

Size Matters: A Look at Evolution in Action

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Have you ever wanted to see evolution in action? Take a glance into the ever-evolving tale of the Darwinian finches from the Galapagos Islands. *The Beak of the Finch*, written by Jonathan Weiner, gives a detailed glance into the concept of evolution, which started with Charles Darwin's brief visit to the Galapagos Islands in 1831, and continues with Peter and Rosemary Grant's twenty year long study of the Galapagos finches. The book, a 1994 General Non-Fiction Pulitzer Prize winner, thoroughly explains Darwin's theories on evolution and how they were tested over time by opposing scientific schools of thought. By mixing the everyday observations and Grants' experiences on Daphne Major with the theoretical knowledge from biology textbooks, Weiner presents to the reader the idea of evolution in the form of a fascinating story, rather than raw facts. He explains the process and significance of evolution in an easily comprehensible manner, even for a non-science oriented reader. Additionally, he provides evidence to support the idea that evolution can actually be observed in nature, which further demonstrates its existence as a legitimate field of study. By studying the appropriate species, the finches, at a specific location, the Galapagos Islands, the idea of observing evolution, commonly thought to be impossible, has now been proven to be possible.

Discovered in 1535 by Spanish explorer, Tomás de Bertanga, the Galapagos Islands were noted by early explorers for the great diversity of species and the tameness of the animals present¹. However, it was not until 1835, when Charles Darwin first landed on Daphne Major, that the evidence of such large animal diversity had actually been collected¹. The Galapagos Islands, which consist of nine major volcanic islands and about fifty islets, are located in the Pacific Ocean a thousand kilometers off the west coast of South America and scattered over an area of about two hundred miles¹. They are often visited by eco-tourists looking to experience the vast array of species that Darwin first made famous, as well as scientists who are eager to observe the phenomenon of evolution. Of those scientists are Peter and Rosemary Grant, world-class evolutionary biologists, famous for their field work with Darwin's finches on Daphne Major.

Although throughout the book Peter and Rosemary exhibit an extreme fascination and passion for their work, initially they showed strong skepticism towards the author, Jonathan Weiner, who eagerly wanted to accompany them and write about their research and experiences². As a Harvard College Alumni of 1977, Weiner is the first to ever write about Grants' work, which he believed to be the most remarkable work in progress on the planet and felt absolutely compelled to write about². He read over 150 scientific papers and several monographs on Darwin's finches, gathered other eyewitness reports of evolution in action, and ultimately observed their work on his own through his collaboration with the Grants². Weiner's third book, *The Beak of the Finch*, is of critical importance to

the understanding of evolution, the theories surrounding it, and the current approaches to measuring the process and observing its subjects.

One of the most critical species that have allowed for the observation of evolution in action are the astonishingly diversified and adapted finches living on the Galapagos Islands. Although nowadays they are commonly known as Darwin's finches, ironically their importance was initially highly underestimated by Darwin². In fact, while he gathered specimens, he assumed that all of the finches collected were different species. It was not until his return to London in 1837, that an ornithologist revealed that the specimens were actually closely related². This idea helped Darwin shape his theories, which he presented in his work, *The Origin of Species*, and consequently the birds became known as "Darwin's Finches."

One of Darwin's most notable theories is the idea that change between generations does not accumulate, but instead fluctuates around an established phenotypic mean. Upon the Grants' first visit to Daphne Major in 1973, they, among other scientists, measured the lengths of the finches' beaks and the hardness of common seeds². They also made detailed descriptions about specific seeds eaten by particular birds with certain beak sizes². When they returned a few months later, the Grants found Daphne Major to be a barren land due to a severe drop in total precipitation on the island that season². Through recapturing, weighing, and measuring the finches, they had noticed multiple consequences, such as significant loss in the finches' weight and a new frequency of different finches. Additionally, they observed a major change in vegetation on the island and a drastic decrease in the number and type of seeds available to the finches². As Weiner explains, due to the change in their living conditions, different finches were naturally selected based on their ability to survive on the nuts and seeds that were available to them at the present time². The impact of such environmental changes on the finches' existence is just one of the examples for the support of natural selection taking place in modern times. Nevertheless, sometimes scientific proof may not be powerful enough to break stereotypical views and beliefs.

