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# Book reviews



DAVID C. LINDBERG and RONALD L. NUMBERS (eds.), **When Science and Christianity Meet**. Chicago and London: University of Chicago Press, 2003. Pp. xii + 357. ISBN 0-226-48214-6. £20.50, $29.00 (hardback).
doi:10.1017/S0007087405217533

John Hedley Brooke's *Science and Religion: Some Historical Perspectives* (Cambridge, 1991) has probably been the most influential work in promoting the view, now widely accepted amongst

historians, that generalizations about science and religion are untenable. Over the last two or three decades this 'complexity thesis' has become a new orthodoxy in religion-and-science historiography. It states that there is no essential, timeless relationship between science and religion; there are only particular people who, in specific times and places, and for a great variety of polemical and apologetic purposes, made the most heterogeneous uses of scientific and religious resources.

*When Science and Christianity Meet*, edited by David Lindberg and Ronald Numbers, aims to make this thesis even more broadly known, to a target readership that includes university undergraduates and the educated general reader. The volume's twelve meticulously researched and insightful case studies successfully combine introductory explanations of key issues with more detailed historical exposition and analysis. As one would expect in a book like this, much of the territory is familiar; there are several chapters on aspects of early modern physical science in Europe, and several more on natural history and evolution in modern Britain and the United States. Galileo, Darwin, Freud and the Scopes trial are all discussed. The emphasis throughout is on local circumstances and the non-inevitability of conflict between religion and science.

David Lindberg's essay on the Galileo affair would be an ideal place for new students of that infamous controversy to start their reading. William B. Ashworth canvasses the reasons European Christians had for embracing a mechanical philosophy of nature in the seventeenth century. Thomas H. Bronan argues that Enlightenment views of matter and force were more often enlisted in support of religious belief (by Newton, Haller and Priestley, for instance) than of anti-Christian views such as those of La Mettrie. Janet Browne, writing on the significance of the story of Noah's Ark in shaping various aspects of early modern natural history, offers one of the most innovative contributions. By organizing her discussion around a major biblical narrative, rather than a period, individual or science, she is able to engage with a wide range of natural historical questions – including the use of fossil evidence, the age of the Earth, the number and distribution of different species and the prehistory of the human race – and to trace their entanglement with problems of biblical exegesis and natural theology over the seventeenth and eighteenth centuries.

David Livingstone's earlier work on differing Calvinist responses to Darwinism in Princeton, Edinburgh and Belfast has done much to raise awareness of the significance of place in studies of religion and science. As with Lindberg's chapter on Galileo, Livingstone's chapter on Darwinism would be a fine introduction for the undergraduate reader. The same goes for Edward Larson's chapter, a condensed version of the superb account of the Scopes trial offered in his *Summer for the Gods* (New York, 1997). The collection ends with a chapter by Ronald Numbers which, like Browne's, successfully experiments with taking a thematic focus. In Numbers's case, the theme is scientific naturalism and the exclusion of God from scientific explanations, from the seventeenth century up to debates about 'Intelligent Design' and 'theistic science' in the present. Other chapters look at premodern ideas of the sciences as 'handmaiden' to theology, nineteenth-century geology, the 'prayer-gauge' debate of the 1870s (over the empirical testing of prayer's efficacy), American discussions of the antiquity of man and American responses to psychoanalysis.

For all the valuable emphasis on the importance of recognizing particularities of local circumstances, whether in seventeenth-century Florence or 1920s Tennessee, certain generalizations are still possible. Indeed, I found myself wishing that there were fewer repetitions of the 'time, place, local circumstances' mantra, and a little more about the suggestive generalizations that, despite themselves, most of the contributors were prepared to make. These touched on, for instance, the changing role of the Bible in the history of science, the importance of the politics of education in driving debates about science and religion, and the processes whereby science became more public and religion more private as the modern period unfolded.

Although the editors claim that this book is directed just as much against defenders of a sweeping 'harmony' thesis about the history of science and religion as against proponents of the

infamous conflict model, it is the latter alone that comes in for recurrent abuse. One of the ways the case against conflict historiography is made, both here and in other works, is to contrast the 'polemical', 'apologetic' and 'partisan' works of earlier writers with the more objective works produced by professional historians today. In this vein, Lindberg and Numbers claim that recent scholarship has been produced by historians who have 'laid aside apologetic and polemical goals, choosing to understand rather than to judge' (p. 2) and that the charge to each contributor to the volume was simply to tell the story of their assigned case 'like it was' (p. 4).

The key to understanding this new anti-conflict historiography lies, appropriately enough, in thinking about the local circumstances of its production. *When Science and Christianity Meet* arose from a conference initiated by the Program of Dialogue between Science and Religion of the American Association for the Advancement of Science, with support from the Center for Theology and the Natural Sciences in Berkeley. Of the eleven contributors, nine are based in institutions of higher education in the United States. This book, then, is not simply an exercise in value-neutral empirical research. It is the product of a time and a place where the idea that there is a conflict between science and Christianity is widely held, by creationists and others, with troubling political and educational consequences. For anyone wanting to understand the deeper historical roots of these circumstances, the scholarly and persuasive essays on offer here are excellent places to start.

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THOMAS J. MISA, PHILIP BREY and ANDREW FEENBERG (eds.), **Modernity and Technology**. Cambridge, MA and London: MIT Press, 2003. Pp. ix + 421. ISBN 0-262-13421-7. £26.50 (hardback).
doi:10.1017/S000708740522753X

Take a blank sheet of paper and a pencil. Draw a picture that illustrates 'the modern world'. What images are formed? Most people – myself included – would produce something straight out of Richard Scarry: a busy world full of cars and roads, aeroplanes and airports, tall buildings and telephone wires. Naively, picturing the modern means picturing technology. Why, then, has technology dropped from view in theories of modernity? The absence is all the more puzzling given the impressive quantity and quality of much recent scholarship on 'modern' technology.

All of the contributors to *Modernity and Technology* seek to engage both modernity theorists and historians and sociologists of technology. Editors Thomas Misa, Philip Brey and Andrew Feenberg are insightful on why these groups find it difficult to talk and how they might overcome those difficulties. A major problem, as Brey points out, is that where historians and sociologists prefer micro-level studies of particular technologies, modernity theorists tend to contemplate 'Technology-with-a-capital-T, about which broad generalizations are made that are supposed to apply equally to nuclear technology and dental technology' (p. 56). To anyone eager to probe the theses of Marx, Weber, Heidegger or Habermas, technological micro-analyses are frustratingly constrained. At the same time, anyone immersed in a given technology's history will look at, in Misa's words, the 'overaggregated approaches' of the modernity theorists and suspect that their views 'cannot help us discern the varieties of technologies we face and the ambiguities in the technologies that we might exploit' (p. 9).

