Book Reviews

Rebels, Mavericks and Heretics in Biology

Oren Harman and Michael R. Dietrich (Editors)
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> *Is the growth of science essentially so slow and so continuous that our attention is attracted only by the sudden showy change, which, like the bursting of a chrysalis, is merely the sequel to something of more importance which went before? Or, does a particular piece of work . . . have a value per se which transcends the others completely? Probably both questions should have affirmative answers.*
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> (E.M. East (1923) 'Mendel and his contemporaries', *Scientific Monthly* 6; 225–237, and epigraph, chapter 4 of *Rebels, Mavericks and Heretics in Biology*)

One of my undergraduate biochemistry assignments involved presenting the work of an iconic biochemist to my peers. A poll was taken based on our presentations, and the winning scientists were elected to the 'Biochemistry Hall of Fame'.

Reading *Rebels, Mavericks and Heretics in Biology* gave me the sense that the authors were competing in a similar game. The aim of this book is not to document milestones in biology (which are well covered elsewhere), but to illustrate characters whose ideas or approaches went against the science of the time. The 19 scientists selected for inclusion are by no means an exhaustive catalogue but were chosen to represent recent history in biology across a range of sub-disciplines. This diversity meant that I approached each chapter from a different perspective. I uncovered fresh insights into familiar names from my own discipline, and was introduced to fields with which I was less well acquainted.

Diversity is apparent in the approach taken by each author to his subject. Some base their writing on their working relationship (Motoo Kimura was a graduate student of James F. Crown, for example, and thus this chapter is based 'in part on personal reminiscences'). Others have written a biography of their subject (Oren Harman on C.D. Darlington) or were otherwise obliged to draw on secondary sources. Snippets of insight come from personal communications and opinions of peers, as well as published scientific works. All of the authors, to varying extents, are at pains to emphasise the maverick nature of their subjects. As each chapter was commissioned, there is no merit to justifying its inclusion, as was the case when I competed with my fellow undergraduates in the Biochemistry Hall of Fame. Indeed, Phillip Tobias establishes that: 'It would convey a wrong impression if I were to paint a picture of [Raymond Arthur Dart] as being dominated by a monomaniacal heretical streak.' Other authors are less conditional in their writing and seem to paint their subjects in the light that the title of the book would suggest.

Given the aims of this book, the authors of each chapter have scope to diverge from a conventional biography. Using controversy as the focus for the discussion leads to a unique consideration of the combination of science, personality and social and historical context that make each of these subjects a rebel in their field. Quirky biographical details illustrate a rebellious nature outside of the scientific context — Howard Temin's scourging of the smokers in the audience at the banquet celebrating his awarding of the Nobel Prize is but one example.

It is clear that the scientists' respective backgrounds affect the public perception of their work. The two females (Barbara McClintock and Thelma Rowell) faced additional barriers due to their gender. As her science made her more famous, McClintock revealed her lifelong self-perception as the unwilling rebel or outsider: she rejected any suggestion that she was 'less rigorous, less mechanistic, less reductionist or more emotional than any other scientist'. Through the filter of interview and reporting, McClintock's 'sensitivity became sentiment' and she tried to diffuse the myth that she had feelings for her research organisms. The delay between her discovery and the award of the Nobel Prize 'has been seen as proof of her marginalization'.

The role of gender is more explicit in the case of primate biologist Thelma Rowell. The contrast between Rowell's findings on behavioural dynamics among baboons and preceding reports could be considered to result from the bias with which men and women observe animal behaviour. Thus, male observers see aggression and the significance of the alpha male, and

Rowell's description of baboon communities centring on the female was initially perceived as heretical.

Is it possible, though, to consider an analogy to the case of heresy in science more generally? Will we see rebellion in science wherever we look? There are numerous examples of biologists who would merit inclusion in a volume such as this, and several are mentioned in the introduction. Louis Pasteur's postulation of the germ theory of disease was disputed by those favouring the spontaneous generation hypothesis, for example. And, although it is considered by some heretical to utter his name in the context of great biologists, J. Craig Venter is undeniably a maverick of our time. Could it be the case, then, that whenever one is considering a great scientist, one uncovers at least something of a rebellious streak? Otherwise, what leads these people to work hard to uncover new science, to break new ground and to disprove those whose work has gone before theirs?