Surrounded by criticism and skepticism, evolutionary biology is still in the process of being acknowledged as a true science. *The Beak of the Finch* is not just a book detailing the story of Darwin's finches; it also tells the story of the changing view on evolutionary biology as an actual science. While Weiner successfully intertwines Darwin's theories with the story of the Galapagos Island and its species, he also provides strong evidence in support of evolution being independently categorized as a science. Natural selection is the essential method and mechanism of evolution, but it is difficult to detail and demonstrate. Weiner does a good job with elaborating upon the ability to determine what natural variation is and when natural selection is taking place in a particular species. However, some people expect evolutionary biology to be able to pinpoint the exact time of the slightest variation in a species that would lead to the development of a new species; yet, that will never be possible, which allows critics to debate the validity and reliability of evolution as a science. One of the most imperative examples of natural selection exhibited in the book are the changes that occur in the finches' beak sizes on Daphne Major during the drought of 1977 and the flood of 1983. As an evolutionary consequence, there was a

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major shift in phenotypic means of beak sizes in further generations of finches living on the island.

Weiner's work utilizes many key concepts that we have learned through our lecture class, Biology 220-Ecology & Evolution. *The Beak of the Finch* mainly discusses the theory of evolution, defined as the change in the inherited traits of a population of organisms through successive generations³. Weiner also focuses on the role of natural selection, the process by which traits become more or less common in a population due to consistent effects upon the survival or reproduction of their bearers³. Evolution provides a straightforward explanation for the way in which the form and functioning of organisms is shaped by the properties of their environments, including physical conditions, food resources, pathogens, and interactions with predators. Through the process of evolution, traits of individuals within populations are continually adjusted to changes in their environment. On Daphne Major, beak size responded to the availability of hard and soft seeds. These concepts parallel teachings from our lecture. Furthermore, we examined the roles of different types of selection. In the Grants' work, beak sizes demonstrated disruptive selection, resulting in increased genetic and phenotypic variation on the island. From our class discussions, we have studied concepts such as population genetics, which focuses on changes in gene frequencies in response to selection. By using this approach, we could predict the frequency of finches with different beak sizes on the island according to various environmental pressures. The Grants were able to witness this first hand on the islands by computing statistical analyses of the data they had gathered. The book also discusses a major component of evolutionary concepts from our class: adaptation. Defined as the process by which an organism becomes better suited for its habitat, it goes hand in hand with evolution³. As the sizes of beaks changed and allowed the finches to be more successful in their habitat, the transfer of these traits to their offspring results in what we call evolution. A great deal of freshly gained knowledge from our Ecology and Evolution lecture has been included in this book; thus, nearly every page of it is applicable to what we have learned. Therefore, it is important to recognize the relationship between knowledge from the class to real work performed beyond the pages of our textbooks because it brings meaning to what we are learning about in the classroom.

The Beak of the Finch is an in-depth exploration of actual evolutionary and ecological research that shows the fallacy of all the misunderstandings of the forces of our world. Weiner's writing style is clear and friendly; he weaves the researchers' anecdotes and scientific principles with everyday language, leaving the reader with a better understanding of the concept. Weiner manages to get across what it really means to be an evolutionary scientist. His vivid portrayals of the life of leading field researchers shows that natural selection is not just a theory in a book or an abstract philosophical concept, but something with a real and vivid presence in nature. Evolution is as testable and observable as any other scientific theory.

Simply put, this Pulitzer Prize winner does not disappoint. Whether you are a beginner or an expert on the subject of evolution, there is something for everyone in Weiner's work. Collectively, we recommend this book to an audience who has an interest in evolutionary biology. The book does a superb job of educating the reader without feeling lectured because of its casual diction and phrasing. *The Beak of the Finch* tells a story alongside a theory, which keeps the audience captivated while learning about a highly controversial issue. Overall, Weiner transforms what is normally considered a boring topic and provides the audience with a surprisingly enjoyable and educational read.

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