

15-1 The Puzzle of Life's Diversity

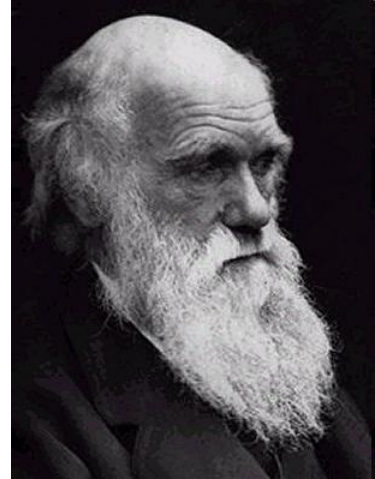


Evolution is the process by which modern organisms have descended from ancient organisms.

* Known as biological change over time

A scientific **theory** is a well-supported testable explanation of phenomena that have occurred in the natural world.

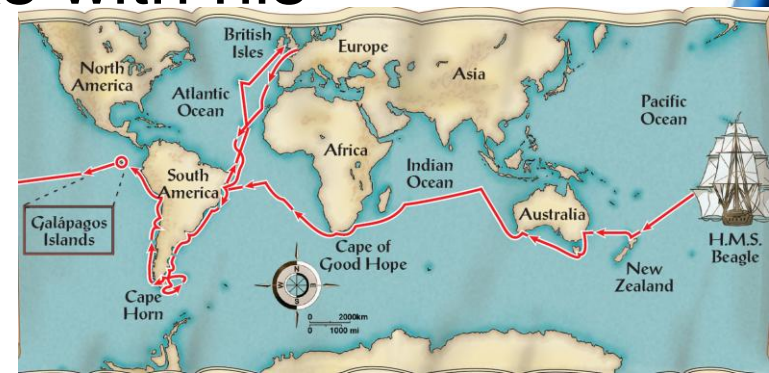
Voyage of the *Beagle*



In 1831, Darwin set sail from England aboard the H.M.S. *Beagle* for a voyage around the world.

Darwin went ashore and collected plant and animal specimens for his collection.

He studied the specimens, read the latest scientific books, and filled many notebooks with his observations and thoughts.





During his travels, Darwin made numerous observations and collected evidence that led him to propose a hypothesis about the way life changes over time.

That hypothesis has become the theory of evolution.

Darwin's Observations

Darwin observed that many plants and animals were well suited to the environments they inhabited.

He was impressed by the ways in which organisms survived and produced offspring.

Darwin was puzzled by where different species lived and did not live.

Grasslands in some regions were similar to one another but were inhabited by very different animals.

Living Organisms and Fossils

Darwin collected the preserved remains of ancient organisms, called **fossils**.

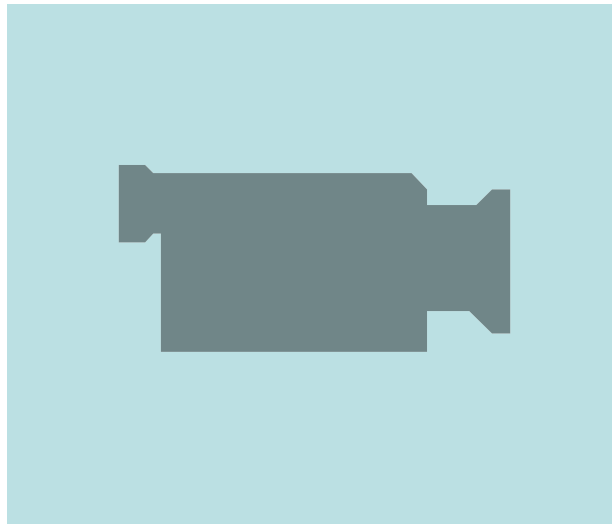
Some of those fossils resembled organisms that were still alive.

Others looked completely unlike any creature he had ever seen.

The Galápagos Islands

Darwin observed that the Galápagos Islands were close together but had very different climates.

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The Journey Home



Darwin observed that the characteristics of many animals and plants varied noticeably among the different islands of the Galápagos.



