BOOK REVIEW

Darwin's spectre: evolutionary biology in the modern world

Michael R. Rose

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Reviewed by AMITABH JOSHI*

It is easy to underestimate the importance of Darwin's intellectual legacy. Most of us, especially in India, first encounter Darwin in secondary school not as the architect of one of the greatest intellectual revolutions in the history of humankind, but as one among many biologists whose contribution is summed up in three trite phrases: *over-production of offspring, struggle for existence*, and *survival of the fittest*. Unfortunately, this state of affairs persists long after secondary school has become a memory far more pleasant than the experience was at the time. Most people, including most biology students in India, would probably think you were being facetious if you told them that Darwin was among the greatest thinkers the world has ever produced, and, moreover, one whose thinking has indelibly changed not only the intellectual but also the practical world. In a class of 14 bright postgraduate students that I taught a few years ago, 13 felt that evolutionary biology had no practical applications (the sole dissenter was a Ph.D. scholar pursuing research in evolution).

Yet, Sir Peter Medawar, a recipient of the Nobel prize for his pioneering work in immunology, once stated, '*For a biologist, the only alternative to thinking in evolutionary terms is not to think at all*.' And modern evolutionary biology, our Darwinian heritage, far from being of purely academic interest and no application, has profound implications for crop improvement, animal husbandry, medicine, pest control, conservation of biodiversity, and the use of DNA data for forensic purposes. Moreover, a Darwinian point of view is also very helpful in trying to understand human behaviour, whether individual or social. As if this were not enough, Darwinism has been (ab)used by political and social demagogues of the right and the left to justify crimes against humanity ranging from segregation of ethnic groups to genocide. Professional evolutionary biologists have been vilified, and, in some countries at certain times, have even lost their lives for being adherents of Darwinism. Teaching Darwinism has been, and continues to be, banned by certain governments, and one can often hear supposedly serious and sober gentlemen on TV channels in America explain that the decline of the civilized world as they know it is entirely due to Darwinism. Clearly, there is something unique about Darwinism among major biological theories: nobody loses their life because of an unshakeable belief in photosynthesis!

What is it about Darwin's intellectual legacy that is so unique? How is Darwinism important from a practical (i.e. applied) point of view? Why does Darwinism frighten many people and groups, and anger others? How might a Darwinian viewpoint help us understand human behaviour, whether in the marketplace, or in the political arena? These are some of the questions that the book *Darwin's spectre* by Michael Rose, professor of evolutionary biology at the University of California at Irvine, tries to answer, and in a manner that is accessible to a nonspecialist reader. The scope of Darwinism, and of its implications, is so wide that even to attempt to write such a book is, in my opinion, a courageous act. The real problem facing an author intrepid enough to attempt such a task is to reconcile the need to deal with fairly deep, often subtle, conceptual issues, with the requirement that the book be neither too long, nor too dense, so as to keep it accessible to the general readership at which it is aimed. On this count, Rose has succeeded to a remarkable degree. The book is rigorous and technical enough to satisfy professional evolutionary biologists such as myself, and, yet, is very readable, often entertaining, in addition to being informative and thoughtprovoking.

The book is divided into three parts of roughly equal length. In the first part, Rose outlines the development of modern evolutionary thinking, starting with a brief introduction to the social, scientific and political climate in England and Europe at the time of Darwin, going on to summarize Darwin's life, and ending with contemporary issues such as genetic constraints on adaptive evolution, and the use of game-theoretic concepts to study evolutionary processes. This section is one of the best and most readable distillates of evolutionary theory that I have ever come across, and I think it deserves to be read by every serious student of biology. Before Darwin, three features of the living world were a source of bewilderment to natural scientists: the relatedness of species, the diversity of species, and the adaptedness of species. The standard explanation for all of these was to fall back upon the notion

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that living beings had been created by god, and that the marvellous diversity and adaptedness of species was a reflection of god's perfection as a creator. '*In total*', to use Rose's words, '*Darwin provided a foundation for biology which was completely free of religious elements. For molecular biologists, this contribution is very much in the background. They can just go on with experiments whose rationale derives more from principles of organic chemistry than evolutionary biology. But the fact that they do not need to bow toward Rome or Canterbury, by way of scientific piety, is largely the result of Darwin's achievement. And away from those biological fields where straightforward molecular analysis is enough to unravel all problems, the evolutionary reasoning first provided by Charles Darwin is often the central means of intellectual analysis, defining problems, suggesting alternative solutions, and deciding among competing hypotheses. Modern biology would be inconceivable without Darwinian theories and findings*.'

Another often underrepresented achievement of Darwin that is well brought out by Rose is that Darwin placed variation among individuals of a species at the centre of the living world. Prior to Darwin, there was a pervasive belief among biologists that a species could be represented by an *archetype*, a sort of ideal representative of that kind of organism. In this view, variation among individuals was a sort of background noise: irritating, and relatively meaningless. This point of view, called *typological thinking* by Ernst Mayr, still lives on in the field of taxonomy (and, unfortunately, in biology curricula in India). Of course, the reason for this concept being alive in taxonomy is very practical. To classify organisms into groups, one must ignore some differences, while concentrating on broad similarities; else one will end up classifying each individual as a separate species. Justifying the persistence of typological thinking in our curricula is considerably more difficult. Variation among individuals is practically a defining hallmark of living systems. Moreover, variation is central to the process of evolution by natural selection. If all individuals are identical, what is there to select? Indeed, when one decides to become an evolutionary biologist after having undergone a basic biology education in India, the most difficult feat to achieve is to shift one's mode of thinking from a typological and deterministic one to a probabilistic one in which variation is important in its own right, not mere noise about some golden mean.

