

introductory section ends up somewhat nebulous. However, in the next few chapters, the key elements for Esposito of the Romantic tradition are easily identifiable as they repeatedly appear in various combinations dependent on particular biologists' interests. These elements include 'denial of vitalism and mechanism; the acceptance of living organisation as a postulate; the use of teleological explanations; the complex dialectics between function and structure; the essential organic relation of parts to the whole; and the fundamental interrelatedness of organism and environment' (p. 84).

In his concluding chapter Esposito examines various factors in the decline of Romantic biology whilst noting that there have been occasional revivals. He moves through Romantic biology's connections to vitalism, the taint of association with 'totalitarian philosophies', Rockefeller Foundation funding for approaches to biology based on known successful physical methods (the 'protein paradigm'), the success of the Morgan school's chromosomal theory of heredity opening the door to research on the physical basis of heredity, and the changes in politics and ideology in the Cold War years when ideas of group conflict and competition displaced those of cooperation. This chapter relies heavily on the work of other historians and Esposito does not draw any strong conclusions as to which factors have been more important to his story. Perhaps this will come later with further work on this subject. In the meantime Esposito's summary is useful and thought-provoking.

ANDY HAMMOND
University College London

OREN HARMAN and MICHAEL R. DIETRICH (eds.), **Outsider Scientists: Routes to Innovation in Biology**. Chicago and London: The University of Chicago Press, 2013. Pp. ix + 374. ISBN 978-0-226-07840-3. £24.50 (paperback).
doi:10.1017/S0007087415000205

Innovation is the key to understanding both Oren Harman and Michael R. Dietrich's most recent volume and its precursor *Rebels, Mavericks, and Heretics in Biology* (2008). What distinguishes the two is that, while the innovative ideas discussed in the latter came from scientists whose disciplinary backgrounds were directly linked to their areas of research, in *Outsider Scientists* we are instead required to focus on those boundary-crossers who were not trained in the areas of biology that they came to practise in. Aside from this important and enlightening shift in focus, the formats of the books are the same, in that they both consist of a series of biographical essays. Harman and Dietrich begin with an introductory chapter that establishes the thesis as they see it (which I will turn to shortly). Eighteen chapters follow, each on particular researchers and their travels into more or less unfamiliar territory. They cover, in turn, Gregor Mendel, Louis Pasteur, Félix d'Herelle, Samuel Butler, Erwin Schrödinger, Linus Pauling, Walter Goad, R.A. Fisher, Nicolas Rashevsky, Robert MacArthur, Noam Chomsky, Elaine Morgan, David Hull, Ilya Metchnikoff, François Jacob, John von Neumann and Norbert Wiener, George Price, and finally Drew Endy. The volume is then completed by an epilogue authored by Richard Lewontin. While the extent to which these biographies support or advance Harman and Dietrich's argument will be the focus of this review, it should be stated that each chapter is punchy, well balanced (for readers unfamiliar with any of the figures listed above), and eminently readable – this book has wider audiences in view than merely history and philosophy of science (HPS).

Harman and Dietrich's central thesis, despite taking on such an ostensibly broad topic as 'outsider science', ends up being really quite specific. Any number of things might be considered sufficient to raise a person's status to that of outsider – gender, social or economic status, nationality, disability, sexuality, language, religion, and so on – each of which, it might then be argued, contributed to how and why they saw an area of science with fresh eyes and produced exceptionally novel solutions. These are not Harman and Dietrich's outsiders. Disciplinary affiliation or previous scientific training (training not shared by the majority of biologists working in the research area to be intruded upon) are the essential features distinguishing outsiders from insiders. The

editors are sure to caution against seeing too much stability in ‘disciplines’, stressing the fluidity of disciplinary boundaries within and without biology. Instead they emphasize the movement of individuals between distinct communities or working traditions (there is a passing reference to Jonathan Harwood’s version of ‘styles of thought’, which I found particularly instructive for understanding the nature of the inside/outside distinction that the authors wish to make). Having fleshed out this idea, and some of the ways that they hope a focus on outsider science will be productive, the editors hand over the reins to their numerous contributors. As with any project of this size, the transition is not entirely seamless, and a few gaps appear. These problems are not, however, fatal to Harman and Dietrich’s thesis, which could simply do with further exploration and clarification – at least more than can be achieved in a single edited collection, especially one built upon the expertise of such a large number of different authors.