Darwin wondered if animals living on different islands had once been members of the same species.

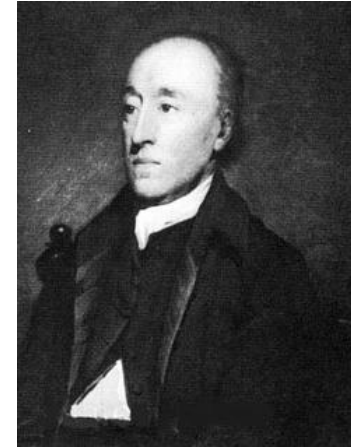
These separate species would have evolved from an original South American ancestor species.

15–2 Ideas That Shaped Darwin's Thinking

An Ancient, Changing Earth

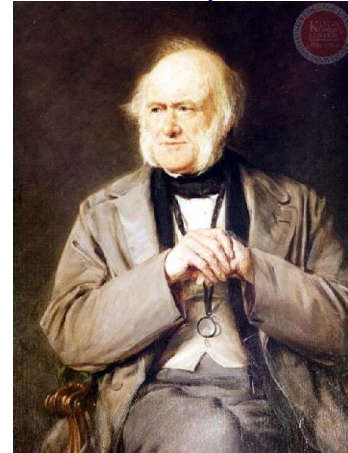
Hutton and **Lyell** helped scientists recognize that Earth is many millions of years old, and the processes that changed Earth in the past are the same processes that operate in the present.

Hutton and Geological Change



- In 1795, James Hutton published a hypothesis about the geological forces that shaped Earth.
- Most of these geological forces operate very slowly, over millions of years.
- Hutton proposed that Earth had to be much more than a few thousand years old, which was much different than what most Europeans were taught and believed.

Lyell's *Principles of Geology*

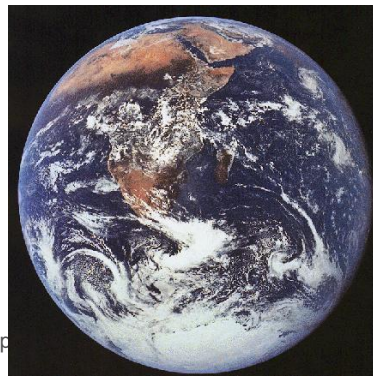


- In the mid-1800's Charles Lyell stressed that scientists must explain past events in terms of processes that they can actually observe now.
- The processes that shaped the Earth millions of years earlier continue in the present.
- Lyell's work explained how geological features could be built up or torn down over long periods of time.

This understanding of geology influenced Darwin:

- If the Earth could change over time, life might change as well.
- It would have taken many years for life to change in the way Lyell suggested.

This would have been possible only if the Earth were extremely old.





Lamarck's Evolution Hypotheses:

- In the late-1700's Jean-Baptiste Lamarck recognized that:
 - living things have changed over time.
 - all species were descended from other species.
 - organisms were adapted to their environments.

Lamarck proposed that by selective use or disuse of organs, organisms acquired or lost certain traits during their lifetime.

These traits could then be passed on to their offspring. Over time, this process led to change in a species.

Tendency Toward Perfection

Lamarck proposed that all organisms have an innate tendency toward complexity and perfection.