Andrew Feenberg offers an interesting proposal for bridging this gap. He sees some good in both modernity theory and technology studies. Modernity theorists have been right, he argues, to emphasize technical rationalization in the emergence of distinctively modern societies. Yet this has been handled in a way that separates science and technology – as rationality – from the social world. And the key finding of the history and sociology of technology is that such a separation is

nonsense. (Feenberg notes in passing that the roots of the theorists' separation lie in disciplinary empire-building; by insisting that rationality is asocial, philosophers preserve territory on which their word goes. 'Could it be', Feenberg asks, 'that the most important differentiation for Habermas is the one that separates social theory from certain sociological and historical disciplines, the material of which he feels he must ignore to pursue his own path as a philosopher?' (p. 83).) Dismantling such boundaries clears the obstacles to synthesis. Feenberg takes from technology studies the idea that technologies develop according to their users' interpretative practices, which he labels 'disclosure'; while from modernity theory he takes the idea of 'de-worlding' – roughly, what Heidegger might have said about rationalization if he had treated technology in a less ideal manner. Put disclosure and de-worlding together and, suggests Feenberg, you have a decent theory for thinking about technology and modernity.

One of the strengths of this collection is that theoretical reflections and empirical studies are both well represented, if not always well balanced. Some of the more empirical chapters fit well with the opening analyses of Misa, Brey and Feenberg. Paul Edwards, for instance, directs our attention to infrastructures, which work on many scales, most pertinently the 'macro' scale relevant, as Misa and Brey stress, to modernity theorists. Edwards's proposal, put to such good effect in his book *The Closed World* (Cambridge, MA, 1996), is that 'mutual orientation' – an alignment of actors' interests – provides a useful means of studying how levels work together. Likewise, Barbara Marshall's account of Viagra as an example of the biomedical rationalization of sexuality follows nicely from Feenberg's argument. In his language, she demonstrates the de-worlding of the penis.

Other contributions do better in satisfying the historian or sociologist of science than the modernity theorist. (The collection would have been enhanced greatly if, in the name of symmetry, one of the big names of modernity theory could have been persuaded to participate.) Don Slater's ethnographic study of Trinidadian Internet use, for instance, is fascinating – it will soon be a classic of the genre – but his thoughts on modernity, while coherent and sound, are just too different from those of the theorists to engage their generalized concerns. If Slater is right about modernity's complex, heterogeneous, local character, then there is very little that the theorists can offer. A variation on this problem is the borrowing of the language of modernity theory without being critical enough of the terms. In a thoughtful account of the rise of technology politics, illustrated through three case studies – the Luddites, port politics in early twentieth-century Rotterdam and the controversy over the expansion of Schiphol airport – Johan Schot dips into Ulrich Beck's risk society thesis, but without, it seems, realizing how contentious Beck's claims are. They require a more searching examination in the light of historical study than they receive either in his chapter or in Arthur Mol's companion piece on ecological transformation.

Schot should nevertheless be praised for raising normative issues. He asks how technology should be talked about in order that social and cultural factors are fully taken account of, and he calls for new design processes. Similar conclusions are reached by David Hess, Mol and Haider Kahn. Their normativism belongs to a wider trend in science and technology studies – witness Harry Collins's and Robert Evans's stimulating but flawed 'third wave' proposal. So long as it promotes engagement, the new normativism should be supported. But, seen historically, there is something paradoxical here. Early sociology of scientific knowledge (SSK) and the social construction of technology (SCOT) that followed from it took shape in the context of the politically charged social movements of the 1960s. SSK and SCOT were radical, and undoubtedly political creations. Yet, with a few exceptions, they eschewed the normative, at least explicitly. Now SCOT, and to a slightly lesser extent SSK, have become academic orthodoxies. (Hands up: who feels threatened by the phrase 'society and technology are co-constructed'?) Sometimes we have to remind ourselves of their radical nature. It is

worth asking why, now, the field is shifting emphasis from a language of 'is' or 'was' to 'ought'.

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Lisa Gitelman and Geoffrey B. Pingree (eds.), **New Media, 1740–1915**. Media in Transition. Cambridge, MA and London: MIT Press, 2003. Pp. xxxiv + 271. ISBN 0-262-07245-9. £23.50 (hardback).
doi:10.1017/S0007087405237536

The title of this welcome collection of historical essays is meant to defamiliarize the term 'new media'. The book accomplishes this by reminding us of the once-newness of the media that are now familiar and by recovering for us old media that are no longer remembered. It thus serves as a useful corrective to contemporary thinking and a capable account of aspects of media innovation at the birth of modernity.

Edited volumes can be more or less coherent; this one is more. Many of the authors draw on common archival collections, notably those of the Smithsonian and the American Antiquarian Society. The scholarly literature shared includes signature work in the history of technology by Carolyn Marvin, Wiebe Bijker, Jonathan Crary, Wolfgang Schivelbusch and Daniel Czitrom, together with theoretical work by Jürgen Habermas, Bruno Latour and Michel Foucault. An interest in discursive regimes and the social construction of technologies animates much of the discussion. All of the essays challenge in some measure a notion of technological determinism associated with the so-called Canadian school (Harold Adams Innis, Marshall McLuhan and Walter J. Ong). At the same time, they alert us to the ways in which technologies once constructed have in turn restructured subjectivity (or, in McLuhan's terminology, the sensorium). The old new media produced different ways of seeing, as editors Geoffrey Pingree and Lisa Gitelman emphasize in their Introduction. They repudiate the assumption that media development continually generates ever more transparent media, superseding older, inefficient forms (p. xiv). Any medium, no matter how apparently efficient, always does something more than transmit information.

Most of the chapters in the book deal with a technology at the moment when a society (usually the United States) is in the process of constructing it. A number of chapters examine the ways in which ordinary people appropriate technologies. Ellen Gruber Garvey contributes a thoughtful and insightful analysis of the uses of the scrapbook. Lisa Gitelman meditates on the reasons why people who attended early phonographic exhibitions kept the foil scraps that their voices were recorded on. These chapters speak to the agency of audiences in constructing media. Others consider the attempt of an entrepreneur or scientist to deploy a technology. Wendy Bellion recounts the attempts of artist and museum operator Charles Willson Peale to promote the physiognatrace, a device that drew a profile of a face. Gregory Radick tells the story of R. L. Garner's attempt to use the phonograph to convince the world that monkeys have a spoken language. Both of these chapters remind us that new technologies invite people to view the world in novel ways, some of which we find sensible (the urge to make an objective record of faces) and others quixotic (the urge to learn the 'simian tongue', as Garner called it).

