

BOOK REVIEW

Beyond Darwin and Dawkins: life is more than its genes

Genetics and the Logic of Evolution

KM Weiss and AV Buchanan

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Reviewed by J Blamire

'In this book, we will be searching for generalities'. It takes a lot of courage to write a sentence like that, and these authors certainly show a lot of courage in tackling a subject that has consistently eluded any such generalities or simple explanations in the past. In the 19th century, Charles Darwin formalized a theory of how organisms evolve by the action of natural selection on their bodies and behaviors. Since he did not know any better, his formalization was based on phenotypes, not genes. He had no idea how phenotypes were created or passed on from one generation to the next. In the 20th century, the mechanism of inheritance was slowly elucidated. The idea of a gene controlling the production of a protein that became a trait, which finally became the phenotype, gradually improved to the point where evolutionists could now incorporate these new ideas into Darwin's original theory. This also led to ways of quantifying the dynamics of gene changes: the whole area of population genetics. However, in the 21st century, as our ability to study genetic regulation has improved, even these extensions of Darwin are no longer enough; hence this book.

Much of modern biology treats organisms as if they can be broken down into discrete, decomposable, building blocks, each coded for by their own gene. Much like an executing a computer program, a creature can be assembled into its predictable phenotype just by knowing which bit goes where. Natural selection then goes to work in a Darwinian manner on the final product and the successful genes and genetic programs leave more offspring and win the evolutionary race. It is not that easy. Too much is missing from such a simple, mechanistic picture. In some ways, nonprotein-coding elements have been downplayed (or even excluded) from the textbook theory of inheritance and thus evolution. Problems of the noncoding DNA that controls and regulates the traditional 'coding' gene are glossed over and none of the latest discoveries in gene regulation have yet been properly incorporated into a comprehensive theory of inheritance and evolution. As this book points out, over and over again for many, many chapters, the pioneering work of Darwin (and Wallace) gave us a basic theory of evolution-by-phenotype, but we still do not have a good, modern theory of how the increasingly complex relationships between genotypes and phenotypes can be incorporated into this theory at anything beyond the simplest level.

What is needed, these authors say quite vocally, is a good *phenogenetic* theory; one that combines the relationship between genotypes and phenotypes, the genes

involved (and variants of those genes), how they are controlled and regulated, and what is the role (the nature and extent) of selection in directing evolution. This is a VERY tall order. As chapter after chapter unfolds, the reader is shown instance after instance where phenotypic traits have more complex genetic and nongenetic components than were known just a few years ago, and thus cannot be easily seen to have evolved by simplistic natural selection mechanisms. The authors are very convincing, perhaps too convincing. It is hard, after being pounded by the evidence they present, to still hold onto the simpler, gentler theory of evolution found in most college textbooks. Just as Darwin did in the several editions of his famous work, so do these authors try to overwhelm the reader with evidence, and more evidence, until the reader is beaten into the acceptance of their point.

This is a comprehensive tome that is not for the faint of heart. There is a wealth of detail summarized in each topic and while it might be easy to pick apart small aspects of what is written, it would be petty to do so. Since information in most of these fields changes so rapidly, it is always possible to find some out-of-date names and details. A better set of URLs to weblinks for some of the faster moving topics would have been a big help. However, it is not in the details that the strength of this book lays, it is in the ideas it delivers. *Phenogenetics*, as presented in this book, tries to incorporate what is known about the regulation of gene expression, the interaction between genes, and the relationship to environmental factors, into a more inclusive definition of inheritance and thus, by extension, into a larger theory of evolutionary mechanisms. For anyone who wishes to know more about genes and evolution and go beyond the classic, classroom theory – this is the book for you. Moving beyond the opening chapters on understanding biological complexity, the reader is taken through the building blocks of life, to awareness of self (internal and external!) to a finale on the evolutionary order and disorder between phenotypes and genotypes. This book tries to say it all and take you on a ride you won't regret. It is a book to reach for whenever you are feeling self-satisfied and think you already know all there is to know about evolution.

If I have a small quibble with this text it is in the way it is written. Time after time it was necessary to go back to the beginning of a sentence or paragraph and reread it (several times) before the beauty of its meaning became apparent. These authors are no Darwin or Dawkins when it comes to clarity of writing style. However, that is a small price to pay for the reward at the end. Darwin himself, in 1817, admitted that natural selection alone was not enough to explain how creatures came to be what they are today. In this book he might have found at least a partial verification of these doubts, but also a lot of support for the basic principles he had laid down. Quite an achievement, but not the generalities the authors had hoped for.

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