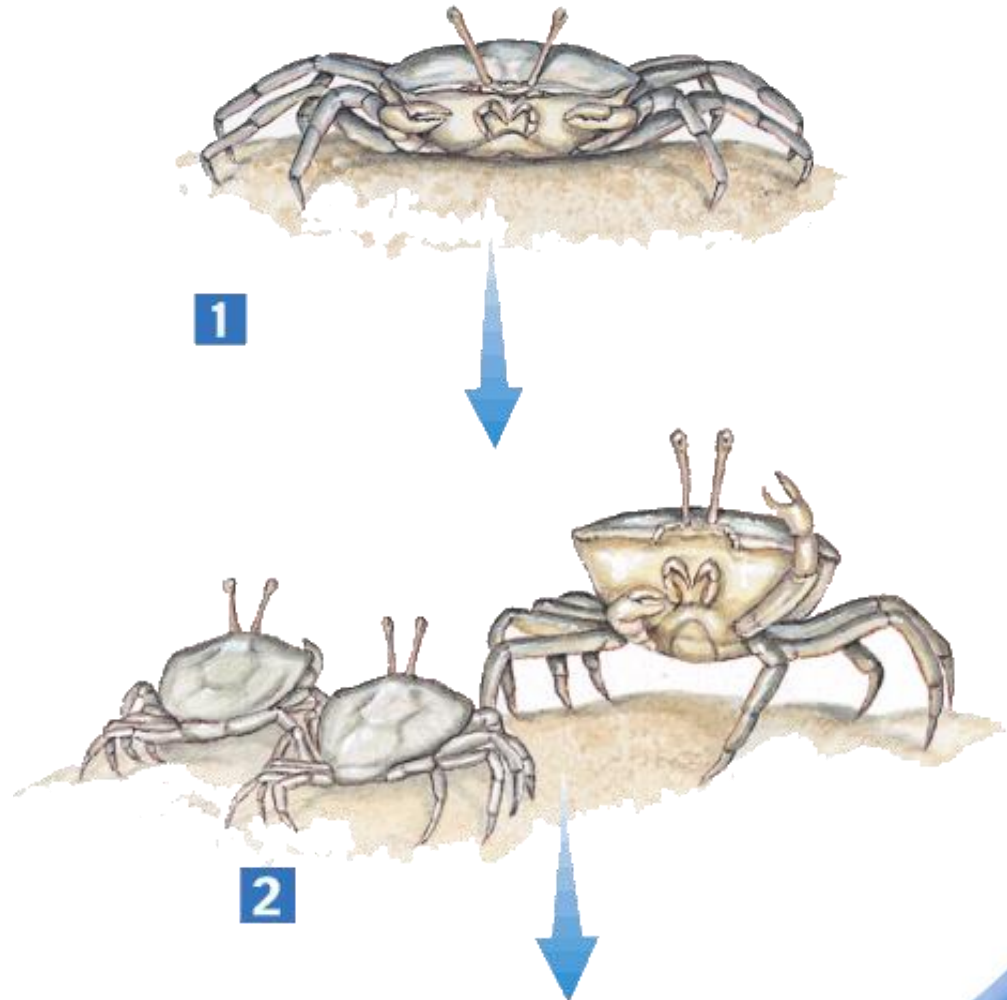
- They are continually changing and acquiring features that help them live more successfully in their environments.

Use and Disuse

- Lamarck proposed that organisms could alter the size or shape of particular organs by using their bodies in new ways.

A male fiddler crab uses its front claw to ward off predators and to attract mates.

