Book reviews

Morning has broken: ten years after the dawn of evolutionary medicine

A review by Dieter Ebert and Natalia V. Sokolova

Evolutionary Medicine. Edited by Wenda R. Trevathan, E. O. Smith & James J. McKenna. Oxford University Press 1999. ISBN 0 19 510356 4. Price £24.95.

Have you ever been confronted with the question: 'Can evolutionary biology be of practical interest to mankind?' There are many possible examples you could give to support an affirmative answer, but those relating to human health and well being will certainly be the most convincing. This is what this book is about and because of that it might be useful in convincing your layman neighbour of such a point of view. The authors argue forcefully for an evolutionary perspective on human diseases, with the aim of providing a deeper understanding of their proximate and ultimate causes and, in part, to offer avenues for improved treatments. The book is aimed not only at those people who want to learn more about an evolutionary approach to medicine, but also seeks to convince those who do not see humans as part of nature, and therefore not subject to the laws of biology. This Creationist type of thinking, which is still fairly common among medics, might have prevented previous generations from using evolutionary thinking as a tool in medicine. This aim deserves pursuit and this book may succeed in influencing the way medically qualified people think about their field.

Ten years after evolutionary medicine first gained recognition (Williams & Nesse, 1991), the field has found many applications. The book by Trevathan *et al*. covers many of them. The list of subjects, which are discussed over the 18 chapters and 469 pages, is long and themes cover many aspects of human biology and disease: neonatal jaundice, sudden infant death syndrome, asthma, pathogen virulence, chronic degenerative diseases, substance abuse and addiction, incest avoidance, and nutrition, to name just a few. These topics are certainly of great public interest and therefore a wide readership may be expected even among nonscientists. Although this book may be entertaining to many people, it lacks the power to convince evolutionary biologists themselves about the critical need to apply evolutionary thinking to medicine.

A leading theme in many chapters is the idea that most of humanness evolved during the Stone Age (about 200 000–10 000 years before present), i.e. when our ancestors lived as hunters and gatherers on wild food resources. Presumably, by the end of this period human beings were well-adapted stone agers and unprepared for the changing environment brought about by the rapidly spreading agricultural lifestyle. As a consequence, we supposedly still carry until today traits that were adaptive in pre-agricultural societies, but prove to be useless or even detrimental now. A convincing example illustrating this notion may be dental caries, which, according to palaeontological records, seems to have appeared only with the onset of the carbohydrate-rich diet of agricultural times. This hypothesis sounds compelling, but a closer inspection reveals that there is more to human nature than its evolutionary legacy from the Stone Age. Certainly the beginning of agriculture signifies a major change in the human environment, but there were other environmental changes as well and every one of them might have had its consequences. The Stone Age argument relies heavily on the notion that evolutionary processes are too slow to lead to adaptations in 10 000 years. A number of examples indicate that this is not the case. For instance, the ability of the majority of mankind to digest milk (lactose tolerance) is believed to be an adaptation to the availability of milk as nourishment for adults after the domestication of wild stock. Likewise, the spread of certain resistance genes to infectious diseases is suggested to have occurred only after human settlements reached densities high enough for the disease agents to cause continuous problems (i.e. after the end of the Stone Age). On the other hand, the Stone Age was presumably long enough to allow for a generally well adapted human being to evolve. However, bipedalism and senescence are certainly older than the Stone Age, and problems related to them were not solved during the last half a million years. After all, *Drosophila* and *Caenorhapditis elegans* show senescence as well. Thus, there must be more to evolutionary medicine than just explanations based on the changes in human environment and life style. Some of the other likely reasons for the aforementioned problems, e.g. antagonisitc pleiotropy and recurrent deleterious mutations, are underrepresented in the discussions on evolutionary causes of diseases in this book.

Much of the book does not come up to the expectations of an evolutionary biologist. Although many

chapters are rich in interesting details, the evolutionary toolbox used to construct logical arguments connecting these details to the grander picture is sometimes rather limited. As a result the reader is left with just-so-stories, and in most cases (but there are exceptions) alternative hypotheses are not considered. The arguments given in support of the presented hypotheses are mostly qualitative and not quantitative. For obvious reasons, there are only a few chapters reporting results of experimental studies. Evidence is often based on comparisons between western and primitive societies and in a few cases between humans and animals. Thus, if you expect to find solid evolutionary arguments in the book, you will be rather disappointed.

The above-mentioned shortcomings clearly indicate that the field of evolutionary medicine remains largely unexplored. This will hopefully change in the near future, as this field certainly deserves more attention. If your graduate student is looking for a research topic with some interesting perspectives, evolutionary medicine might be a good choice. However, the field of evolutionary medicine is not well represented in the book by Trevathan *et al*. but rather highlights certain aspects of it. In particular, we felt a lack of theory and clear conceptual thinking is a weakness. Therefore we would recommend this book only together with another recent book on the same topic, edited by Stephen Stearns (1999). Together, these books give a good overview of the field and its problems and highlight the numerous unexplored areas that are ripe for further investigation and for the development of rigorous research programmes.

The most powerful tool evolutionary biology can provide to medicine is a concept-orientated thinking that allows formulating hypotheses and testing their predictions. This method may be particularly helpful in those cases where traditional approaches have failed. However, care should be taken not to 'throw the baby out with the bath water'. Evolutionary method is very powerful, but its usefulness for medicine has to be thoroughly tested. The accumulation of examples where evolutionary approaches have made positive contributions to human health and well being is very slow. Traditional medicine has been enormously successful in the last 100 years and it will certainly continue to be so. Evolutionary medicine cannot compete with this success, but it may add to it, by pointing out alternatives and suggesting unconventional solutions that might have been overlooked otherwise. The contributors of the book deserve credit for their attempt to use the conceptual power of evolutionary biology to work out medical problems and to suggest further directions of research.

References

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Adaptive evolutionary change in natural populations

A review by Derek A. Roff

Adaptive Genetic Variation in the Wild. By Timothy A. Mousseau, B. Sinervo and John Endler, eds. Oxford University Press, Oxford. 2000. 265 pp. Price £40.00. ISBN 0-19-512183-X.

The meaning of the title of this book is not immediately obvious and it is only in the last chapter, an overview by John Endler that its meaning is defined (p. 251), 'I use the term ''adaptive genetic variation'' in the sense of genetic variation that is correlated with variation in lifetime or total fitness of individuals'. In other words, genetic variation that permits adaptation. This is slightly at odds with the description given in the preface, which is (pv), 'The central thesis of this collective work is that the expression of genetic variation is modulated and shaped by the action of natural selection in the natural environment'. I do not disagree with either of these statements and both can be applied to the chapters in this book, to the extent that genetic variation is presumed to exist. However, none of the chapters, with the possible exception of chapter 1 (see below), addresses the questions 'how is genetic variation maintained?' or 'is genetic variation *per se* adaptive or does it merely permit adaptation?' At the present time we do not have satisfactory answers to either question.

Within the above limitation of the scope of research this book provides a valuable glimpse into the continuing research on adaptive evolutionary change in natural populations (which is probably a better title). The collection of chapters is not organized in any particular manner (at least to this reviewer) and the chapter I would suggest starting with is the last chapter, the overview by John Endler.

The 10 chapters forming the main body of the book are each organized about a particular taxon, from the level of the species to variation among families, with most focusing upon variation within species. After reading Endler's overview I recommend the following sequence of chapters (there are a number of possibilities but I definitely found the order as given not satisfactory):

(1) Chapters emphasizing genetic variation and its consequences: Chapter 9 by Hoffman addresses the question of whether genetic variation measured in the