

Moving to a very different space, Richard Staley considers the links between observatories and physical laboratories. The institutional success of astronomy made it an attractive model and the opportunities presented through astrophysics to share techniques, spaces and even cultural associations were grasped by two American experimental physicists, Henry Rowland and Albert Michelson. Staley's fairly technical discussion of Michelson's experiments contrasts with the approach of John Tresch, whose chapter considers Alexander von Humboldt's interpretation of the aesthetic and moral philosophy of Kant and Schiller. Tresch argues that for Humboldt objectivity in science was realized through communal activity and exchange, allowed through the medium of shared techniques and instrumentation.

Humboldt's inclusivity points the way to the three slightly shorter essays that conclude the book, each of which tackles aspects of the interaction between astronomers, observatories and the public sphere. Theresa Levitt focuses on François Arago, director of the Paris Observatory, and suggests that his attempts at popularization were fundamental to his republicanism. Charlotte Bigg considers the overlaps between popular astronomy and the new field of astrophysics. Finally, Ole Molvig analyses the foundation of the popular Berlin Urania in the context of its Humboldtian origins and the immediate politico-scientific context. These chapters highlight the fact that popularization was often an attempt to counteract specialization and professionalization but often, in fact, helped to create an ever sharper divide between scientific elites and their audiences. There is, however, too little attention paid to the changing and diverse nature of those audiences.

There are some interesting confluences between these and earlier chapters. For example, Tresch and Levitt see a significant change in science and its presentation to the public after 1848. For the former, this relates to a new rhetoric of mechanical objectivity, which links to professionalization and the exclusion of less elite contributors to, and audiences for, science. For Levitt, 1848 marks an end to attempts to create a broad and educated public that was fully incorporated into the state. Likewise, Staley and Bigg both tackle views of the new astronomy. As the former writes, many saw astrophysics as 'largely speculative and faddish' (p. 245) but, for the pioneers and, as Bigg shows, for many popularizers and audiences, it was exciting, inspiring and, ultimately, more profound. Bigg demonstrates that individuals like J. Norman Lockyer utilized this enthusiasm in building their field and their careers.

The contributors to this book are to be congratulated for putting together a thought-provoking and wide-ranging collection of essays. The editors should be thanked not only for bringing these together but for providing a thorough review of the field in their introduction and the excellent bibliography. They have ensured that scholarship from different countries has been included, not least in the fact that Aubin and Bigg have themselves translated two of the essays, as well as contributing their own chapters. It is to be hoped that there is more to come from these scholars and from others inspired by this collection.

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CHRISTOPHER CARTER, *Magnetic Fever: Global Imperialism and Empiricism in the Nineteenth Century*. Philadelphia: American Philosophical Society, 2009. Pp. xxvi + 168. ISBN 978-1-60618-994-8. \$35.00 (paperback).  
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This is a fine monograph written by a specialist in the history of geophysical fields in imperial Britain. During that period, the scientific community developed considerable interest in meteorological phenomena and Earth magnetism. The book focuses specifically on the key individuals, events and political manoeuvres leading to the so-called 'Magnetic Crusade' (p. xv). The key idea is that in both Britain and the United States 'the interaction of science and state

allowed a range of geophysical projects to develop' (p. ix). The main focus, however, is the development of such projects in the British system. The main argument is that 'the British Empire provided the necessary resources for the creation of a universal inductive geosciences that was shaped by the political and social realities of the state apparatus that sponsored it' (p. xxv). The reason is that the widely held belief in generalization from several empirical observations required scientists, in this case, to press for the use of the imperial structure in order to set up many stations throughout the globe. Only by comparing and contrasting the measurements obtained in each station could they proceed to the next step in their research.

The book, then, closely follows the events leading to the 'Magnetic Crusade' in order to answer how British scientists obtained resources from the government, which enabled the construction of a system of observation stations and expeditions. Carter portrays the 'Magnetic Crusade' as a 'new relationship between science and state' (p. 69). Not only did government serve science (p. 27), but also it benefited from the information collected by the research programme, as well as from other indirect technological improvements.

Carter's narrative provides incredibly rich detail on the topic, with abundant use of primary sources (such as letters, memoirs and congressional records) and an extensive bibliographical selection. Particularly interesting is the picture drawn by the author regarding scientific exchange and networking based almost exclusively on those primary documents. There are, for example, a number of passages taken from the correspondence of key figures (like John Herschel, Alexander von Humboldt, Edward Sabine, Carl Gauss and Michael Faraday) which in themselves make this volume useful to those primarily interested in biographical aspects of the history of science. Herschel's role is specifically stressed. In the author's words, arguably 'at least one half of the Magnetic Crusade [was] Herschel's own creation' (p. 71).