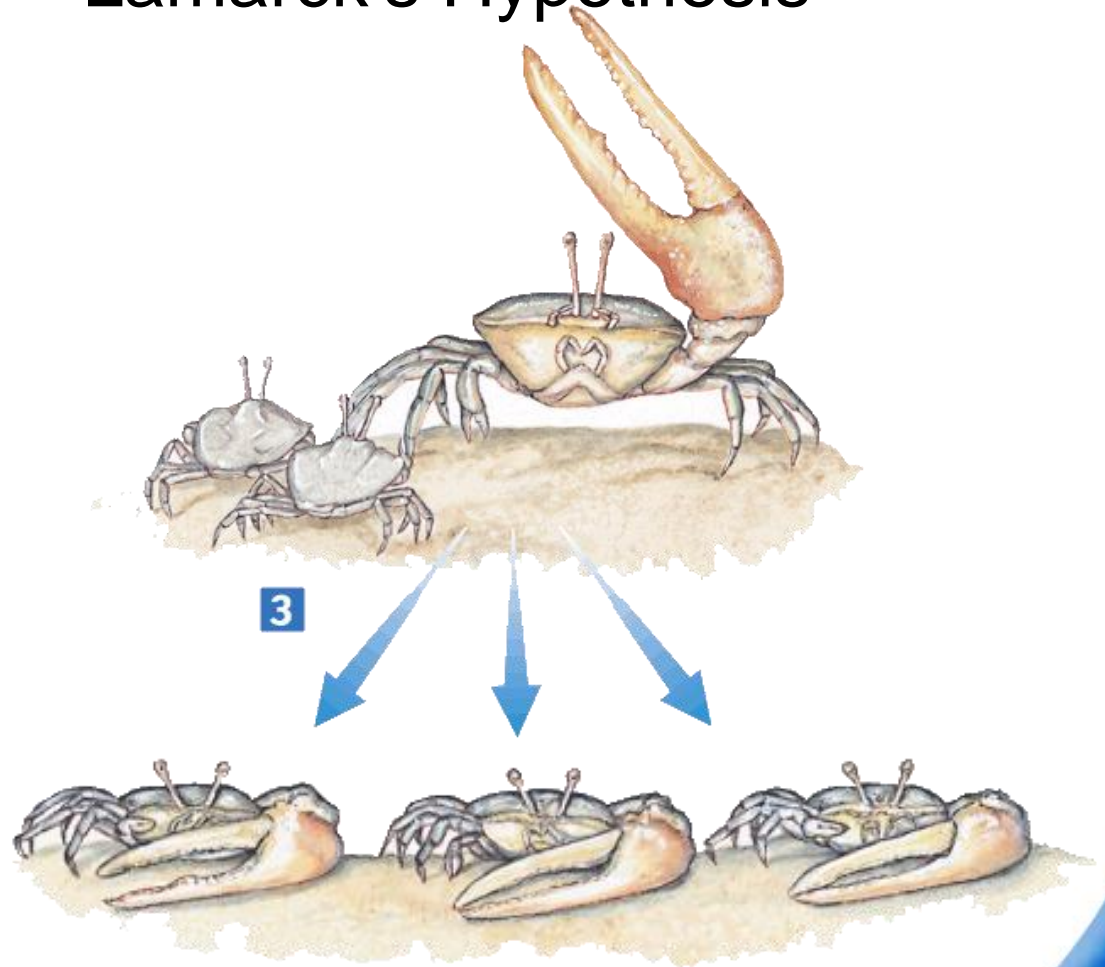
Lamarck's Hypothesis



Because the front claw is used repeatedly, it becomes larger.

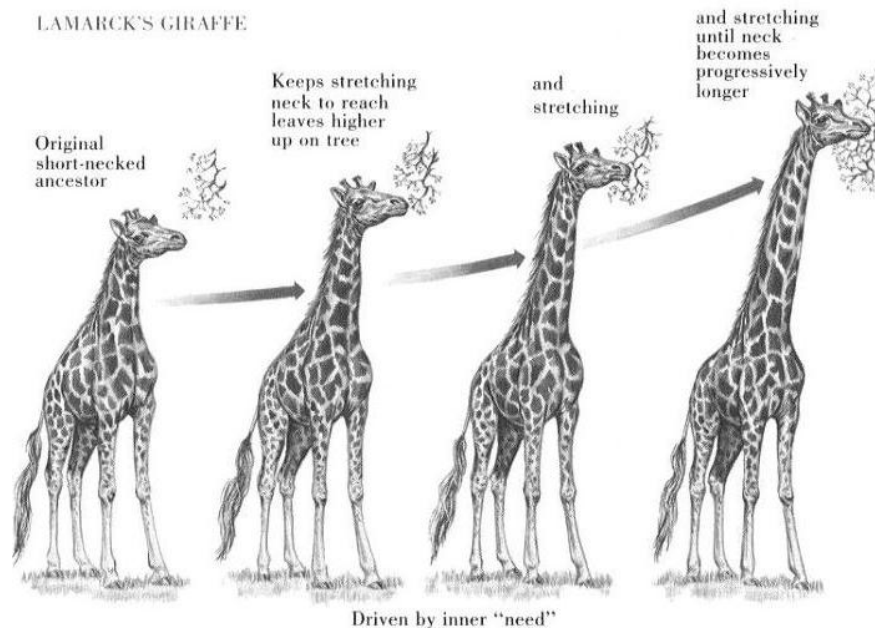
This characteristic (large claw) is passed onto its offspring.