Although a few chapters deal with the dimension of strategic choices, the realm of policy is for the most part left out. Diane Zimmerman Umble recounts the debate among Amish and Mennonite communities about adopting the telephone. Here, constituted deliberative processes determined the use of a technology within a community, although that technology had already been constructed for the larger society. By far the most common topic in the volume is the

construction of a now-vanished technology as a cultural order. Erin Blake describes the zograscope, an eighteenth-century device for viewing engraved images through a lens. She suggests that polite society in England viewed zograscope images of scenes from the centres of civilization as a way of imagining the kind of civilized space in which a rational public could operate. Patricia Crain argues that the manuals of the education reformer Joseph Lancaster produced classrooms that disciplined students by literally putting them in their places, positioning them according to a map and teaching them to understand their interactions according to the metaphor of the telegraph. Katherine Stubbs and Paul Young further examine the cultural impact of the telegraph by examining its deployment in, respectively, fiction and early film. Laura Schiavo discusses the transformation of the stereoscope from a scientific tool to a popular amusement.

All of these chapters are well crafted. Each presents a careful argument, most use interesting archival resources and all engage with significant scholarship and are theoretically informed. Individually they are strong, and collectively they articulate a defensible position on the development of media technologies. Yet the promise of the book's title – of revising our perspective on the way that new media can be constructed – is only partly redeemed. Most of the book deals with byways and cul-de-sacs and not the main roads of media development. Several chapters touch on the history of the telegraph, telephone, cinema and other successfully institutionalized media technologies, but none discusses the formation of, say, the movie industry or the telephone system. The chapters that come closest touch on industrial development in more or less negative ways, pointing out something strange that could have happened but did not, rather than explaining what did happen and why.

Taken as a whole, then, this volume may inspire critics of the developing new media, but it will not guide them in the strategic choices that are being made right now. However, thoughtful readers will have their minds opened to paths not taken, and will gain a sense of new possibilities in today's media environment.

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PAOLA BERTUCCI and GIULIANO PANCALDI (eds.), **Electric Bodies: Episodes in the History of Medical Electricity**. Bologna Studies in History of Science 9. Bologna: Università di Bologna, Dipartimento di Filosofia, 2001. Pp. 298. ISBN 88-900162-2-1. No price given (paperback).
doi:10.1017/S0007087405247532

This volume derives from a workshop held in Bologna in June 2001. As editors Paola Bertucci and Giuliano Pancaldi explain, the historiography of medical electricity has come a long way since Margaret Rowbottom and Charles Susskind's *Electricity and Medicine: A History of Their Interaction* (San Francisco, 1984). No longer can medical electricity be treated as a well-defined hybrid of 'electricity' and 'medicine' considered as stable bodies of knowledge and practice. On the contrary, it is now clear that, since the term 'medical electricity' emerged a little over 250 years ago, there has been no single unifying procedure or institutional formation identified with it.

How, then, to tell the history of such a problematic practice? The Bologna participants have taken the 'episode' to be the appropriate unit of historical study. Their chapters seek to identify the contexts, assumptions and imperatives of a large cast of natural philosophers, physicians, electricians, instrument-makers and patients who, using particular devices and methods, mediated electricity and explored the phenomenology of electrified bodies. Out of such localized studies, the editors suggest, a new, alternative commonality does emerge. What holds the history

of medical electricity together, they propose, are the attempts of medical electricians to carve out niches for themselves against constraints set by extant traditions, by adopting strategies (not always successfully) informed by locally contingent circumstances. Readers will be able to judge for themselves how useful a generalization this is, especially bearing in mind the editors' observation that a more common feature is tension between medical electricians' claims and their accredited accomplishments.

The first two chapters concentrate on the 'origins' of medical electricity in the late 1740s, with Gianfrancesco Pivati's controversial claims to effect healing by *intonocature* (medicated tubes). Lissa Roberts contrasts Abbé Nollet's scepticism about Pivati's therapy with the broader credence accorded to Jean Jallabert's shock treatment of paralysis in Geneva. Paola Bertucci – punningly titling her chapter 'The electrical body of knowledge' – examines the Pivati case in greater detail, showing that tests of electricity's therapeutic power were coextensive with debates in high society and the Royal Society on the very nature of electricity, its transmission via human bodies and the operation of associated devices, such as electric baths, spark extractors and the shocking Leyden jar. While little closure can be found in the discussions, Bertucci's key point is that reputations were made in medical electricity, notably for non-physicians such as Nollet and the London FRS William Watson. Both gained authority by acting as arbiters over claims on healing applications of electricity.

In a complementary chapter, Oliver Hochadel shows that German-speaking medical electricians – even the respected natural philosopher Jallabert – typically relied on physicians to witness and evaluate their therapeutic practice. Yet in the case of the Augsburg instrument-maker Jakob Langenbucher, as Hochadel notes, patients noisily disputed clinical judgements of success, so confounding any simple correlations the historian might be tempted to draw between skill and authority in medical electricity. Further valuable international comparisons can be found in Peter Heering's portrait of the French revolutionary Jean Paul Marat, who criticized the presumptive status of electricity as panacea, and in the studies by Delbourgo and Bresadola of Luigi Galvani's 1792 researches on animal electricity and the ways in which these were incorporated, in very different ways, into, respectively, American and Italian forms of electrotherapy.

Electromagnetic therapies were as controversial in later Victorian Britain as electrostatic cures had been a hundred years earlier. As Iwan Morus observes, each new generation of practitioners hailed itself as the first to cast off medical electricity's 'unfortunate antecedents' and relaunch it on a 'proper medical and scientific footing' (p. 209). Morus shows that while several adventurous figures were attacked and marginalized by either physicians or electrical engineers, most large metropolitan hospitals were installing 'electrotherapeutic' departments as a matter of course by about 1900. Cornelius Borck argues that electrical technology went on to become as ubiquitous and uncontentious in 1920s brain research as it had in life outside the laboratory walls. In Roberta Passione's account of the 'electro-shock' of psychiatric patients in 1930s Italy, however, we learn of the resilience of disagreements over the value of direct electrical therapy. Even when Ugo Cerletti renounced his shock treatment in favour of pharmacological methods in 1947, he could not prevent others applying the often destructive machinery that he had previously sanctioned for the technocratic cure of madness.

*Electric Bodies* does much to advance our to understanding of the diverse geographical and historic forms of medical electricity in relation to issues of authority, technology and expertise. Although not a collection of uniform excellence, the volume takes a refreshingly latitudinarian approach to its subject, and will serve as an invaluable source of reference.