It is usually the case that detailed in-depth studies such as this one lose the reader's attention by focusing too much on minutiae and de-emphasizing the key arguments. However, this is not the case in Carter's narrative. The text is well constructed and one is always reminded of the main points. The book is not only an amazing description, but also a welcome analysis of the interaction between science and policy-making. Although those interested merely in robust theorizing on this aspect of the scientific enterprise will look in vain for a general statement on how it relates to politics, there are in this volume several particular instances of how the science-politics interaction worked in the 'Magnetic Crusade'.

Besides merely mentioning examples of the interaction between science and policy-making, Carter also draws an interesting conclusion by comparing and contrasting the way in which two distinct political systems, the British and the American, dealt with the demands of the science lobbies for an increase in government spending for scientific expeditions and observation stations: 'Proposals that started out as similar plans could transmute into largely different projects whose success was influenced as much by the politicians who approved the funding as the scientists who crafted the theories' (p. 73). In the British case, for example, a network of political contacts in the local aristocracy functioned as the main vehicle for the scientific agenda, whereas the features of American political institutions prevented the use of any major expenses without the express sanction of Congress. Members of Congress, in turn, as a matter of political ideology, were extremely reluctant to approve any expenses which could not be justified in terms of the common good.

Besides the political success of the 'Magnetic Crusade', the empirical observations which it enabled are also portrayed as key contributions to nineteenth-century science. They eventually led to the uncovering of a relation between solar and Earth magnetism, a discovery which 'caused a stir in the field of geomagnetism' (p. 148). As a general result, science would from that point onwards deal with expeditions and observation stations as valuable devices that should be encouraged. By being taken to the colonies, research spread to other parts of the globe.

Overall, the book is successful in establishing the main points, although it is relatively limited in scope. For example, the author abstains from general normative remarks on the relation between governments and the science lobby. There is not much indication of any explicit judgement concerning whether the allocation of public resources for scientific experiments leads to more efficiency than do alternative courses of action. Perhaps to be further explored is what happened to other fields of research which did not benefit from the same favourable policies as the geophysical sciences at that time. Another potentially relevant issue is the role of not-so-direct political argumentation within the political sphere, such as whether there was any considerable use of nineteenth-century inductivist philosophy of science by the scientists attempting to persuade policy-makers. That some of the scientists did adopt inductivist empiricism as their personal view of science is evident from Carter's study. However, given the relevant remarks on the interaction between political and meta-scientific discourse presented in works such as John Gunnell's *Orders of Discourse* (1999), taking a further step in this direction might lead to interesting results. In any case, science historians and practitioners with an interest in the history of the geophysical fields will certainly welcome Carter's contribution.

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PIETRO CORSI, *Fossils and Reputations. A Scientific Correspondence: Pisa, Paris, London, 1853–1857*. Pisa: Edizioni Plus–Pisa University Press, 2008. Pp. 411. ISBN 978-88-8492-564-0. €25.00 (paperback).

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*Fossils and Reputations* brings together correspondence between Igino Cocchi (1827–1913) and his teacher, Giuseppe Meneghini (1811–1889), which was written as Cocchi travelled between the scientific centres of Pisa, Paris and London, and in which he reported on the distinctive science cultures present in those cities. All but the first fifty-seven pages of this volume are transcriptions of these 'long, detailed, rather open and at times brutally frank' (p. 8) letters in their original Italian but with copious footnotes in English. Of particular interest, however – and considerably more accessible to English readers – is Corsi's superb introduction, which gives new insights into the cultures of scientific production in these three European cities. While much historical work has been done on the social structures and interactions of early nineteenth-century British geologists (of all persuasions and levels), hardly anything similar has appeared on practices in France and Italy. In addition to the rich cultural setting Corsi provides, we are also treated to an account of two quite believable and different individuals, and their changing relationships as the well-travelled Cocchi became increasingly worldly. This narrative is greatly helped by extensive quotes from the letters in English.

I will leave readers to discover the rich cultural nuances of these different settings which so shaped the doing of science, what one might believe and who one might befriend, but I was surprised to see (as was the author) that Cocchi found far less scandal in London than in Paris. Indeed, from the moment of his arrival the young Italian discovered that Paris was filled with scientific intrigue. In this backbiting world, authorities began to dissolve into frail and selfish individuals. But Corsi does not use these letters to merely survey a culture and certainly not to exaggerate the extraordinary social relationships that lay beneath the cool head of science. Instead, he reveals under-resourced Meneghini, with his reputation on the line, desperately in need of authorities. Here Corsi's prose moves swiftly and engagingly, capturing the political nuances and implicit alliances that were forged simply by the holding of particular opinions or the use of certain terms. Alcide d'Orbigny (1802–1857), for example, whom Cocchi increasingly dislikes, is soon revealed to have paid no attention to texts of other geologists and considered only their illustrations – or at least this is what Cocchi tells Meneghini when d'Orbigny dismisses the Italian's