

15-1 The Puzzle of Life's Diversity

Vocabulary

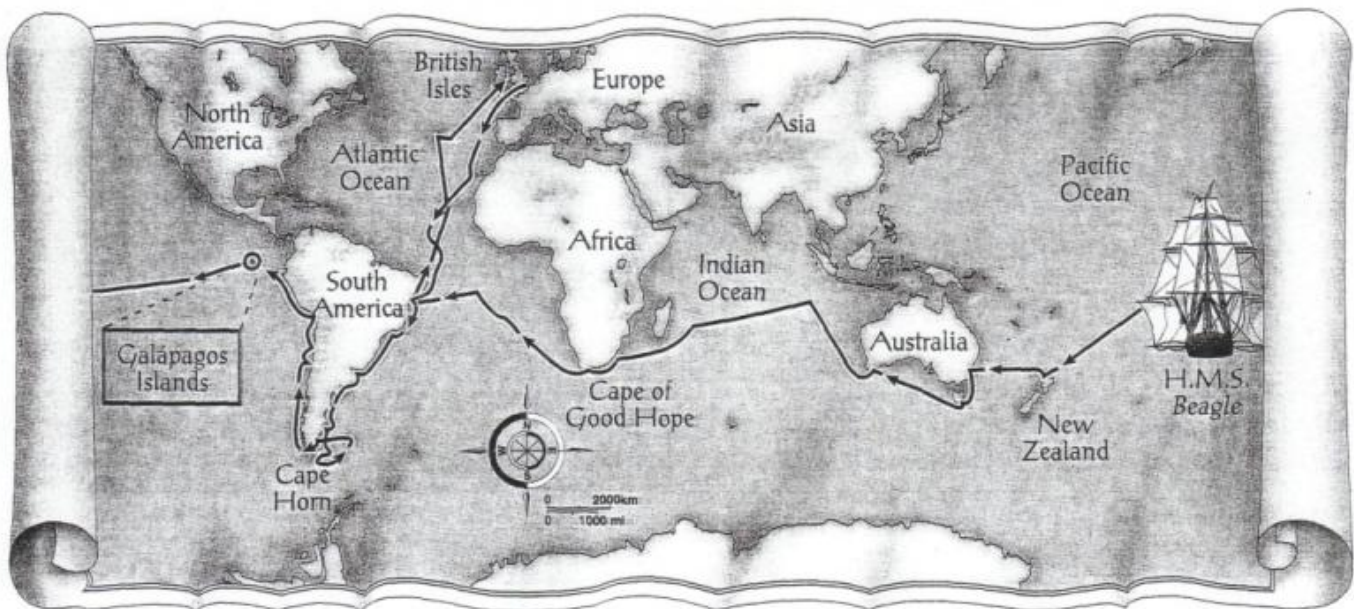
evolution, theory, fossil

Nature presents scientists with a puzzle. Humans share the Earth with millions of other kinds of organisms of every imaginable shape, size, and habitat. This variety of living things is called biological diversity. How did all these different organisms arise? How are they related? These questions make up the puzzle of life's diversity.

What scientific explanation can account for the diversity of life? The answer is a collection of scientific facts, observations, and hypotheses known as evolutionary theory. Evolution, or change over time, is the process by which modern organisms have descended from ancient organisms. A theory is a well-supported testable explanation of phenomena that have occurred in the natural world.

Voyage of the Beagle

The individual who contributed more to our understanding of evolution than anyone was Charles Darwin. Darwin was born in England on February 12, 1809—the same day as Abraham Lincoln. Shortly after completing his college studies, Darwin joined the crew of the H.M.S. Beagle. In 1831, he set sail from England for a voyage around the world. His route is shown. Although no one knew it at the time, this was to be one of the most important voyages in the history of science. **During his travels, Darwin made numerous observations and collected evidence that led him to propose a revolutionary hypothesis about the way life changes over time.** That hypothesis, now supported by a huge body of evidence, has become the theory of evolution.



Wherever the ship anchored, Darwin went ashore to collect plant and animal specimens that he added to an ever-growing collection. At sea, between bouts of seasickness, he studied his specimens, read the latest scientific books, and filled many notebooks with his observations and thoughts. Darwin was well educated and had a strong interest in natural history. His curiosity and analytical nature were ultimately the keys to his

success as a scientist. During his travels, Darwin came to view every new finding as a piece in an extraordinary puzzle: a scientific explanation for the diversity of life on this planet.

