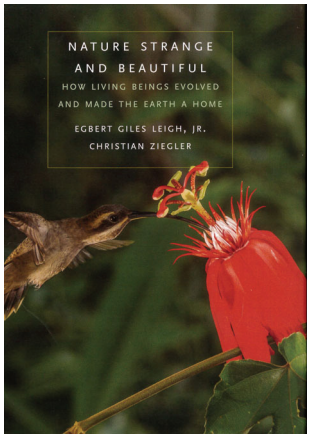


Nature Strange and Beautiful: How Living Beings Evolved and Made the Earth a Home. Egbert Giles Leigh Jr and Christian Ziegler. Yale University Press, in association with Smithsonian Tropical Research Institute. 2019. xiv + 258 pages. Price: US$ 28.

Why one more 'popular' book on evolution? The authors, Egbert Giles Leigh Jr and Christian Ziegler (henceforth L&Z), have an up-front answer in the first few sentences of their preface:

> '*The French mystic Simone Weil believed that the true definition (and proper function) of science is the study of the beauty of the world; this book accordingly tries to show how evolutionary thinking can help us appreciate this beauty. ..... we focus on the beauty and strangeness of nature, the unexpected steps and curious mechanisms by which the natural world we find so beautiful came to be.*'

Both authors are well known in their respective fields. Egbert Leigh is an evolutionary ecologist associated with the Smithsonian Tropical Research Institute, and has been studying species interactions at the level of the community and the ecosystem for more than 50 years. Christian Ziegler is an award-winning photojournalist who specializes in capturing nature in all its glory, and contributes to the likes of BBC and National Geographic. Thus, between them, L&Z most certainly have all the credentials needed for taking the reader on a guided tour of appreciating the beauty of nature through the lens of evolution. In this book, L&Z are joined by a group of talented sketch artists, but more on the latter's work later.

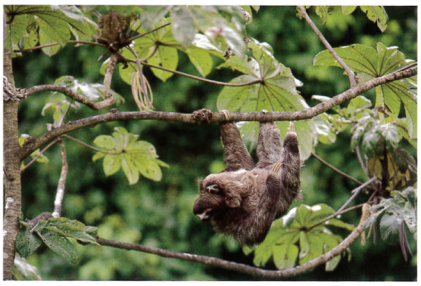
This is a slim volume with 11 chapters distributed over a mere 201 pages. Like a Ph.D. thesis or a monograph (but unlike most popular science books) L&Z devote the first two chapters to set up the backdrop of the journey, or to be more precise, the kind of questions that they plan to ask and answer in the forthcoming chapters. They start with the observation that adaptations (individual as well as social) exist everywhere and this is something that requires an explanation (chapter 3). For this, they discuss the various evidences suggesting that life diverged from shared ancestors and follow it up with a nice account of why deep-sea vents are the most likely candidates of being the sites of origin of life (chapter 4). Chapter 5 takes us on a whirlwind tour of how life diverged from these modest beginnings below the sea to the bewildering diversity that we witness today and chapter 6 talks about how all this diversity came together through various interactions and interdependences to form intricately balanced communities and ecosystems. These two are the longest chapters in the book and carry a number of ecological insights, of which, I found the relationship between competition and diversity to be particularly interesting.

Having outlined the pattern, L&Z go back to the underlying processes in the next three chapters. Chapter 7 is an introduction to Mendelian genetics followed by a brief account of the structure of DNA, while chapter 8 seeks to demonstrate how natural selection can operate at the level of genes, and includes an account of the costs and benefits of sexual reproduction. In the ninth chapter (which is the third longest in the book), L&Z discuss various ways in which new species can arise and spend quite some time on the evolution of cooperation, the latter happens to be one of the primary themes of Leigh's professional research over the last several decades. They also allude briefly to the major transitions in evolution. The tenth chapter deals with the evolution of thought and language while the eleventh chapter is a summary of the major lessons from the various chapters.

Any book on a technical topic needs a reference section, and this book is no exception. However, I particularly enjoyed the reference section of this book, which the authors call a 'bibliographic essay', spread over 38 pages, but in a much smaller font. Annotated bibliographies are very common in popular science books. However, I am yet to see one which has a two-page mathematical description of a fluid dynamics equation (pp. 205–206), or the chemistry behind respiration (pp. 210–212). I thoroughly enjoyed peeking into this essay from time to time and learned a number of new things by looking up the references.

As stated already, the book is brief. It seems to be primarily aimed towards the interested but non-technical reader with little or no exposure to evolutionary biology. Its biggest competitor in this segment would perhaps be some of the visually stunning documentaries produced by National Geographic, BBC and their ilk, and the book seems to be mindful of this situation. At several places in the main text (i.e. chapters 3–10), the book reads almost like a script for a documentary on any of the natural history related channels. Overall, the language is simple and crisp with little meanderings, and as a result, for most part, the book is easy to read. The similarity with a natural history documentary is made stronger by the constant references to the large number of drawings and photographs in this book. When one of the co-authors is an acclaimed wildlife photographer, one expects good stills, and this book does not disappoint. However, to my mind, the real asset here are the various sketches by Debby Cotter Kaspari. An expertly executed sketch of a biological object can sometimes transcend into a work of art, and Kaspari's drawings stand out as a nice USP for this volume.

