BOOK REVIEW

The deep roots of evo–devo and the ‘origins’ question

Treasure your exceptions: the science and life of William Bateson

Alan G. Cock and Donald R. Forsdyke

Springer 2008, 745 pgs

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The more things change, the more they remain the same, though the fundamental similarities are often masked by superficially differing veneers of terminological and technological refinement. A hundred years ago, when William Bateson, co-founder of Journal of Genetics, was in his prime, the world of biology was mired in the great debate between the ‘Mendelians’ and the ‘Biometricians’ that lasted over a decade and finally needed the genius of Fisher for its formal resolution through the reconciliation of statistical results on the correlations between relatives and the first principles of Mendel’s laws. Fisher’s work clearly established the compatibility of discrete inheritance with continuous phenotypic variation via the postulation of many Mendelian factors (genes) for each trait. A major issue that underlay this debate, however, was not resolved by the formalism of quantitative genetics. This involved the question of phenotypic variation, its genesis and role in speciation. The essential question was whether the kind of relatively small-scale continuous variation that was typically seen among individuals within species was relevant to the production of species differences. This question was largely ignored in Darwin’s seminal book that, despite its title, had little to say about the mechanisms for the origin of new species. An implicit belief that natural selection among individuals would lead to differences large enough to yield species given sufficiently long spans of time permeates Darwin’s book, and this belief was further strengthened by some, especially Dobzhansky, during the Neo–Darwinian Synthesis in the mid-twentieth century.

Two major sets of developments in twentieth century genetics contributed to the question of variation being shelved by most mainstream geneticists. First, the flowering of transmission genetics into an extension of Mendel’s laws to entire populations yielded a coherent theoretical framework for microevolutionary change in the genetic composition of populations. However, this approach ignored phenotypes and focussed on genotypic variants and how their relative abundance would change as a consequence of arbitrary differences in Darwinian fitness among them. The second, and later, development was the establishment of a detailed understanding of expression genetics: how genes give rise to proteins. This approach, too, largely ignored organismal phenotypes, especially for traits that had traditionally been of interest in evolution due to their ecological relevance. Of course, some geneticists like Richard Goldschmidt and Cyril Waddington continued to emphasize the importance of understanding the nature and genesis of variation to speciation, but these concerns were treated largely as anachronisms and had little influence of the development of genetics during much of the mid-twentieth century.

In the past few decades, however, this old question of variation has been resurrected as part of the growing field of evolutionary–developmental biology or evo–devo. Of course, evo-devo itself was an outgrowth of the stunning advances in our understanding of the genetic control of the various processes in development that give rise to the body-plans characteristic of different taxa. With a better understanding of the genetic and epigenetic control of the ontogeny of form has come a renewed appreciation of the Batesonian position that perhaps the kinds of phenotypic variations that are relevant to speciation may be of a qualitatively different kind than the variations that typically mediate the response to selection during adaptive fine-tuning of populations. The times are now, thus, especially propitious for a critical re-examination of thoughts and writings from the early decades of genetics. Often, there are insights to be gained from the thoughts and speculations of past thinkers, particularly if we take the ef-

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fort to understand the context in which they were working. This is why historical works on science are often so important even to the current practise of science, and biography is an important genre of scientific historiography.

Given the centrality of the question of variation in Bateson’s thinking on biology, and the present resurgence of interest in this question, Cock and Forsdyke’s detailed scientific biography of Bateson is very timely. The book is also somewhat unique in that the two co-authors did not write the book together. Alan Cock, a poultry geneticist, began his career working at Cambridge as assistant to Michael Pease who had earlier assisted Reginald Punnett. In the 1970s, Cock decided to write a book on Bateson and over the next many years did a lot of collating of information and records, as well as preliminary writing. The book, however, was never completed. Donald Forsdyke, working on molecular genetics, genomics and bioinformatics at Queen’s University, Canada, independently decided to write about the relevance of Bateson’s ideas to evolutionary biology and eventually realized that Cock had planned to write a biography of Bateson many years earlier. Forsdyke and Cock met in 2004 and the idea of a co-authored book emerged from those discussions. The present book, published three years after Cock’s death, includes two chapters solely by Cock and five solely by Forsdyke, with the remainder being written by Forsdyke but also incorporating material from Cock’s never-published book.