Darwin's Observations

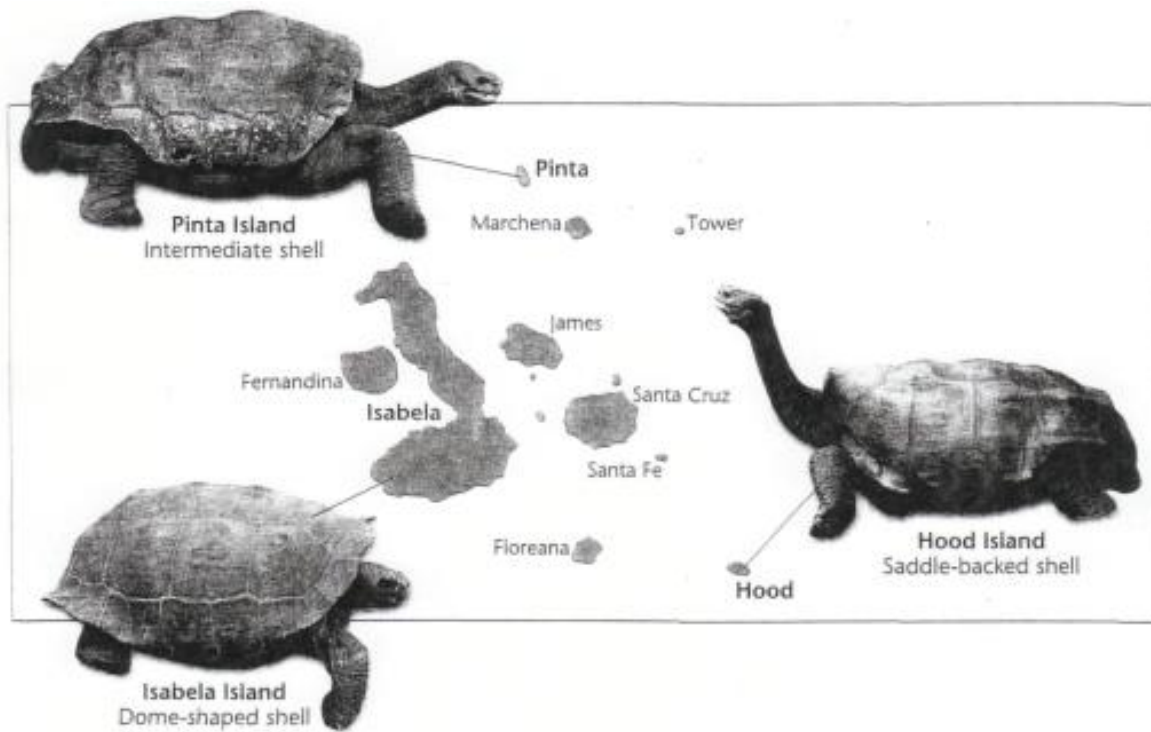
Darwin knew a great deal about the plants and animals of his native country. But he saw far more diversity during his travels. For example, during a single day in a Brazilian forest, Darwin collected 68 different beetle species—despite the fact that he was not even searching for beetles! He began to realize that an enormous number of species inhabit the Earth.

Patterns of Diversity Darwin was intrigued by the fact that so many plants and animals seemed remarkably well suited to whatever environment they inhabited. He was impressed by the many ways in which organisms survived and produced offspring. He wondered if there was some process that led to such a variety of ways of reproducing.

Darwin was also puzzled by where different species lived—and did not live. He visited Argentina and Australia, for example, which had similar grassland ecosystems. Yet, those grasslands were inhabited by very different animals. Also, neither Argentina nor Australia was home to the sorts of animals that lived in European grasslands. For Darwin, these patterns posed challenging questions. Why were there no rabbits in Australia, despite the presence of habitats that seemed perfect for them? Similarly, why were there no kangaroos in England?

Living Organisms and Fossils Darwin soon realized that living animals represented just part of the puzzle posed by the natural world. In many places during his voyage, 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. As Darwin studied fossils, new questions arose. Why had so many of these species disappeared? How were they related to living species?

The Galapagos Islands Of all the Beagle's ports of call, the one that influenced Darwin the most was a group of small islands located 1000 km west of South America. These are the Galapagos Islands. Darwin noted that although they were close together, the islands had very different climates. The smallest, lowest islands were hot, dry, and nearly barren. Hood Island, for example, had sparse vegetation. The higher islands had greater rainfall and a different assortment of plants and animals. Isabela Island had rich vegetation that tortoises could easily reach



Darwin was fascinated in particular by the land tortoises and marine iguanas that lived in the Galapagos. He learned from the vice-governor of the islands that the giant tortoises varied in predictable ways from one island to another, as shown above. The shape of a tortoise's shell could be used to identify which island a particular tortoise inhabited. Darwin admitted in his notes that he "did not for some time pay sufficient attention to this statement."

✓*Checkpoint - How did the fossils Darwin observed compare with the living organisms he studied?*

Darwin also saw several types of small, ordinary-looking brown birds hopping around, looking for seeds. As an eager naturalist, he collected several specimens, however, he did not find them particularly unusual or important. As Darwin examined the birds, he noted that they had differently shaped beaks. He thought that some of the birds were wrens, some were warblers, and some were blackbirds. But he came to no other conclusions—at first.

The Journey Home

While heading home, Darwin spent a great deal of time thinking about his findings. Examining different mockingbirds from the Galapagos, Darwin noticed that individual birds collected from the island of Floreana looked different from those collected on James Island. They also looked different from individuals collected on other islands. Darwin also remembered what the vice-governor had told him about the tortoises. Although Darwin did not immediately understand the reason for these patterns, he had stumbled across an important finding. **Darwin observed that the characteristics of many animals and plants varied noticeably among the different islands of the Galapagos.** After returning to England, Darwin began to wonder if animals living on different islands had once been members of the same species. According to this hypothesis, these

separate species would have evolved from an original South American ancestor species after becoming isolated from one another. Was this possible? If so, it would turn people's view of the natural world upside down.

15-1 Section Assessment

1. What did Darwin's travels reveal to him about the number and variety of living species?
2. How did tortoises and birds differ among the islands of the Galapagos?
3. What is evolution? Why is evolution referred to as a theory?
4. What is a fossil?
5. Darwin found fossils of many organisms that were different from any living species. How would this finding have affected his understanding of life's diversity?