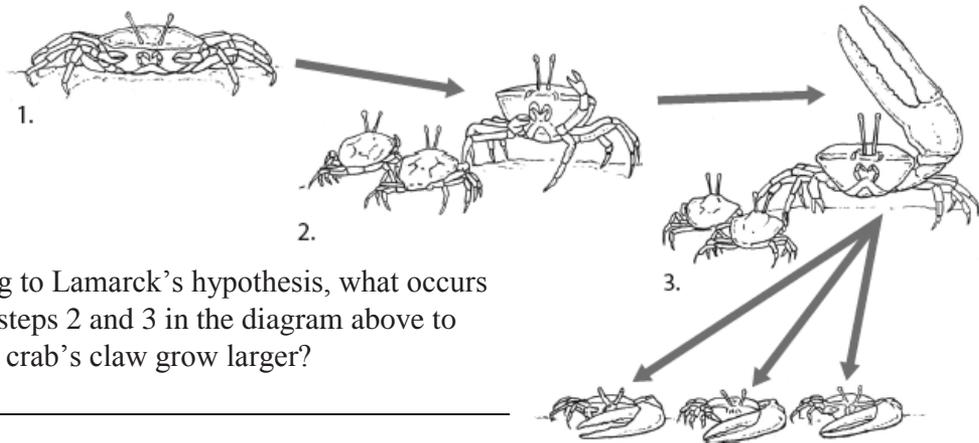
For Questions 2–5, write *True* if the statement is true. If the statement is false, change the underlined word or words to make the statement true.

- _____ 2. Hutton realized that Earth was much younger than previously believed.
- _____ 3. Lyell thought most geological processes operated extremely quickly.
- _____ 4. The processes that changed Earth in the past are different from the processes that operate in the present.
- _____ 5. Lyell's work explained how large geological features could be built up or torn down over long periods of time.

Lamarck's Evolutionary Hypotheses

6. How did Lamarck propose that species change over time?

Use the diagram to answer Questions 7–8.



7. According to Lamarck's hypothesis, what occurs between steps 2 and 3 in the diagram above to make the crab's claw grow larger?

8. Which step in the diagram above shows the inheritance of acquired traits as proposed by Lamarck?

9. How did Lamarck pave the way for the work of later biologists?

10. Which of Lamarck's ideas turned out to be true? Which turned out to be false?

11. How would Lamarck have explained the length of a giraffe's neck?

Population Growth

For Questions 12–14, write the letter of the correct answer on the line at the left.

_____ 12. Which observation caused Thomas Malthus to form his theory about population growth?

- A. Human birth rate was higher than the death rate.
- B. War caused the death of thousands of people.
- C. Famines were common in England in the 1800s.
- D. The offspring of most species survived into adulthood.

_____ 13. Which of the following is an idea attributed to Malthus?

- A. As a population decreases in size, warfare and famine become more common.
- B. As a population increases in size, the percentage of offspring that survive also increases.
- C. If the human population grew unchecked, its rate of evolution would increase geometrically.
- D. If the human population grew unchecked, there wouldn't be enough living space and food for everyone.

_____ 14. Malthus's ideas led Darwin to conclude that

- A. Earth is much older than previously thought.
- B. the size of the human population can grow indefinitely.
- C. many more organisms are born than will survive and reproduce.
- D. organisms are able to evolve through a process known as artificial selection.

Artificial Selection

15. How do humans affect artificial selection? What role does nature play?

16. What is another name for artificial selection?

17. Describe how you could use artificial selection to breed pigeons with large beaks.

Apply the Big idea

18. Complete the table about scientists who contributed to the development of the theory of evolution.

Scientists Who Contributed to Darwin's Theory of Evolution	
Scientist	Contribution to Darwin's Theory
James Hutton	
Charles Lyell	
Jean-Baptiste Lamarck	
Thomas Malthus	