The first 18 chapters, spread over three parts, provide a fairly comprehensive account of Bateson’s professional life and offer the reader a good overview of how his thinking evolved. Bateson’s childhood and student years are sketched out in brief, but with some attention to formative influences. From his first field expedition to Kazakhstan, an attempt to link morphological variation in crustaceans to environmental differences, to his becoming the champion of Mendelism, and up through his being slowly left behind by the rapid march of the Morgan school due to his reservations about the chromosomes being the ‘carriers’ of genes, the book is full of detailed information and insights into Bateson’s speculations about various issues from the perennial question of variations to the material basis of Mendelian factors. The Mendelian-biometrician controversy is discussed in considerable detail, especially the tension between the personal and professional aspects of Bateson’s relationship with Weldon. The authors have also benefited from access to a lot of Bateson’s voluminous correspondence, especially from the period of the rise of the Morgan school at which time there was considerable disagreement between Bateson and Morgan et al. regarding the explanation of the phenomenon of linkage. The fourth part of the book deals with influences, such as Butler’s, on Bateson and indeed on the times. Other chapters in this section deal with issues germane to the sociology of science, especially Bateson’s role in exposing the now notorious Kammerer affair involving doctored specimens of the midwife toad. There is also a chapter on Bateson’s role as an international statesman of biology, especially during the period after World War I when it was important to once again integrate scientific activities and bodies in a politically charged and divided Europe. One chapter covers Bateson’s immense contributions to the cause of educational reform in Britain in general, at both school and university level, and to the cause of women’s education in particular. Bateson championed the argument for awarding university degrees to women and, as early as 1897, was looking forward to universities being truly coeducational. This was a side of Bateson of which I had previously been unaware, and reading this chapter certainly raised my regard for him.

Scientifically, too, there is much in this book that I was not aware of, despite a formal training in genetics and a strong amateur interest in the history of biology. For example, I was not aware that it was Bateson who first suggested that sex determination could be ‘Mendelian’ with one sex being homozygous and the other heterozygous. I had also not known of Bateson’s major early emphasis on epistasis in determining phenotypes. It was also interesting, and ironic, to learn that Bateson and Punnett declined to publish in the Journal of Genetics the paper by Bridges that provided the first clear evidence that genetic recombination was accompanied by exchange of chromosomal segments. This apparently sparked the launching of the journal Genetics in the USA, and the Bridges paper is the first article of the first issue of that journal. Apart from the specifics of Bateson’s life and science, the book is also informative about other figures, not too well known today, and their often very prescient thoughts. Particularly notable in this regard are the discussions of the work of Edmund Catchpool and George Romanes on the importance of reproductive isolation as one of the ‘selective’ mechanisms required for speciation and of Samuel Butler on ‘heredity as information’. It is certainly a book that any serious student of either genetics or evolution would greatly benefit from reading.

That said, however, the book though extremely rewarding is not particularly easy to read. In fact, I found the best way to read the book was to breeze through it once and then do a more careful back and forth reading of specific sections. There is a certain abruptness in the way some chapters begin in a manner that seems to be unconnected to the preceding ones, and certain parts of the book occur out of chronological sequence. Some chapters read like little stand-alone essays unconnected to the rest of the book which, of course, may have been what they originally were. Also occasionally bothersome is the extremely partisan nature of the book. The authors believe that they are rehabilitating Bateson’s ideas and thinking and this, at times, shows itself in a somewhat unnecessary shrillness and, more often, in a somewhat lopsided coverage of controversial debates. Of course, there is no such thing as an objective history, but in this book the subjectivity is perhaps a little too often expressed. There is also a rather avoidable plug for evolutionary bioinformatics at the end. Perhaps a slightly heavier editorial hand may have helped in these specific regards. Despite these minor irritants,
however, the book is a fascinating read and well worth the
effort. It is a splendid addition to the several good historical
works on genetics that have appeared in recent years and also
serves as a salutary reminder that great ideas in science have
a habit of being successively reborn, often in superficially
different forms and guises, and that it is in the avatar that
happens to arrive at a propitious time that an idea strikes root
and gains acceptance. If nothing else, this realization should
serve as a pragmatic impetus for all scientists to carefully
study the history of their respective fields.

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