Lamarck's Hypothesis



Inheritance of Acquired Traits

- Lamarck thought that acquired characteristics could be inherited.
- He believed that if an animal acquired a particular feature in its lifetime, that feature would be passed on to its offspring.



Evaluating Lamarck's Hypotheses

- Lamarck's hypotheses of evolution are incorrect in several ways.
- Lamarck did not know:
 - how traits are inherited.
 - that an organism's behavior has no effect on its heritable characteristics.
- However, he paved the way for the work of later biologists.



Malthus's theory of population

Population Growth

- In 1798, Thomas Malthus published a book in which he noted that babies were being born faster than people were dying.
- The only forces he observed that worked against this growth were war, famine, and disease.
- Malthus reasoned that if the human population continued to grow unchecked, sooner or later there would be insufficient living space and food for everyone.

When Darwin read Malthus's work, he realized that this reasoning applied to plants and animals.

If all the offspring of almost any species survived for several generations, they would overrun the world.

This information was central to Darwin's explanation of evolutionary change.

15-1 Section QUIZ

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Section QUIZ

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15-1 Section QUIZ

1 Darwin's observations in the Galápagos Islands included all of the following EXCEPT

- a. characteristics of many living organisms did not vary among the different Galápagos Islands.
- b. many plants and animals were well suited to their environments.
- c. very different animals inhabited many similar ecosystems.
- d. though close together, the islands had very different climates.

2 What did Darwin learn about the tortoises of the Galápagos Islands?

- a. Tortoises with dome-shaped shells were found on all of the islands.
- b. The tortoises resembled fossil remains that were found on the islands.
- c. The shape of the Galápagos tortoise shells varied with their different habitats.
- d. Different shaped tortoise shells occupied the same habitats.

15-1 Section QUIZ

3

According to Darwin's proposed theory of evolution, species of organisms

a. change over time.

b. are not related to fossil remains.

c. do not vary from one location to another.

d. remain unchanged when the environment changes.

15-1 Section QUIZ

4 Darwin hypothesized that different-looking mockingbirds from different islands might be descendants of birds that

- a. belonged to a single species that had originated on the islands.
- b. belonged to a single species from the South American mainland.
- c. belonged to a different species from similar habitats in South America.
- d. had been brought to the islands by earlier visitors.

15-1 Section QUIZ

5 What role did the evidence gathered by Darwin play in developing his ideas?

- a. It immediately gave him the idea that organisms evolved.
- b. It confirmed evolution—an idea he had before he left England.
- c. It confirmed evolution, which he proved on his arrival in the Galápagos.
- d. It led to considering the possibility of evolution only after he was heading home.

15-2 Section QUIZ

1

Hutton and Lyell recognized that geological processes

a. of the past differ from those of the present.

b. indicate that Earth is many millions of years old.

c. operate quickly, often over thousands of years.

d. always involve violent events like volcanoes, earthquakes, and floods.

2 The discovery of many fossils challenged the idea that

- a. acquired traits could be inherited.
- b. Earth is many millions of years old.
- c. species had never changed over time.
- d. geological changes are slow.

3 Which of the following scientists proposed the hypothesis of selective use and disuse?

a. Charles Darwin

b. Jean-Baptiste Lamarck

c. Thomas Malthus

d. Charles Lyell

4 The scientist that proposed that Earth is shaped by geological forces that took place over long periods of time is:

a. Malthus

b. Hutton

c. Darwin

d. Lamarck

15-2 Section QUIZ

5 Darwin's reading of Thomas Malthus made him realize that

- a. because of overpopulation, human beings cannot avoid extinction.
- b. all living things must evolve.
- c. living things produce more offspring than can possibly survive.
- d. the basic ideas of Lamarck were wrong.