

Matisoo-Smith, Elizabeth, and K. Ann Horsburgh
2012 *DNA for Archaeologists*. Left Coast Press, Inc. Walnut Creek, CA. 233 pages. ISBN: 978-1-59874-681-5

Abstract: *This book is an introductory guide for nonspecialists to DNA analysis and its archaeological applications.*

Elizabeth Matisoo-Smith and K. Ann Horsburgh have written a valuable and practical guide to molecular anthropology. Their target audience is archaeologists who are not trained in genetics but want to be able to understand and make use of molecular research. While most archaeologists will be consumers, rather than producers, of DNA analysis, they do have two important roles to play – they will likely choose what samples are submitted for DNA analysis, and they are the ones who put the results in context. Therefore, it is crucial that archaeologists have an understanding of how DNA research is conducted.

They begin with a brief history of DNA research. Three of the most significant developments occurred in the mid to late 1980s: the analysis of mitochondrial DNA (mtDNA), the successful identification of ancient DNA (aDNA) from archaeological specimens, and the invention of polymerase chain reaction (PCR) technology, a quick and easy way to make copies of DNA to study: "With PCR, almost anyone could amplify DNA with minimal laboratory investment or experience. As a result, molecular biology became accessible and

could be done just about anywhere – even in a hotel room" (p. 16). Next Generation Sequencing (NGS) techniques would later reduce the time and cost of DNA analysis even more.

Chapter two may feel at first like a high school biology refresher course, with definitions of terms like chromosomes, nucleotides, mitosis, and meiosis and descriptions of mitochondrial DNA, Y chromosomes, and autosomal markers. These are supplemented by a five-page glossary in the back of the book. The second part of the chapter gets into the details of laboratory and analytical methods, including how scientists construct and interpret phylogenetic trees, which show the inferred evolutionary relationships among different groups or species.

Ancient DNA is simply any DNA obtained from a no longer living organism. There are two main issues with analyzing aDNA: degradation, which begins at death and only gets worse over time, and sample contamination. Contamination is a daunting problem, and, in fact, in aDNA studies, contamination of samples seems almost unavoidable. As modern DNA gets everywhere, molecular anthropologists "can often be identified by the smell of bleach, one of the favorite methods for destroying contaminating DNA" (p. 62). Although there are methods of dealing with samples excavated and processed under non-ideal situations, it is of course best to avoid contamination as much as possible when collecting samples in the field. Once again, Matisoo-Smith and Horsburgh provide

practical advice on potential sources of aDNA such as pollen and soil, guidelines for collecting samples, and common field practices to avoid.

The authors also address ethics, but the bulk of that chapter is taken up by a long narrative of issues raised during the course of the Human Genome Project (an international project begun in 1990 to sequence the entire human genome) and its successors—intellectually interesting but more detailed than this book needs.

The second part of the book surveys research areas where molecular anthropology has made large contributions, including research on Neanderthals, the so-called Denisovans, *Homo floresiensis*, and ancient Australians. Their review of population origins and dispersals has a truly worldwide scope, including studies of Africa, Europe, Asia, Oceania, and North and South America. If there is a common thread here, it is that everything is more complex than originally thought. The fact that most studies of past migration patterns have been based on the modern distribution of various haplogroups found in humans highlights how important it is to study aDNA. Unfortunately, there are still relatively few studies of aDNA that provide definitive evidence of past populations.

DNA research has also studied the interaction of humans with other animals and plants, including extinction, domestication, and trade. In one cautionary tale, a study of plant domestication in the Fertile Crescent concluded that early plant

domesticates including einkorn, emmer, and barley were each "derived from a single and rapid domestication event" (p. 144), but later analysis determined that this conclusion was an artifact of the specific method of phylogenetic analysis used. Finally, other research deals with "individualization"--using aDNA to try to answer specific questions about a specific individual, like identifying sex or evidence of disease from a single skeleton.

The field of molecular anthropology is advancing so rapidly that it is unavoidable that some of the information will quickly become outdated. Matisoo-Smith and Horsburgh, however, provide pragmatic advice, like a list of questions you should ask about methods used and analytical decisions made when you talk with a potential collaborator, that is unlikely to go out of style. One of the most important themes that runs through this book is data quality. Especially during the early days of DNA analysis, researchers were not always aware of quality control issues and what the authors refer to as "the inevitability of contamination" (p. 17). Consequently, much of the subsequent research has attempted to identify and control for contamination, and they remind readers that earlier published results may no longer be considered reliable if they cannot be replicated.

The book would have been improved by better maps showing the current geographic distribution of the numerous haplogroups they discuss in chapter six (there are small maps showing the inferred spread of mtDNA haplogroups). A table listing the

alphabet soup of mitochondrial and Y chromosome haplogroups and where in the world they are found would also have been valuable. These minor issues, however, do not detract from the overall value. Matisoo-Smith and Horsburgh have hit their target. This book is exactly what it claims to be: a useful and readable guide to understanding the archaeological applications of DNA research.

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