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G. E. R. LLOYD, **In the Grip of Disease: Studies in the Greek Imagination**. Oxford: Oxford University Press, 2003. Pp. xxi + 258. ISBN 0-19-925323-4. £25.00 (hardback).
doi:10.1017/S0007087405257539

This book takes a step back from the study of ancient medicine in specialist terms to open new vistas on disease as a central image in Greek literature and culture. It is the work of a scholar at ease not just with a formidable array of texts and periods, but with a project of openly ambitious scope. Most recent work on ancient medicine and disease, Geoffrey Lloyd's included, has concentrated either on the medical texts of Galen, Celsus or the Hippocratic Corpus, or on the preserved material traces of the medical realm, as in Mirko Grmek's pioneering *Diseases in the Ancient World* (Baltimore, 1989). Lloyd's new book works as a provocation to historians of medicine, philosophers and classicists alike to look again at the larger discourse on medicine within ancient Greek culture, to see what it can tell us 'about causation and responsibility, about the self and the relation between mind and the body, about purification and pollution, about authority and expert, about reality and appearance, about good and evil' (p. 1). This is a daunting remit, and one which necessarily produces a suggestive rather than a comprehensive study. But the wide angle allows Lloyd to expose some insistent themes in the thinking about and the uses of disease in Greek writing from Homer to Aristotle.

When historians have discussed the symbolism of disease, it has usually been in terms of metaphor, as in the case of Roger Brock's recent essay on disease in the body politic (in the edited collection *Death and Disease in the Ancient City* (London, 2000)). Adopting a standpoint defended at greater length in his *Demystifying Mentalities* (Cambridge, 1990), Lloyd suggests that the notion of metaphor, with one meaning literal and the others secondary, is not helpful in dealing with words such as *pathos* (illness, experience, feeling) or *pharmakon* (medicine, incantation, poison). It is the range of possible meanings and applications of disease that interests Lloyd in the different contexts he discusses. He begins from the premise that medical writing shares the concerns and preoccupations of other kinds of Greek writing on diseases and those who can cure them. The differences, he suggests, are usually differences in degree rather than kind.

The book's argument is difficult to summarize, as Lloyd aims more to expose and explore a series of problems than to provide a linear solution to them. One of his most intriguing lines of enquiry takes up the question of the authority of medical practice. The authority of medical texts and practitioners has long been a key interest in research on ancient medicine; important new contributions include Rebecca Flemming's *Medicine and the Making of Roman Women* (Oxford, 2000). As Lloyd discusses in his early chapters, not only were there no universally recognized qualifications for being a healer, there was no consensus about what caused disease or how it should be cured, whether by divine or natural means, although practitioners on either side of the divine–natural theoretical divide used many of the same treatments. Even the nature of 'disease' itself was complicated, Lloyd argues, by the fact that desire and creativity could be expressed in terms that are indistinguishable from descriptions of madness and physical illness. What is so striking is that, despite the fiercely contested nature of disease and medical practice, writers with very different purposes could nevertheless invoke both the authority of the doctor and the idea of disease as self-evident and evil. Plato and Aristotle wrote of disease in the body as a parallel for disease in the soul and in the civic state, with the authority and expertise of the doctor in curing the body regarded as analogous to the skill of the philosopher in curing the soul and the state. Differences between their approaches, Lloyd shows, reveal differences in opinion about medicine, about authority and about what counts as well-being for the individual and the state. But the central fact of their appeal to the doctor's authority remains.

*In the Grip of Disease* had its origins in a series of lectures given to a mixed group of students with backgrounds in philosophy, history of medicine, history of science and classics. To

some extent these beginnings are still visible in the book's structure, organized as it is around chronological periods and key authors. The writing is clear and accessible, and assumes little knowledge about either the terms of the debates or the specific texts discussed. Each chapter ends with several pages of Greek, with facing English translation, of selected passages from the texts that have been mentioned in the preceding discussion, to stimulate further reading and analysis. At times, the brevity of the discussion is frustrating, as in the case of the chapter on Greek tragedy, where the range of material available means Lloyd has to be more than usually selective. However, his book contains much to interest scholars working in the history of medicine or ancient Greek culture. It will also serve as a thought-provoking introduction for prospective students.

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FRANCESC RELAÑO, **The Shaping of Africa: Cosmographic Discourse and Cartographic Science in Late Medieval and Early Modern Europe**. Aldershot: Ashgate, 2002. Pp. x + 271. ISBN 0-754-60239-7. £52.50 (hardback).
doi:10.1017/S0007087405267535

The main ambition of Francesc Relaño's fascinating book *The Shaping of Africa* is to show how the idea of Africa, as a continent distinct from Europe and Asia, emerged between the late Middle Ages and the early modern period from a mixture of natural philosophical, theological, nautical and popular discourses, as well as from several initially separate traditions of mapmaking. He illustrates in the process that the African interior remained largely a mystery to Europeans until the late nineteenth century.

In his opening chapters, Relaño explains how, throughout the Middle Ages, European conceptions of the regions of the Earth south of the Libyan desert and the Pillars of Hercules were the subjects of varied and often wild speculation. If it was acknowledged at all that there were lands south of Libya and Ethiopia, scholarly opinion generally held that there were a number of reasons why they were not suitable for human habitation. These ranged from popular beliefs that they were inhabited by various monstrous races inimical to humankind, to patristic beliefs that God had ordained that only Europe should be habitable, and that a fiery 'torrid zone' around the equator made it impossible for human beings to travel from the northern to the southern hemisphere.

Running counter to the accepted wisdom were, however, equally tantalizing suggestions of a sea passage to Asia via Africa. As Relaño shows, reports of Phoenician circumnavigation had circulated since the time of Herodotus, as had similar reports of successful Arabic, Indian and Chinese voyages from the eleventh or twelfth centuries onward. Vast swathes of Africa were thought to be under the dominion of the Christian potentate Prester John, who, it was commonly believed, might offer military and other assistance to the European powers in their ongoing struggles with the nations of Islam. Most importantly, the experiences of European travellers and explorers to the east, west and south during the fourteenth and fifteenth centuries suggested the possibility of extraordinary new commercial opportunities in the newly discovered lands.

Relaño explains that for hundreds of years the most influential of the European cartographic traditions was that associated with monastic *mappae mundi*. Following the accepted wisdom of divines such as Augustine of Hippo and Lactantius, who had sought to reconcile biblical teaching with the theories of the late classical geographers Macrobius and Martianus Capella, the monastic tradition portrayed Africa as part of the medieval ecumene. In this conception, Europe, Asia and Africa were all part of one 'super-continent' surrounded by an enormous ocean.

By the late Middle Ages, Portolan navigational charts, combined with the recently revived Ptolemaic tradition of geometrical cartography and increasingly reliable reports from travellers and explorers, provided the essential elements of the modern conception of Africa. Relaño does an

excellent job in detailing the cross-pollenating of the various cartographic traditions, travellers' narratives and cosmographic discourses behind this innovation. In so doing, he illuminates the labyrinthine processes by which the modern conception of Africa was realized.

