BOOK REVIEWS

The Ten Thousand Year Explosion: How Civilization Accelerated Human Evolution

By **Gregory Cochran** & **Henry Harpending**
Basic Books, New York, NY, 2009, xii + 288 pp., ISBN 0465002218 [Hdbk, $17.82]

Reviewed by: **Aurelio José Figueredo** and **Pedro Sofio Abril Wolf**
Ethology and Evolutionary Psychology, Dept. of Psychology, University of Arizona, Tucson, AZ 85721-0068 [E-mail: ajf@u.arizona.edu; wolfp@email.arizona.edu]

Overall, we found this book to be very easy and entertaining to read. Among its many merits are that it is short and sweet and to the point. We used an earlier, prepublication version of this book that was generously provided to us by the authors as the first reading in a recent graduate seminar that the first author of this review taught on "Evolutionary Theories of Culture". The second author of this review was one of the graduate students in that course, and provides a student's perspective. Based on student feedback during class discussion, it was clear that the majority of them enjoyed the book and found it a valuable addition to the course. The text was used to prepare the students for the controversial concept of gene-culture coevolution, which requires an acceptance (at least in principle) of the possibility of significant human genetic change during historic time. The traditional view has long been that pure cultural evolution, without any associated genetic selection, has been dominant during the last 10,000 years.

It is unfortunate that many researchers who study human evolution believe that human evolution during the Holocene (i.e., the last 10,000 years, as in the book's title) has not occurred. This book makes it clear that evidence for phenotypically significant Holocene genetic evolution is rapidly accumulating. Many Darwinian anthropologists and molecular geneticists concur with Cochran and Harpending that human evolution did not end with the close of the Pleistocene, but instead continued well into the Holocene (e.g., Irons, 1998; Hrdy, 1999; Evans, Gilbert, Mekel-Bobrov, Vallender, Anderson, Vaez-Azizi, Tishkoff, Hudson, & Lahn, 2005; Mekel-Bobrov, Gilbert, Evans, Vallender, Anderson, Hudson, Tishkoff, & Lahn, 2005). The 10,000 years or more since the inception of agriculture have been more than enough time for gene-culture coevolution to produce physiological and behavioral genetic adaptations to the dramatically altered conditions of existence (Lumsden & Wilson, 1981; Irons, 1998).

The authors make a strong empirical argument supporting the theory that evolution did not stop with the onset of the Holocene and, in fact, may have sped up during this period. For this reason alone, this book is an important contribution to the study of human evolution. For example, among the genetic changes during the Neolithic period cited by Cochran and Harpending are the evolution of genes for lactose tolerance and for resistance to malaria. Convergent evidence from other sources for such continuing gene-culture coevolution includes the finding that the geographic patterns of variation in the first principal component of gene frequencies for the six most important milk proteins in native European cattle breeds correlated both with the locations of European Neolithic cattle farming sites (-.75) and with the frequency of genes for lactose

tolerance (-.59) in modern Europeans, the distribution of cattle farming sites being correlated (.73) with the lactase persistence gene frequencies (Beja-Pereira1 et al., 2003). Similarly, the spread of genes for sickle-cell anemia was correlated with the spread of the malaria parasite, with its mosquito vectors, and ultimately with the clearing of patches of rainforest for the cultivation of yams in Africa (Durham, 1992; Coluzzi, 1999).

Given the massive changes in both morphology and behavior that have occurred in virtually all of our domesticated plants and animals in exactly the same time period (Palumbi, 2001), it is hard to believe that gene-culture coevolution did not produce any significant changes in humans during the Holocene (Lumsden & Wilson, 1981). Arguably, these domesticates changed our "Adaptively Relevant Environments" (Irons, 1988) as much as we changed theirs. There is substantial molecular genetic evidence for massive population expansions and migrations during the Holocene over many large areas of the world, typically correlated with innovations in, and intensification of, food production (Cavalli-Sforza, Menozzi, & Piazza, 1993, 1994).