With this very brief distillation of the book’s aims in mind, three problems within the contributions are worth flagging. First, more than one author seeks to diminish or even eliminate their historical actor’s status as an ‘outsider’. This is helpful inasmuch as it reminds the reader that the category of ‘outsider’ is a problematic one, but as far as advancing the argument that scientists with non-biological training have contributed to biological science, one cannot help but wonder why all were included. This problem is almost wholly confined to the chapters on Mendel, Pasteur and Schrödinger (the first two of which are discussed under the section ‘Outsiders before the inside’, which, though playful, also invites confusion). Second, a more pervasive problem throughout all chapters is an overemphasis on the innovative ideas themselves. This comes at the expense of concretely demonstrating that these innovations were the result of previous non-biological training – rather than some other influence – or explaining why certain innovations were adopted by biologists and others virtually ignored. Those chapters dealing with outsiders who innovated but failed to have their ideas taken up within biology do not give a symmetrical explanation as to why; the most common explanation is some form of personality clash. Third, and finally, the motivations of outsider scientists for approaching biology in the first place do not enter into Harman and Dietrich’s broad programme, which instead focuses on the processes of transition from one field to another, dependent – as they see it – upon personalities, patrons, institutions and so on. While Harman and Dietrich warn against seeing their outsiders as ‘lone knowers’, the ultimate effect of focusing on individual characters is inevitably that the heroic qualities of boundary-crossers are emphasized in ways that might not be to the tastes of an HPS audience (though once again, this is not the only audience that Harman and Dietrich are catering for). Not enough consideration of what was ‘in it’ for outsiders means that the obvious answer – further evidencing of their expertise or further evidencing of, or legitimacy bestowed upon, the original insight or method inspired by science elsewhere – is overlooked. To repeat: these problems are far from fatal for the Harman and Dietrich thesis, which merely requires more dedicated elaboration in order to ensure that it explains as broad a spectrum of outsider cases and phenomena as possible.

Having dealt with these problems, it is much more important to emphasize all the new avenues for research that Harman and Dietrich have opened up before us, and which are now ripe for exploration. Two are particularly attractive. First, for instance, in virtually every chapter, industry or war provide important patronage, or contexts of incentive, for the work of the outsiders discussed. This therefore places these scientists – the majority working within the twentieth century – directly within the purview of some of our most successful and comprehensive accounts of science in this period (while partially addressing the problem of motivation highlighted above). Does this also thereby tell us something distinctive about the relationship between outsiders and industrial/military problems? Second, the importance of the social perception of outsider scientists – both within different scientific communities and within society more generally – is another common feature of all of these biographies. If being an ‘outsider’ has such important social implications, might we have a further distinct phenomenon worthy of analysis? Could we soon be reading articles moving beyond the ‘Matthew effect’ to consider the ‘Marvin effect’, the greater public attention, scholarly scrutiny, perhaps also

(in some cases) scientific value, given to work originating in alien hands? All this is to say that Harman and Dietrich have introduced a provocative concept, and corralled a rich body of work that brings it to life. Knowing now that outsiders exist, you might start to see them everywhere.

DOMINIC BERRY
University of Leeds

KERSTEN T. HALL, **The Man in the Monkeynut Coat: William Astbury and the Forgotten Road to the Double Helix**. Oxford: Oxford University Press, 2014. Pp. ix + 242. ISBN 978-0-19-870459-1. £18.99 (hardback).
doi:10.1017/S0007087415000217

Did William Astbury just miss becoming a household name? He certainly would have secured an honoured status in the history of science, not to say world history, had he uncovered the structure of DNA. The chief problem he faced is that he did not do that. The question is, did he come close?

Kersten Hall's biography of Astbury, *The Man in the Monkeynut Coat*, is primarily a scientific history that follows the career of Astbury through his work on the structure of proteins to his rise to head a research department at Leeds. The title refers to Astbury's experiments in fabricating textiles from vegetable proteins. The book is not intended to take readers very far at all into the culture of early twentieth-century British science and advanced science education. Rather its stated premise is to restore Astbury to a more honorable rank in the history of the race to discover the structure and function of DNA.

Hall has done a marvellous and marvellously detailed job of tracing particular relationships between key British scientists, demonstrating Astbury's central position in those networks. The book is also exceptionally informative about the development of techniques, notably X-ray crystallography, on which Astbury built his very successful career and did internationally recognized work. Hall has been careful to give full credit to graduate students and technical staff who helped make possible the glories credited to the bigger names in the story. The descriptions of the trials and dangers of early X-ray diffraction photography, for example, are both fascinating and a bit horrifying. It is difficult to believe that the profound discoveries of twentieth-century biology derived from such primitive and dangerous equipment. If ever there were historical illustrations about the critical nature of research funding, here they are.

In the end however, Hall himself cannot escape a certain ambivalence about the proper ranking of Astbury. On the one hand, early in the book Hall asserts that Astbury was indeed a principle founder of molecular biology and, concomitantly, a mighty pioneer in the technical use of X-ray diffraction studies of large biomolecules. As such, Hall argues early on, Astbury set upon a path that almost brought him to the grand prize: deciphering the DNA molecule. On the other hand, almost the entire ninth chapter is dedicated to showing where and exactly how Astbury went wrong in the hunt for DNA structure. The reasons here are legion. Shortly after the Second World War, Astbury was already feeling pressure from a veritable wave of younger scientists and technicians now returned to civil society and well situated for likely government and granting-agency funding. He was poorly placed at Leeds, which simply did not make the financial or intellectual commitment necessary for building a world-class competitive research facility or respond well to rapid developments in science. His own work there seemed superseded and insufficiently aimed at the hottest fields, like medicine. So while Astbury repeatedly lost staff to other appointments, struggled with facilities and funding, and lacked equipment, other centres of British science fared very differently. Sir John Randall at King's College London had, at times, luminaries like Maurice Wilkins, Rosalind Franklin, Raymond Gosling, Alex Stokes and Herbert Wilson on staff. Astbury's department never could boast of a roster like that.

Astbury himself was not fully committed to the hunt as his other duties as a department head eroded his research time and resources. It can be argued whether this was fate or compensatory