Any book that aims to convey technical information to the lay audience needs to be accurate in terms of what is being conveyed. When one of the authors is an acclaimed expert, and the book is being



A mother sloth, *Bradypus variegates*, specialized to live only on leaves, with its dependent offspring. Taking care of one's young is the origin of social life. (Photograph by Christian Ziegler.)

published by a famous University Press, then the expectations about the content are indeed high. Unfortunately, a few issues about the text detract from the merits of the book.

Selection (along with adaptation) is supposed to be a major theme running through this book. However, the concept of selection is dealt with somewhat arbitrarily in the text. The preface (p. viii) states 'Natural selection is competition.' Surely, it is not! Then on the last paragraph on page 1, it is stated 'Such differential reproduction, which we call natural selection... .' However, here one needs to keep in mind the fact that for natural selection to operate, there has to be (at least partial) inheritance of the traits that lead to the said differential reproduction. The same paragraph then goes on to state 'An organism's genome may be viewed as its hypothesis, encoded in its DNA, of how to live and reproduce in its environment. By trial and error, strictly speaking, by testing variant hypotheses generated by copy errors, natural selection improves this hypothesis, coordinating the organism's function more nearly with relevant features of its environment.' The authors' use 'An organism's genome' right at the beginning of the sentence and then omit to state that the 'improvement in hypothesis' being talked about happens across generations. This can automatically lead to the assumption that natural selection 'improves' an organism within its own lifetime, which is a very Lamarckian idea that I am sure the authors do not wish to convey.

This book takes an unabashedly 'gene-centric' view of evolution. While understandable for a book in the 1970s, that seems to be completely anachronistic for a book published in 2019. I can appreciate that a focus on Nature might preclude the authors from focusing too deeply on concepts from epigenetics, evo-devo or gene–environment interactions in the context of evolution. However, given that there are three full chapters on the mechanisms underlying evolution, would it have been too out of place to consider these phenomena? More critically, why so much of focus on the 'selfish gene', when the field of evolutionary biology has moved quite beyond it?

Another feature of the writing that merits some discussion is the high degree of anthropocentrism. Many authors use examples familiar to the reader to create a context, before introducing new concepts as an analogy. L&Z use this trick throughout the book. For example, chapter 6, which deals with how diversity is organized into communities, starts with a three-and-a-half page long discussion about the central role of competition and cooperation in organizing human economies, which then forms the basis of explaining how communities and ecosystems are structured. This actually adds to the relatability of the book and is laudable. However, to my mind, L&Z overdo this with sentences like 'To become de facto lord's of creation, human beings…' (p. 26) and 'An ultimate animal technology is conscious human minds...' (p. 3). Given that this is a book about Evolution – a field that has a historical baggage of the *Scala Naturae* – I would have been happier if the book were a little more careful about this issue. In a year in which the whole of humanity has been brought to its knees by a virus, the first statement seems ironical.

Finally, the book contains a few claims that have no business of being in any book on biology. Page 131 states 'How does a gene store the instructions for its process? James Watson and Francis Crick showed in 1953 that its instructions are encoded in its sequence of "nucleotides"…' Watson and Crick's 1953 paper does not contain anything about how the genetic information is encoded. Page 56 states 'A coral is a colony of sea anemones…' Perhaps not, particularly when, on the same page, they are identified separately as examples of cnidarians. Page 128 states 'Mendel's paper came out in 1866, but it lay ignored until 1900, when studies of chromosomes suggested that they were the carriers of heredity.' The first part is correct as Mendel's work was indeed rediscovered in the year 1900. However, the realization that chromosomes are physical carriers of heredity comes about 2–3 years later with the work of Sutton, Boveri and others (Wilson, E. B., *The Cell in Development and Heredity*, Macmillan, New York, 1925, 3rd edn, pp. 923–927). Thus, this book is in dire need of a thorough round of editing and fact checking.

So who should read this book? Curiously, L&Z do not mention the audience they have in mind for the book. Therefore, here is my personal take on that question. If you are a teacher of evolution, looking for excellent examples to illustrate concepts in Ecology and Evolution for your students, this book (and particularly its bibliographic essay) is an excellent resource. If you are a person who loves pretty pictures, wishes to be awed by the wonders of nature and evolution, and have reasonable tolerance for a few inaccuracies here and there, this book is going to be of interest to you. However, if you are a student of evolution, who is trying to learn the concepts of the subject, I would recommend that you look for some other resources. In its current form, this book badly needs a thoroughly revised and considerably enlarged next edition.

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Annual Review of Biophysics, 2020. Ken A. Dill (ed.). Annual Reviews, 4139 El Camino Way, P.O. Box 10139, Palo Alto, California 94303-0139, USA. Vol. 49. viii + 345 pages. Price: US$ 118.00.

Biophysical is a subject where theoretical and practical knowledge of physics is implemented enormously to understand the biological system and study the function of biological macromolecules. These techniques are entirely integrated with biochemistry, microbiology and cell biology techniques to understand the structure, function and mechanism of biological systems. Recently, molecular simulations, computational biology, integrated modelling, spectroscopic techniques, microscopic techniques, membrane biophysics, nanotechnology, system biology and structural biology are employed together to address the biological key questions. These biophysical techniques are used to address the biological assembly, dynamics of biomolecules, protein folding and mechanistic behaviour of biological macromolecules. The *Annual Review of Biophysics* is one of the oldest Biophysics review journals, mostly covering the best exciting biophysical research. However, the volume under review mostly focuses on the novel biophysical techniques or new