The evolution of the beak of the finch

During Charles Darwin’s journey on HMS Beagle from 1831 to 1836, he spent five weeks on the Galápagos Islands in 1835. Although his visit was short, the observations Darwin made and what he concluded about how evolution works made his trip one of the most famous events in the history of science.

When Darwin first encountered the finches, he collected and categorized them into three distinct groups: blackbirds, wrens, and finches. After he returned to England, he presented his specimens to one of Britain’s leading ornithologists, John Gould. Gould identified all the birds as belonging to a single group, based on their anatomy and colourings, rather than several groups as Darwin had thought. Darwin was struck by the fact that although the birds were all finches according to Gould, the sizes and shapes of their beaks were remarkably different, as different as those of birds from different taxonomic groups on various continents. In a particularly evocative phrase in his book The Voyage of the Beagle, Darwin wrote: “Seeing this gradation and diversity of structure in one small, intimately related group of birds, one might really fancy that from an original paucity of birds in this archipelago, one species had been taken and modified for different ends.”

His discovery of the finches, along with other evidence he had gathered during his voyage, all pointed toward one conclusion: All the various species were not created in their current forms but have instead evolved through natural, undirected processes. Darwin famously took many years to publish his ideas about how species form and his theory of evolution through natural selection. On the Origin of Species was published in 1858—only after Darwin received a letter from Alfred Russel Wallace independently outlining the same ideas.

Fast-forward to 1973, over 100 years after Darwin wrote his revolutionary ideas, when Peter and Rosemary Grant travelled for the first time to the Galápagos Islands to study variability among finches within and among populations. By then, the theory of evolution was no longer questioned by scientists but accepted as a central unifying principle in biology. However, biologists were continuing to investigate and ask questions about the processes that drive evolutionary change. For example, what roles do competition, genetics, and the environment play? How do these factors work together to produce the variety of species in existence today as well as those we have discovered in the fossil record? Forty years of research on the Galápagos finches has helped provide some of the answers.

Naturalists from Charles Darwin to E.O. Wilson have marvelled at the incredible number and diversity of species on Earth. Understanding why there are so many species on our planet is an active area of current research. The Origin of Species: The Beak of the Finch follows Princeton University biologists Peter and Rosemary Grant as they study the finches endemic to the Galápagos Islands. Their work, conducted over the course of four decades, shows how geography and ecology can both drive the evolution of new species.

Summary of the Key Concepts:

* Habitats and ecological niches are constantly changing; even entire ecosystems change over time. New species can arise as populations adapt to changes and new opportunities in the environment.
* Newly formed islands provide many new habitats for species to occupy. In the Galápagos Islands, a single ancestral population of finches has given rise to 13 separate species, each adapted to different habitats and niches.
* An adaptation is a structure or function that confers greater ability to survive and reproduce in a particular environment.
* When two groups within one species become geographically isolated—separated by a physical barrier, such as a river, canyon, or mountain range—genetic changes in one group will not be shared with members of the other, and vice versa. Over many generations, the two groups diverge as their traits change in different ways.
* For two groups to become distinct species, traits must change in ways that will keep members of each group reproductively isolated, meaning that they will not mate or produce fertile offspring with members of the other group even if they come to be in the same geographic location.
* Evolutionary change can occur rapidly, in only a few generations, if there is genetic variation among individuals in a population and if natural selection acting on this variation is strong. However, major change, such as the origin of new species, often takes many thousands of generations.

As you are watching the video try to answer the following questions:

1. What evidence did scientists use to determine that all 13 species of finches on the Galapagos have one common ancestor?
2. How did the population of medium ground finches on island of Daphne Major change as the result of environmental changes?
3. Does evolution happen quickly or slowly?
4. What is the definition of a species?
5. What two characteristics played a role in reproductively isolating ground finches?
6. How did one ancestral population give rise to many species, each with different adaptations?