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SIGMUND EISNER (ed.), **A Variorum Edition of the Works of Geoffrey Chaucer. Volume VI: The Prose Treatises. Part One: A Treatise on the Astrolabe**. Norman: University of Oklahoma, 2002. Pp. xxiv + 358. ISBN 0-8061-3413-5. $75.00 (hardback).

doi:10.1017/S0007087405277531

Because its author is Geoffrey Chaucer, the *Treatise on the Astrolabe* has an unusual place amongst medieval technical works. Scholars of medieval literature who would not consider reading any other astrolabe text will sometimes read Chaucer's *Treatise*. Historians of astronomy and of instruments, meanwhile, value it as providing one of the clearest explanations of how to use an astrolabe. It is no easy task to balance the needs, interests and expectations of these two audiences, but in this new edition of the *Treatise* Sigmund Eisner does an excellent job. He has almost fifty years' experience as a student of medieval literature, and has published not only on Chaucer's *Treatise* and the *Kalendarium* of Nicholas of Lynn, but also on the *Canterbury Tales* and the Tristan legend. He therefore brings to this project the ideal combination of technical and literary expertise.

A number of introductory sections preface the text. The first is a description of the astrolabe and its history. A detailed account follows of the so-called Painswick astrolabe, which Eisner describes as 'an excellent example of an astrolabe Chaucer might have used' (p. 10). Noting that the Painswick astrolabe resembles those in the diagrams of some manuscript copies of Chaucer's *Treatise*, Eisner goes on to explain that, on that basis, he has chosen to illustrate this edition of the text with diagrams based on the Painswick astrolabe (or, more precisely, on a replica of it owned by the University of Arizona). Here Eisner follows the precedent of an illustrated edition of the *Treatise* published in 1929, whose editor, R. T. Gunther, replaced the manuscript diagrams with his own hand-drawn constructions. It is unfortunate that Eisner did not instead take the original diagrams seriously as part of the content of the *Treatise*. In Chaucer's text, after all, there are explicit references to the figures; many sections end 'lo here the figure', directing the reader to the accompanying diagram. Eisner's justification for redrawing the diagrams, rather than reproducing diagrams from one of the surviving illustrated copies of the text, is that those in the manuscript are sometimes inaccurate or inapt – an argument which sits awkwardly alongside his otherwise careful and sensitive treatment of the text and its variants.

After the initial discussion of astrolabes, there are summaries of topics related to Chaucer's text, including the evidence for the authorship of the *Treatise*, the identity of 'little Lewis' to whom it is addressed, the date of composition, and likely sources. To anyone not already familiar with the extensive literature on the *Treatise* these digests will be extremely useful. There are also detailed descriptions of the manuscript copies and printed editions of Chaucer's text. As for the text itself, it is clearly laid out, with variants in all manuscript copies and printed editions included. All in all, then – and the unfortunate decision about illustrations aside – this new edition is an extremely valuable tool for the study of medieval technical literature, of Chaucer's works and of the astrolabe. It serves as an excellent starting point for detailed study of the text of the *Treatise on the Astrolabe*, while also providing the necessary introductory materials which a less expert reader will need to get to grips with it.

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AYVAL LESHEM, **Newton on Mathematics and Spiritual Purity**. International Archives of the History of Ideas, 183. Dordrecht, Boston and London: Kluwer Academic Publishers, 2003. Pp. x + 230. ISBN 1-4020-1151-2. £58.00, $86.00, €90.00 (hardback).
doi:10.1017/S0007087405287538

Ayval Leshem's goal in this ambitious volume is to show that Newton's mathematics, in particular his method of fluxions, reflected in an essential way his religious beliefs. Her work thus falls comfortably, as she acknowledges, within the framework of Newton studies over the last two decades, notably the concern of many scholars to counteract the positivist and neo-positivist dismissals of the activities of the private Newton as bearing on the interpretation of his science. Accordingly, she draws throughout on the well-known work of historians such as Betty J. T. Dobbs, Frank E. Manuel and David Castillejo, as well as the more recent work of James E. Force, Robert Markley and Matt Goldish.

In outline, Leshem's book is structured as follows. Her first two chapters seek to establish two conclusions: first, that Newton's historical work should be read in conjunction with the experiments described in the *Principia* and the *Opticks*; second, that his recourse to natural philosophy was founded on the increase of corruption which, as he saw it, was rife in his time, and which prevented scientific truth from continuing to be encoded in religious ritual. In her third, fourth and fifth chapters Leshem goes on to contrast rather extensively the theological backgrounds to Newton's and Leibniz's respective calculi and their notions of space and time. The relevance of such detailed comparisons for understanding the religious meaning of Newton's mathematics does not, however, come across clearly.

She returns exclusively to Newton, and more squarely to her thesis, in her sixth chapter, on the *Principia* and the *Opticks* as contributions to a revival of the ancient true worship. She argues that Newton's natural philosophical works aimed at uncovering the hidden mechanism of God's design, and thereby at allowing humans to attune directly to God, to synchronize or connect with Him, and so avoid the distortion and ulterior corruption caused by the interference of sensible objects between God and ourselves. In Leshem's view Newton's fluxional method was a method of purification in that it was capable of calculating and continuously correcting the unavoidable distortion experienced by equable flowing quantities, attuning them back to the continuous divine flow. For Newton, the method of fluxions thus had the same purpose as any other resource used by God to re-establish the normal order of things, like His sending of prophets or restoring vegetative life through comets.

From the outset Leshem acknowledges that Newton never made explicit the theological purpose she detects behind his mathematical method. Despite this evidentiary gap, her optimism about the correctness of her thesis increases as the book proceeds. In support of her contention that the method of fluxions had a purifying role for Newton, Leshem exhibits an array of corruption–purification analogies that cut across Newton's mathematical, historical, alchemical and prophetical works. These analogies point, she suggests, to the likeness of moral and mechanical laws for Newton – a likeness which she believes is hinted at in 'all published works and manuscripts' of Newton (p. 104). So, according to Leshem, matter in Newton's conception is everywhere subject to an action–reaction chain that is doomed to disrupt the divine original order. When this disruption occurs – when passive inertial force corrupts the natural world – spiritual intervention is needed, bringing about a purifying restoration. Leshem further identifies this same cyclical structure at work in Newton's alchemy and his world history.