In the second part of the book, Rose discusses practical applications of Darwinism. Many people, of course, are aware of the importance of Darwinism to agriculture. The development of better varieties of animals and plants by breeding is essentially an attempt to drive the evolution of those breeds towards a goal determined in advance by us. In breeding, therefore, we humans are subverting the process of natural selection to our own ends. Needless to say, the better one understands something, the easier and more efficient the subversion. Historically, too, it was by analogy to the ancient practice of animal and plant breeding that Darwin refined the argument in favour of evolution through natural selection. Today, with the advent of molecular-biology techniques, it is easy to downplay the importance of classical plant and animal breeding. However, even this modern technology, seemingly far removed from the issues of evolution, has come with its baggage of potential problems for which only evolutionary biology suggests solutions. To take just one example, there is considerable concern today about the possibility of 'foreign' genes from a genetically modified plant spreading to other, related wild species (imagine the consequences of a transgene for herbicide resistance getting transferred from a crop to a weed). The evaluation of the likelihood of this type of gene flow is a problem smack in the domain of evolutionary biologists, who have been studying gene flow as an evolutionary process for decades.

Less well known and far more recent than the relationship of Darwinism and agriculture is the role Darwinian thinking plays in medical issues. This is an area where Rose's own research on the evolutionary biology of ageing over the past two decades has been instrumental in getting the medical community to appreciate the importance of an evolutionary perspective when dealing with geriatric problems. In this section of the book, Rose also outlines how the Darwinian framework allows for a much better understanding of the intricacies of host–pathogen relationships which, obviously, have a bearing on how we deal with infectious diseases. The interface of epidemiology and evolutionary biology is today a very active research area, and one that is already beginning to influence medical practices. Understanding the evolutionary genetics of antibiotic resistance in microbes is another obvious research area where evolution and medicine meet with important practical consequences.

In addition to beneficial applications of Darwinism, Rose also dwells upon its abuses (the demonic aspect of Darwin's Spectre), and outlines the history of eugenics, an attempt to guide the evolution of humans that, in its most extreme form, resulted in the gas chambers of Nazi Germany. Racism, of course, predates Darwinism, but, in the hands of demagogues, Darwinism provided a facade of 'scientific' respectability to hate-mongering. On the other end of the political spectrum in mid-twentieth-century Europe, the Soviet regime under Stalin persecuted Darwinians and geneticists for believing that the genes present in individuals in a population constrained the evolutionary possibilities open to it. This was decreed to be a counterrevolutionary idea because the Stalinists believed that the environment would mould evolution in favourable directions. In addition to briefly chronicling this sad misapplication of Darwinian thought to social tinkering, Rose also marshals some of the main lines of argument from evolutionary genetics that debunk the main tenets of racist ideology.

The last third of the book is the most speculative, extremely thoughtprovoking, and very likely to be controversial. In this section, Rose is theorizing at the intersection of biology, sociology and psychology, trying to present

alternative Darwinian ways of understanding human behaviour, both individual and social. Two alternative evolutionary theories of human behaviour are contrasted here, and some suggestions are made of how these theories might be tested. In one view, typically called evolutionary psychology, human behaviour is considered as being more elaborate than the behavioural repertoire of other animals, but not essentially different. Thus, various specific human behaviours are assumed to have evolved by natural selection because they are adaptive. The alternative theory, called Immanent Darwinism by Rose, suggests that human behaviour has actually evolved to be very flexible, open-ended and indeterminate. In this view, specific behaviours are less likely to be genetically programmed in humans than in most other animals. Instead, human behaviour is viewed as being characterized by the ability to assess situations and make responses to them that are consistent with an optimization of Darwinian fitness. Rose presents some interesting suggestions as to how such a flexible behavioural repertoire might have evolved. He also stretches the logic further and shows how these two alternative theories lead to profoundly different predictions about how human societies will evolve, and how Immanent Darwinism provides a reasonable explanation for some interesting social, economic and political behaviours that are seen in most human societies.

To sum up, this is an excellent book that I would recommend to people irrespective of their background. It is very lucid, concise, informative, thoughtprovoking, and, yet, entertaining. This will not be surprising to those who, like me, are familiar with Rose's technical writing. He is one of the few scientists I have read whose scientific papers actually make for interesting reading quite independently of the merit of their scientifc content. Of course, as in any book, one may find things, especially in the last section, with which one disagrees, but these are interesting nevertheless. Biologists, sociologists, psychologists and philosophers will all find something of interest in this book, as will that faceless person often labelled the 'intelligent reader', a category that, in my opinion, includes the vast majority of literate individuals.