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REVIEW

Ancestors in Our Genome: The New Science of Human Evolution

by Eugene E Harris
New York: Oxford University Press, 2015. 248 pages

reviewed by Daniel J Fairbanks

In his recent book *Ancestors in Our Genome: The New Science of Human Evolution*, Eugene E Harris assumes the daunting task of explaining to a lay audience how the massive amount of genomic information currently available to geneticists has informed our understanding of human evolutionary history. With extensive research experience in both physical anthropology and molecular evolution, combined with an engaging writing style, Harris is well-qualified as both a scientist and author for the task.

He begins the first chapter describing his own transition during graduate school in the 1990s from reliance on comparative anatomy to analysis of DNA for evolutionary research. This sets the stage for the next three chapters, which delve into how DNA sequence information, ultimately on a genomic scale, can be used to reconstruct the evolutionary relationships of living species. Most authors of popular books on evolution gloss over methodologies for evolutionary analysis and their underlying assumptions. Harris, by contrast, lucidly explains at a level of detail rarely seen in popular science books, how geneticists analyze DNA sequences to address evolutionary questions.

The second chapter is devoted to a thorough discussion of phylogenetic tree construction, using as an example the trichotomy problem—among humans, chimpanzees (common and bonobo), and gorillas, namely: Which two groups share a more recent ancestry? He takes readers through the history of research on the problem and how evidence gradually emerged, leading to the conclusion that humans and chimpanzees share a more recent ancestry with each other than either does with gorillas. In doing so, he includes examples of evidence pointing to contrary conclusions, portraying the ongoing process of scientific discovery not as a clear-cut process but rather as a statistical consensus that emerges after abundant data have been collected and analyzed.

The book describes how DNA evidence is used to estimate when the lineages leading to humans and chimpanzees parted ways, and when anatomically modern humans emerged as distinct species. It also explains how population genetic theory can be applied to DNA, and more recently to entire genomes derived from hundreds of people, to determine how humans (members of the genus *Homo*) originated in Africa and how the descendants of humans expanding out from Africa ultimately populated the rest of the habitable world.

The fifth, sixth, and seventh chapters constitute some of the most intriguing sections of the book. They address how human genetic diversity evolved throughout human diasporas,

and how mutations in DNA coupled with natural selection influenced the evolution of a diverse array of adaptations, among them brain development, speech, loss of body hair, variation for pigmentation and hair structure, resistance to malaria, and lactose tolerance. The eighth and final chapter addresses one of the most compelling recent discoveries—genomic sequencing of DNA from fossilized skeletons—and how it provides evidence of limited interbreeding of ancient humans outside of Africa with Neanderthals and Denisovans.

Several themes are apparent throughout the book. Harris repeatedly depicts scientific discovery as it really happens, citing lines of evidence that at times may conflict, leading to tentative conclusions that are eventually modified and clarified as additional evidence accumulates. The picture that emerges in the book is a portrayal of molecular evolutionary analysis as something that is not always neat and clear, but rather a process that may leave questions not fully answered. Readers quickly sense that this is a book describing cutting-edge science, recounting discoveries as recent as 2014. For each discovery that is addressed, a multitude of new questions arise.

One of the book's most laudable features is its accuracy. Errors are common in popular science books, but not this one. Harris cites some of the most pertinent research on the molecular foundations of human evolution, and he is invariably true to the original research. Rather than interpreting it to promote his own views, he recounts it much as the scientists who conducted the research did in their original publications. His expertise is evident, and where appropriate he includes examples from his own research.

The subject of human evolution should be of interest to many not only because it helps us to understand our own history as a species, but also because the evidence for human evolution is some of the most important for debunking non-scientific ideas regarding Earth's past and present diversity. This book, however, is entirely about the science of human evolution and the groundbreaking discoveries that have arisen from genomic research—there is no mention whatsoever of creation science or "intelligent design," nor of the current political intrigue associated with these movements. In essence, it dismisses them by complete omission, while at the same time recounting the excitement and intrigue of scientific discovery. Those seeking a purely scientific book, uncluttered by politics and demagoguery, will find it here.

The writing style is engaging and clear, and the book is not excessively long (eight chapters in just under 200 pages). However, it is not an easy read. Harris often takes the time to fully explain complex topics that are essential for understanding the process of evolutionary analysis at the genomic level, but are not easy for casual readers to grasp. For example, he explains in some detail how geneticists use genomic comparison to detect evidence of selective sweeps (variants in DNA that increase in prevalence within a species over a relatively small number of generations due to natural selection). Rather than stop with an explanation of how the evidence of selective sweeps is identified, he further explains the nuances of the science by describing how geneticists are pushing the boundaries with more complex analysis can detect "soft sweeps" involving natural selection that affects variations in several genes simultaneously. Explanations as thorough as this require the use of scientific terminology that can often be difficult. Fortunately, the book includes a glossary with straightforward definitions that readers can consult when they encounter unfamiliar words and concepts.

Though the effort to read this book may be considerable for those not familiar with genomic science, it is well worth it. Readers will come away from it with a powerful and up-to-date understanding of how the science of genomics is revolutionizing our understanding of human evolution and of evolution in general.

About the author

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