The latter parts of the book veer away somewhat from the main argument. A section on Newton's studies of the structure of Solomon's Temple, for instance, is not clearly integrated with what precedes it. Moreover, the attribution to Newton of the idea that the mathematical lawfulness of human corruption was expressed in the proportions of the Tabernacle and Jerusalem

temples is not fully justified. Here Leshem relies too much on the arguments from Castillejo's eccentric *The Expanding Force in Newton's Cosmos as Shown in His Unpublished Papers* (Madrid, 1981) and Goldish's reading of Newton in his *Judaism in the Theology of Sir Isaac Newton* (Dordrecht, 1998), while no attempt is made to present a first-hand analysis of Newton's main temple manuscript, *Prolegomena ad Lexici Prophetici*. A suggestion that Newton's numerical proportions must have had significance for his cosmic calculations or determination of prophetic dates is unfortunately not carried through. Leshem's belief that Newton hid some of the overarching implications of his conclusions even from his own manuscripts allows her nevertheless to expand an analysis that, in the absence of textual evidence, can be given only limited credence.

In brief, *Newton on Mathematics and Spiritual Purity* is a stimulating and complex work that will be of interest to philosophers as well as Newton and Leibniz scholars. Notwithstanding a back-cover recommendation to the contrary, those not familiar with Newton or Leibniz will find the subtleties of the argument difficult to follow. The more general reader in history of science expecting to learn about Newton's theological writings will be especially disappointed, as Leshem's failure to confront Newton's manuscripts directly is the most obvious drawback of her volume. If it is to be successful, the case for the epistemic coherence of Newton's intellectual enterprise will need to be based on more than analogies that, by interpretation, can be made to postulate the very unity they were meant to prove.

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William J. Ashworth, **Customs and Excise: Trade, Production and Consumption in England 1640–1845**. Oxford: Oxford University Press, 2003. Pp. xiii + 396. ISBN 0-19-925921-6. £55.00 (hardback).
doi:10.1017/S0007087405297534

Tax is often considered a tedious business. Those who collect it may well have an interest in fostering this assumption. Here William Ashworth, surveying the heyday of indirect taxation, shows how notions of power, controversy and variability were systematically excluded from the public image of an institution actually endowed with massive social and technical agency. Besides fiscally underpinning state- and empire-building, taxation policies and practices mediated the boundaries between luxury and necessity, waste and efficiency, legitimate enterprise and crime. This study ranges over all these, and we are fortunate that its author is as conversant with the history of science and technology as with economic themes. Ashworth's view of the intermeshed social, political and technical spaces of production, exchange and consumption is anything but tedious.

The structure is loosely chronological. Ashworth's first section, tracing the rise of public credit and the revenue innovations which maintained it, is titled 'Consuming the people'. If there was a 'consumer revolution' in the eighteenth century, then the concerted reorientation of the state's taxation strategy towards consumption, via customs duties (applied to imports) and excise duties (levied mainly on inland production), is to be found at the heart of economic and political change. The controversies over liberty, property and representation introduced here resound throughout the book. A short section on the birth and structure of the Excise traces both power-play among early commissioners and the lives, hopes and perceptions of individual excisemen. Informed by the established literature on strategies for engendering trust, notably the work of Theodore

Porter, Ashworth shows how the unloveable Excise developed a rhetoric of disinterested, equitable practice and atypically meritocratic preferment.

There follow two sections addressing the battles of Customs and Excise respectively against those who, uncharitably, preferred not to pay taxes. Ashworth's characterization of the thriving dockside 'common economy' is noteworthy; practices such as obtaining perquisites ('perks') in kind – eloquently encapsulated by one labourer, in 1757, as 'the sugar that runs in the buildings' (p. 157) – could, although prohibited in law, operate under coherent shared understandings accepted at the local level. Ashworth is scrupulously agnostic in chronicling the debates over what should be legitimate, forcing the point home by deliberate equation of 'smuggling' and 'free trade'. The Excise section provides less analysis, describing the perpetration and detection of frauds with regard to each of the principal taxable products in turn. Whilst offering valuable new research, the narrative here tends straightforwardly to recapitulate primary material, and may occasionally be tripped up by the specialist – I puzzled over a mention of 'malted hops' (p. 211). But microhistory is not Ashworth's aim here, and the study overall illustrates convincingly the complexities of the gauger's art.

The penultimate section, however, will prove of greatest interest to historians of science and technology. Ashworth's earlier work on spirits hydrometry is synthesized with a broad metrological consideration of revenue assessment, invoking Witold Kula on the contingency of quantification processes whilst further exploring the issue of trust. Against localized, essentially premodern understandings of fairness and accuracy, the Excise mobilized standard measures, philosophical instruments, meticulous book-keeping and hierarchy of supervision, creating an 'impartial' culture of interchangeable operators which coopted as much natural philosophical authority as was socially possible. Ashworth correctly highlights a paradox here: taxation could only appear equable – and hence tolerable – if it were seen to proceed from universal, disinterested principles; yet these principles, being inimical to established arrangements, had to be applied in a coercive, 'roughshod' manner (p. 283). The Excise, then, was not impartial; in particular, it favoured structures which were readily conformable to the gaugers' inspection.

It is inferentially clear that tax regimes were constructed to drive trade into the hands of larger producers, who could be held more easily accountable and hence more comprehensively taxed. State motives, then, must be assessed alongside economies of scale in accounting for industrial systematization and growth. Ashworth's analysis extends to physical as well as operational structures; on the Customs side, warehousing, containerization, enclosing walls and locks were introduced to thwart the common economy. Meanwhile, adulteration was fostered (and, to its defenders, legitimated) by the burden of Excise, leading ultimately to the foundation of a state laboratory for chemical analysis. Taxing consumables, then, was a device which sculpted and selected not only public tastes in products but the patterns of their production, their configuration once produced, and their very internal composition.

The final part, 'Dismantling the fiscal–military state', counterpoints the rise of the Excise as a model for state administration with its decline as an actual revenue technology. Made powerful and secure by industry and Excise-funded warcraft, Britain shifted to seek yet greater fortune in the 'Calico Millennium' of the free-traders. The volume's conclusion is remarkably brief (the institution of income tax serving in the unaccustomed role of punchline), but this does not detract significantly from an impressive synoptic work whose central thesis suggests new possibilities in writing the history of industrialization and consumption.

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JEAN-DANIEL CANDAUX and JEAN-MARC DROUIN (eds.), **Augustin-Pyramus de Candolle: Mémoires et souvenirs (1778–1841)**. Bibliothèque d'histoire des sciences, 5. Geneva: Georg Editeur, 2003. Pp. xv + 591. ISBN 2-8257-0832-1. €33.00 (paperback).
doi:10.1017/S0007087405307539

Augustin-Pyramus de Candolle (1778–1841) was possibly the greatest plant taxonomist of the first half of the nineteenth century. A student of Cuvier and Lamarck, his active teaching career spanned over three decades, during which he produced nearly three hundred publications and created the Geneva botanical garden. His masterpiece was the *Prodromus systematis naturalis regni vegetabilis*, of which he produced seven volumes (1824–41); it was continued by his son Alphonse and grandson Casimir. Candolle loomed large in the fields of plant morphology and physiology; contributed to plant chemistry, agronomy and pharmacology; and was a founder of phytogeography. His memoir is witty and informative, even sometimes self-deprecating.

