

of genes, and chapter 8 deals with the construction of molecular classifiers for the identification of subtypes of samples, such as tumors. Each of these chapters contains interesting ideas and applications, as well as small examples that use real data to illustrate major concepts. Chapter 8, in particular, is quite short and contains only passing references to some of the current hot topics, such as neural nets or vector support machines. It does, however, suggest how these types of classification schemes can be used and what should already have happened to the data prior to their use, which will be useful information for most researchers.

The remaining chapters cover a variety of topics. Chapter 9 deals with some of the issues encountered when selecting genes for printing on a chip. Chapter 10 is an extremely short passage outlining some caveats about the limitations of data derived from microarray experiments. Chapter 11 is a passing mention of genotyping chips but also has another very brief overview of neural networks and how they can be used in data analysis. Chapters 12 and 13 deal with available software for tackling various issues raised in the book, with chapter 12 containing scripts for performing various types of analyses for those enterprising researchers who would prefer to work in a Unix or Linux environment. There are also some instructions for programming in R for many of the operations dealt with earlier in the book, again using the familiar example that has been used throughout. For those of us with little time or inclination to learn to program in Awl, Perl, or R, chapter 13 is a listing of some commercial software packages that are available to help with microarray analyses. Readers should be aware, however, that this list is necessarily incomplete, and there is no discussion of the relative merits of any of the programs.

Overall, the major shortcoming of the book could be viewed as the extremely brief treatment of most of the topics, which are sometimes given no more than a passing mention. However, this might equally be regarded as a strength, since the reader is never bogged down in a heavy discussion of mathematical arguments. In addition, the brevity is countered by extensive reading lists, which accompany every chapter, and by references to a variety of Web sites and other resources to which readers may go to find more-detailed help. True to its word, the book remains accessible throughout to the biologist who may have no formal training in the statistical arts. What it does manage to do quite nicely is to introduce the fascinating world of microarray analysis beyond scanning and to provide a framework for the kinds of questions that can be asked and the tools available to help answer them. In that respect, this book has fulfilled its promise as a biologist's guide.

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Mapping Human History: Discovering the Past through Our Genes. By Steve Olson. Boston: Houghton Mifflin, 2002. Pp. 278. \$25.00.

As human genetics becomes increasingly a part of everyday experience, there is a need for literature that accurately explains our science to the general public. Steve Olson, an experienced science writer, has done an excellent job of balancing scientific content with journalistic spice in this new book about the genetic history of our species.

Olson writes clearly and gracefully, and his enthusiasm for the subject is readily apparent. He defines a number of key concepts, including speciation, mutation, natural selection, genetic drift, and even the concept of coalescence. The definitions are usually quite approachable, as in the following description of recombination: “the chromosome pairs delicately intertwine and exchange pieces in a process known as recombination. The result is two hybrid chromosomes, as if a husband and wife had exchanged arms and legs” (p. 15).

As the book progresses, we are presented with genetic evidence bearing on major events in our history. Considerable attention is devoted to the competing “out of Africa” and “multiregional” hypotheses. Olson agrees with most geneticists in finding the former more convincing than the latter, although I think he concludes too readily that archaic humans made no contribution at all to our genetic heritage. A chapter is devoted to the origins of agriculture, and there are chapters on the genetic histories of Africa, Asia, Europe, the Americas, and the Pacific Islands. Although the focus is on genetic studies, some attention is also devoted to inferences made from archaeological and linguistic evidence. Each chapter is laced with vivid descriptions of places visited by the author in the course of writing the book, including the grasslands of Botswana, the city of Jericho, Skhul Cave, the Stonehenge monument, and—not surprisingly—the beaches of Hawaii. During these travels, the author interviewed many of our colleagues, and we read excerpts of interviews with Becky Cann, Luca Cavalli-Sforza, Li Jin, Himla Soodyall, and Doug Wallace, among others. These personal touches enliven the book and will doubtless make it more inviting to lay readers.

A book about human genetic variation must inevitably address the delicate issue of “race.” In fact, considerable discussion is devoted to this subject, and I found it to be, for the most part, accurate and sensitive. Olson does not make the mistake of simply declaring that we are “all the same.” He rightly emphasizes the low degree of nucleotide diversity in humans, relative to many other species, but he also recognizes that “real physical differences exist between the average Nigerian, the average Norwegian, and the average Filipino. Most of the members of these groups share a common biological history, which is reflected in their DNA” (p. 49). He achieves an appropriate balance by highlighting the massive exchanges of genetic material that have occurred during our species' history, such that “in terms of our DNA, all humans overlap” (p. 50). Because of this overlap, we observe a geographic continuum of genetic variation, and individual humans (and even populations) do not always fit neatly into the categories some-

times defined as races. As the author demonstrates, accurate depictions of human genetic variation, including our intertwined history, constitute powerful arguments against racism.

Another controversy addressed in this book is the Human Genome Diversity Project, an initiative that was strongly opposed by some groups. Olson presents an evenhanded treatment by including interviews with Cavalli-Sforza, Hank Greely, Morris Foster, and several members of opposition groups, such as the Rural Advancement Foundation International. He feels that studies of human genetic diversity are beneficial and should proceed, with appropriate attention to such issues as informed consent and “group consent” and with sensitivity to the rights and concerns of study subjects.

As with any book written for a popular audience, certain details are glossed over or even misstated. For example, it isn't exactly true that “all humans everywhere in the world have exactly the same set of genes.” And the proportion of conceptions that end in miscarriage is definitely greater than 20%. But such transgressions are relatively minor and detract little from the impact of the book. The one assertion I found troublesome—in part because it appears in multiple places in the book—is that all humans alive today are direct descendants of virtually everybody who lived more than a few dozen gen-

erations in the past. Thus, we are all said to be direct descendants of Confucius, Julius Caesar, Nefertiti, and even Kennewick Man. This claim is based on a statistical analysis by J. Chang (Adv Appl Prob 31:1002–1026) that assumes random mating throughout the population, no geographic structure, and a constant population size. As Chang himself recognized, these assumptions are completely unrealistic for the entire human population and therefore would not support Olson's conclusions. Fortunately, this was the only major factual element that I found objectionable.

In sum, this book nicely outlines the potential of human genetics to improve not only human health but also our understanding of our common origins and history. It deserves to be read and enjoyed by a wide audience.

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