R. C. Lewontin's epilogue reflects on the constraints surrounding science in practice. The culture of science restrains iconoclastic research, particularly among the young, through the metres of grant proposal and peer review. Lewontin expresses the widely understood constraint that 'if one wants to do something innovative ... the best way is to divert funds from already approved research, and then, if the experiments work, to use the results to justify a new research proposal'. Such a formal, systematic approach to breaking new ground in biology is not familiar from the 19 histories documented here. In most cases, tenacity, confidence and good fortune are the key traits combined in the formulation of groundbreaking science.

Despite being united in the maverick status, these scientists are as diverse as any group in background, training and routes to success, as well as in how their work has been accepted (or otherwise) by their peers. With this in mind, one has to question the validity of declaring a subgroup of 'rebels, mavericks and heretics in biology'. Is science not defined by questioning the status quo, posing new hypotheses and being prepared to support your own beliefs? A scientist that is not a rebel, albeit in some small way, inhibits his own capacity for achievement.

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Methods for Computational Gene Prediction

William H. Majoros
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Methods for Computational Gene Prediction is a new work covering contemporary methods for gene prediction. As the number of sequenced genomes has exploded, gene prediction methodologies have seen increasing levels of interest and research over the past 20 years. With the increased importance of genome-based biology, and the problem of automated gene prediction remaining unsolved, in the absolute sense, this topic is likely to remain an active field of research for some time to come. Majoros' timely book summarises and explains the state of the art in the field of *ab initio* gene prediction in a clear, concise and lucid fashion.

This book is a well written and welcome addition to the field. The content is presented as a textbook and, judging by the depth and complexity, it would make an excellent postgraduate level text. I would shy away from using it for an undergraduate level course, however, even for the 'advanced undergraduates' that the cover blurb suggests. Each chapter ends with a series of exercises for students, which should make it easy to integrate this material into any suitable course of study. As for a wider research audience, the book would be an invaluable addition to the bookshelf of any group working in the field of gene prediction or for those who have to work with gene prediction data.

The text fairly comprehensively deals with its subject matter in a relatively brief space. A consequence of this is that the book is very information dense, and it is not difficult to imagine that if you came to the book without a biology or computer science background, you might quickly feel out of your depth. Those with a computer science or mathematics background, however, will probably find that they have an easier time with the information that is presented. Thankfully, the clarity with which the material is presented helps to overcome the density of the information.

The book leads with two brief preliminary chapters, one covering an introduction to the relevant biology and biochemistry and the other covering an introduction to the mathematical and computer science concepts. While the treatment of these topics is, by necessity, rather brief, in some cases a few more simple examples would have helped to make things clearer. I also felt that, for clarity's sake, the mathematical preliminaries chapter may have benefited by being more clearly subdivided into mathematical or computer science topics. In the second chapter, the conventions for the book's pseudo code are covered. As a rule, the pseudo code throughout the book is pithy, clear and well written. This makes the code easy to follow, which will greatly benefit anyone coming to this topic with a strong computer science background.

The remaining chapters follow an alternating pattern, whereby each new topic area is introduced with an overview chapter before subsequent chapters deal with that topic in some depth. The majority of the book concerns itself with hidden Markov models and their derivatives in some detail. This is hardly surprising, given Majoros' background and the current state of the more successful algorithms which underpin the best gene prediction algorithms. Detail in these topics seems to come at the expense of a more complete treatment of some other accessory methods. Dynamic programming gets a rather brief summary towards the start of the book, yet is referenced repeatedly throughout the text. As a result, the book seems rather biased towards hidden Markov model methodologies, although perhaps not unfairly so.

The closing chapters concern themselves with cutting edge research and the future developments that computational gene prediction research software might undergo. In this latter section, a wide range of complex topics are covered in a rather cursory manner. This gives the impression that these topics were included for the sake of completeness, rather than with a view to covering these topics seriously. This is a shame but, to some extent, given the current state of the art, understandable. Combined with the shallow treatment of some of the techniques earlier in the book, it means that this text is rather 'single issue'.

To summarise, this is a clear, well written book and a valuable summary of the current state of the art. While it may suffer from a rather singular view of the world of computational gene prediction, this is understandable and probably shouldn't be of concern to the interested reader. I certainly would not hesitate to recommend it to anyone who requires an introduction to the field of *ab* initio gene prediction.

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