Candolle was, as he noted, born shortly after the death of Linnaeus and only a few months after those of Albrecht von Haller and Bernard de Jussieu; he would go on to publish works in imitation of each of these great predecessors. He came from the Protestant branch of a prominent Provençal family. Candolle's father was first a banker and then a member of the *conseil d'état* of Geneva; his mother was a grand-niece of Peter the Great's French admiral. In 1798 Candolle migrated to Paris, where the *Ancien Régime* scientific institutions had been either closed down or reformed, but where science itself – especially natural history – flourished, valued for its contributions to 'public utility'. In that year he marched as part of a contingent of scientists in a solemn triumphal procession from the Jardin des plantes to the Champ de Mars, organized by the Directory to commemorate its victories in Italy and symbolizing the alliance of science with the state.

In Paris Candolle studied medicine, but found the hospitals so distressing that he could not continue (an apt comparison could be drawn with Darwin). Instead he studied zoology with Cuvier, Lacépède and Lamarck, botany with Desfontaines and mineralogy with Haüy. He found Lamarck so obsessed by his diatribes against modern chemistry that he proved a useless teacher, although Candolle later contributed substantially to Lamarck's great *Flore française*. Candolle was thrilled to consult the library of L'Heritier de Brutelle and to purchase his herbarium. He likewise acquired herbaria from Thuillier (the Paris environs), Schleicher (the Alps) and Hoppe (Austria). Using these materials he added two thousand native species to Lamarck's *Flore*.

From this humble start, Candolle went on to greater things. He was not only quick and intelligent – professor of botany at Montpellier at thirty, and natural history at Geneva at thirty-eight – but also well connected. Especially notable among his friends was Benjamin Delessert, wealthy scion of a Swiss banking family that had befriended Jean-Jacques Rousseau during his exile from France in the 1760s. Delessert had come under the influence of Rousseau's teachings in botany as disseminated in eight famous letters to Madeleine-Catherine Delessert, Benjamin's mother, and to his older sister Madelon (for Rousseau's letters in English translation see his 'Botanical writings', ed. and tr. A. Cook, in a recent volume of *The Collected Writings of Rousseau* (Hanover, NH, 2000), pp. 130–63). Benjamin Delessert devoted part of his considerable wealth to developing a significant botanical collection open to all researchers. He also established the first workingman's saving institution, the *caisse d'épargne*, an institution perhaps inspired by Rousseau's teaching that political freedom is impossible without a reasonable degree of equality. Candolle joined Delessert in related philanthropic activities far removed from the lecture theatre and herbarium.

As a political realist, Candolle understood the possible consequences of French royalism; he accordingly returned to Geneva in 1816, where he pursued a political career alongside his

scientific one. In his memoir Candolle did not hesitate to judge his famous teachers and contemporaries, comparing Cuvier to Haller in lacking the 'inventive spirit' (p. 168), and declaring Etienne Geoffroy Saint-Hilaire to have 'knowledge but poorly directed, imagination but poorly directed, a good character, but often blinded by vanity' (p. 171).

Jean-Daniel Candaux and Jean-Marc Drouin have produced a beautiful edition of Candolle's memoir, with a comprehensive introduction by Drouin, an expert on late eighteenth- and early nineteenth-century botany. The footnotes are ample and informative. This engaging memoir is recommended to anyone interested in the history of nineteenth-century natural history.

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John Cantrell and Gillian Cookson (eds.), **Henry Maudslay and the Pioneers of the Machine Age**. Stroud and Charleston: Tempus, 2002. Pp. 192. ISBN 0-7524-2766-0. £16.99, $26.99 (paperback).
doi:10.1017/S0007087405317535

As the editors note in the introductory chapter, this book began with the idea of exploring the network of Manchester engineers who were working at the time of Joseph Whitworth, James Nasmyth and Richard Roberts – during, that is, the first half of the nineteenth century. They discovered, however, that Henry Maudslay in London was a significant influence on these workers and on the development of machine tool technology in general. Thus the project was redirected. The eight contributors to this volume paint an intriguing portrait of Maudslay, the environment of the London engineering industry during his career, and the wider context of a pioneering generation of innovative British engineers. In the process, they provide a form of industrial career history that transcends previous technical histories that focused merely on nuts and bolts. The Introduction describes the authors' approach as 'using the wider lens of biography to explore the technological, business and personal progress of the men who made the machines' (p. 16). Moreover, they extricate their stories from the ambivalent, if not malign, historiographical influence of Samuel Smiles, whom the editors characterize as a 'caricaturist … interested in stories of ''triumph over adversity'', of single-mindedness, dedication and the rise from humble origins' (p. 12). While Smiles preserved important raw material, he marginalized some engineers (such as David Napier and William Muir) while vaunting the careers of others (e.g. Maudslay, Nasmyth, Roberts, Whitworth and Joseph Clement). Each of these engineers receives a chapter in this book. Bracketing these biographical contributions are two chapters, one that surveys London engineering at the time of Maudslay, and another that discusses the activities of his company to the end of the nineteenth century.

The ten chapters are rather well matched, adopting a perspective and level of detail that are largely consistent. Nearly one hundred illustrations – ranging from crisp and detailed to muddy and blurred – include many drawings, engravings and photographs of machines and individuals, as well as a handful of others showing maps, factories and advertisements. Their captions are generally terse, and so restrict the analytical value of the images. The index is equally sparse, with some two hundred entries limited mainly to the names of individuals and their machines. The index provides no link to the context of business (apart from company and process names) or the wider perspectives of engineering, society and culture. This is unfortunate, because the individual contributions do touch, to varying degrees, upon these aspects of the story. In portraying the interweaving of the career histories of a handful of influential engineers, the book communicates a strong sense of the local pressures and opportunities influencing them, and their ingenuity in conceiving technical solutions.

On the other hand, the chapters do not depict a rich economic or cultural history of technology or technologists. This is perhaps inevitable given the format of the book, which focuses on the biographies of individual early innovators. The tracing of their interconnections and common environments is a distinct improvement over the Smilesian style and its moralistic undercurrents, even if the engineers' backgrounds were too dissimilar to allow a very extensive analysis in the form of prosopography. As with the chapters themselves, the five-page bibliography, focusing on earlier biographies and technical histories, tends not to engage with the more analytical works on the history, sociology, philosophy and culture of technology that have become popular in recent scholarship.