The book is written in a lively fashion with a considerable amount of solid historical, archaeological, and molecular genetic evidence presented in support of continuing human genetic evolution during the last 10,000 years. The numerous particulars provided are well-documented ones that help not only to persuade the reader that recent human genetic evolution must have happened, but also to convince the reader that it did in fact demonstrably occur. On the other hand, we do have certain constructive criticisms of the book that we hope that the authors might correct in any future edition.

For example, the major claim made in Chapter 2 is that immigrant Cro-Magnon populations may have experienced enough low-level interbreeding with Neanderthals so that a biologically meaningful number of Neanderthal genes found their way into the European gene pool. The implication is made that this selective introgression (the transfer of genes from another species) might account for some of the unique features of contemporary Europeans as opposed to non-Europeans. We believe that there is no need to base so much of their otherwise solid argument upon a hypothesis that is likely to be controversial in the light of the many recent molecular genetic findings that establish a very large genetic distance between modern humans and Neanderthals. As it stands, the hypothesis that Cro-Magnons interbred with Neanderthals appears (perhaps unnecessarily) to be a major premise for the arguments being made in the book, but the empirical evidence presented in this chapter in support is weak at best. However, we do not believe that agreement with the Neanderthal admixture theory is really necessary to the remainder of the argument.

There are very plausible alternative hypotheses to interbreeding with Neanderthals for the evolutionary changes in question, such as the relatively stable environment of the Holocene enabling the invention of farming as a mode of subsistence (e.g., Figueredo et al., 2007). This novel form of subsistence resulted in higher population densities, and both of these factors in combination provided novel and strong adaptive problems that resulted in an acceleration of human genetic evolution. In addition to being perhaps equally likely, this alternative hypothesis may be more palatable to many than the seemingly Eurocentric hypothesis of the incorporation of valuable Neanderthal genes as a major driver of this evolutionary change. In our opinion, the Neanderthal information was worth presenting but not to the extent it was emphasized in this chapter. Fortunately, the very next chapter does indeed emphasize the importance of the

agricultural revolution to recent human evolution.

Another problem with the current form of the book is an inconsistency of style. The book alternates between a very technical style and a very informal style in a way that may be a bit jarring to some readers. While we appreciate the evident effort on the part of the authors to write a book that will be both appealing and accessible to a broad readership, a sufficiently and consistently authoritative tone might have been preferable in our opinion.

The empirical examples given in the book are helpful, but we believe that they should be expanded upon in any future edition in order for a more general readership to be able to understand them adequately. Given that this is a relatively new topic of research, providing more information on the limited number of documented test cases of recent human evolution is particularly important.

Within the context of the graduate seminar in which we used this book, we found that reading this at the outset did much to dispel the common skepticism regarding the relative speeds of genetic and memetic/cultural evolution. The conventional wisdom is that memetic evolution is so much faster that cultural change leaves genetic change pretty much in the dust. This book does much to support the controversial position of Lumsden and Wilson (1981) that what is in fact occurring is a more symmetrical gene-culture coevolution and not the one-sided arms race proposed by Dawkins (1976), in which parasitic memes can have their way with our bodies. The book therefore helped set a more balanced tone at the beginning of the theoretical discussion and we strongly recommend it for that purpose.

References

Beja-Pereira1, A., Luikart, G., England, P. R., Bradley, D. G., Jann, O. C., Bertorelle, G., Chamberlain, A. T., Nunes, T. P., Metodiev, S., Ferrand, N., & Erhardt, G. (2003). Gene-culture coevolution between cattle milk protein genes and human lactase genes. *Nature Genetics, 35(4),* 1-3.

Cavalli-Sforza, L L., Menozzi, P., & Piazza, A. (1993). Demic expansions and human evolution. *Science, 259,* 639-646.

Cavalli-Sforza, L. L., Menozzi, P., and Piazza, A. (1994). *The History and Geography of Human Genes.* Princeton, NJ: Princeton University Press.

Coluzzi, M. (1999). The clay feet of the malaria giant and its African roots: Hypotheses and inferences about origin, spread and control of *Plasmodium falciparum*. *Parassitologia*, 41, 277–283.

Dawkins, R. (1976). *The Selfish Gene,* Oxford: Oxford University Press.

Durham, W. H. (1992) *Coevolution: Genes, Culture, and Human Diversity.* Stanford, CA: Stanford University Press.

Evans, P. D., Gilbert, S. L., Mekel-Bobrov, N., Vallender, E .J., Anderson, J. R., Vaez-Azizi, L .M., Tishkoff, S. A., Hudson, R. R., & Lahn, B. T. (2005). Microcephalin, a gene regulating brain size, continues to evolve adaptively in humans. *Science, 309(5741),* 1717-1720.

Figueredo, A.J., Brumbach, B.H., Jones, D.N., Sefcek, J.A., Vásquez, G., & Jacobs, W.J. (2007). Ecological constraints on mating tactics. In Geher, G., & Miller, G.F., (Eds.), *Mating Intelligence: Sex, Relationships and the Mind's Reproductive System* (pp. 335-361). Mahwah, NJ: Lawrence Erlbaum.

Hrdy, S. B. (1999). *Mother Nature: Maternal instincts and how they shape the human species.* New York: Ballantine Books.

Irons, W. (1998). Adaptively relevant environments versus the environment of evolutionary adaptedness. *Evolutionary Anthropology, 6(6*), 194-204.

Lumsden, C. & Wilson, E.O. (1981). *Genes, Mind, and Culture: The Coevolutionary Process*. Cambridge, MA: Harvard University Press.

Mekel-Bobrov, N., Gilbert, S. L., Evans, P. D., Vallender, E. J., Anderson, J. R., Hudson, R. R., Tishkoff, S. A., & Lahn, B. T. (2005). Ongoing adaptive evolution of ASPM, a brain size determinant in Homo sapiens. *Science*, *309(5741)*, 1720-1722.

Palumbi, S. R. (2001). *The Evolution Explosion: How Humans Cause Rapid Evolutionary Change*. New York: WW Norton & Company.

Aurelio José Figueredo, Ph.D., is a professor of psychology at the University of Arizona, and serves as Director of the Graduate Program in Ethology and Evolutionary Psychology and Co-Director of the Graduate Program in Program Evaluation and Research Methodology. His major area of research interest is the evolutionary psychology and behavioral development of life history strategy, sex, and violence in human and nonhuman animals.

Pedro Wolf, M.A., is a graduate student at the University of Arizona in the Graduate Program in Ethology and Evolutionary Psychology. His major research interests are human evolutionary genetics and its relation to the evolution of human behavior.

Sexe Machines: 50 découvertes scientifiques qui changent nos idées reçues sur la sexualité

[Sex Machines: 50 scientific discoveries that are changing our ideas about sex]

By **Charles Muller** and **Peggy Sastre**
Max Milo Editions, Paris, 2007, 215 pp., ISBN 978-2-35341-006-4 [Pbk, 16 €] *{in French}*

Reviewed by **Glenn Weisfeld**
Department of Psychology, Wayne State University, Detroit, MI, 48202, USA
[e-mail ad4297@wayne.edu]

True to its title, this book is a collection of recent studies on human sexuality. Its sections are: sexual attraction, sexual pleasure, sex and the brain, hormones and pheromones, the ovulatory cycle, sexual orientation, and miscellaneous. An epilogue discusses the respective adaptive advantages of sexual and asexual reproduction; sexual selection and parental investment; reproductive arrangements in primates; polygyny; concealed ovulation; and sexual selection for intelligence and creativity.

Each study or group of studies is clearly described in two or three pages. Methodological details about the subjects and procedure are included. Relevant previous research is cited, and complete citations of the original articles are provided. The authors are, respectively, an author and editor of popular science, and a popular writer with a doctorate in science. I noticed no scientific errors—remarkable for a popular science book.

I found the selection of articles and interpretation of results to be excellent. This said, everyone has his or her favorites; I wish that the book described the underlying brain