The book therefore succeeds in its stated aims. By juxtaposing parallel and well-chosen biographies it enables the reader to draw insights about the similarities and differences of the individuals and their working environments. And by rehabilitating engineers such as Napier and Muir while providing nuanced portraits of other key figures, the collection counteracts the still-prevailing histories of nineteenth-century engineering. But these contributions could have gone further, illuminating not only the mechanical engineering that evolved in Georgian London, but its significance for wider studies of technology.

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Iwan Rhys Morus, **Frankenstein's Children: Electricity, Exhibition, and Experiment in Early-Nineteenth-Century London**. Princeton, NJ: Princeton University Press, 1998. Pp. xiv + 324. ISBN 0-691-05952-7. $45.00, £32.50 (hardback).
doi:10.1017/S0007087405327531

The title is arresting but misleading, in that Mary Shelley's Creature makes as slight an appearance in this book as (despite James Whale and company) electricity does in *Frankenstein*. But Morus explains that he intends his title to be an ironic reflection on the relations between the natural philosophers and society. He is here concerned to chart the emergence of an industrialized and commodified culture in Britain, in which the science and technology of electricity played a central role. 'For most Victorians who paid attention to such matters', he writes, 'electricity had little immediate to do with fields of force or even a lumeniferous ether' (p. 261). The concern here is not with the physics of Michael Faraday and William Thomson, but with the impact of electricity on the wider culture through its production by machines and technologies. In studying the cultural impact of science, this study of electrical experimentation in London from the 1820s to the 1840s bears on the role of science in the industrial revolution in Britain.

Morus begins with the electrical science of Faraday, but rapidly moves from the world of the natural philosophers of the Royal Institution and the Royal Society to the activities of popular lecturers and instrument-makers such as William Sturgeon. He discusses the London Electrical Society, an important group of experimenters; the flourishing of galleries of practical science which provided public exhibition; and contemporary images of the universe as an electrical machine, including Andrew Crosse's claims for the production of life by electricity. Morus seeks to highlight the different cultures of science as exemplified in the various styles of the public performance of experiments. The contrast drawn between Faraday and Sturgeon illustrates the style of argument in this book. Morus argues that Faraday urged an 'abstracted' or 'disembodied ontology' divorced from the 'artefacts that Faraday manipulated' – that is, from the apparatus that produced the phenomena (p. 39). By contrast, Sturgeon's 'electrical cosmology … was made real through the experiments and instruments he designed' (p. 69); the electricians 'tended to regard their apparatus as *constituting* nature' (p. 111; original emphasis). Morus links these

different scientific cultures to the conflict between artisanal and middle-class definitions of work and skill, and thus to the arena of technology and machinery.

The argument then moves to examine the machine culture itself: how electrical technologies became commodified, in the electrical telegraph of Cooke and Wheatstone and in the electrotherapies of London doctors. The efforts of the latter enable Morus to draw out the relationships between technology, medicine and Victorian commercial culture. With the example here of the attempt to cure 'hysteria', we enter ground that has been well trodden in recent years (though Peter Gay's *Bourgeois Experience* (New York, 1985–98), is not cited). The chronological sweep of the book concludes with the late 1840s, though it might have been appropriate to illustrate these themes of exhibition and machine culture in the Great Exhibition of 1851.

This is an imaginative book, very much in line with current trends in the history of science. Some may find the argument overly rhetorical, but there is much solid documentation here. In depicting the filiation of electrical science within this particular local culture, Morus has shed light on the role of science in emergent industrial society in Britain.

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P. M. Harman (ed.), **The Scientific Letters and Papers of James Clerk Maxwell. Volume I: 1846–1862**. Cambridge: Cambridge University Press, 1990. Pp. xxviii + 748. ISBN 0-521-25625-9. $195.00 (hardback). **Volume II: 1862–1873**. Cambridge: Cambridge University Press, 1995. Pp. xxx + 999. ISBN 0-521-25626-7. $285.00 (hardback). **Volume III: 1873–1879**. Cambridge: Cambridge University Press, 2002. Pp. xxvii + 932. ISBN 0-521-25627-5. £210.00, $315.00 (hardback).
doi:10.1017/S0007087405337538

Leafing through the large quarto volumes of *The Scientific Letters and Papers of James Clerk Maxwell*, one cannot help feeling that these may be among the last of a noble breed. Historians, and especially historians of science, have long relied on expertly edited and elegantly printed letterpress editions of the letters and papers of important figures. One need only think of Antonio Favaro's edition of Galileo's *Opere*, or D. T. Whiteside's of Newton's mathematical writings, or the ongoing edition of Darwin's correspondence. It is fitting that James Clerk Maxwell, generally ranked just behind Newton and Einstein in the pantheon of great physicists, should now receive the full 'letters and papers' treatment. But the form that treatment has taken is one that seems likely soon to pass from the scene.

Big documentary editing projects have, so far as I can see, three main aims: to pull together scattered source materials; to arrange and explicate them in accordance with the highest editorial standards; and to make the results of these labours widely available to scholars, particularly to those who cannot readily travel to the relevant archives. There are points to quibble with in Peter Harman's selection and arrangement of Maxwell's papers, but the editing here is generally very good; the fact that Harman did it all himself, without the teams of assistants that mark so many comparable projects, makes his accomplishment all the more remarkable. I fear, however, that the enormous volumes issued by Cambridge University Press will serve as much to entomb as to disseminate Harman's work. Volume III runs to over nine hundred pages and weighs in at nearly seven pounds; it carried an eye-popping price tag of $315 (£210) on publication, later raised to $350. Purchasing all three volumes as they came out in 1990, 1995 and 2002 would have set you back a total of $795. Almost no one beyond a few big research libraries can afford to pay such prices, and I count myself lucky to have managed to snag review copies for my own shelves. Worse yet, Volumes I and II have already gone out of print and are almost unobtainable even second-hand. My own university, which has one of the largest research libraries in the United States, somehow missed the initial window of availability for

Volume II, and our librarians had to scramble later to complete their set. I am happy to report that they succeeded, but a quick check of online catalogues shows that while many leading university libraries in the US, Britain and Canada possess all three volumes, quite a few are missing either Volume II or Volume III, and several prominent institutions have none. As a way to make edited documents widely available, expensive printed volumes evidently have some limitations.

Were such a documentary editing project to be launched today, it seems likely that funding agencies would steer the editor towards web publication. The work of gathering and editing the documents would be about the same as for a printed edition, and the final product would be accessible from virtually any computer in the world, at little or no cost to the user. Funding agencies would have to make provisions to update the site periodically and migrate it to new electronic platforms as needed, but the payoff in improved access and usability, and the savings in printing and distribution costs, would seem to tip the balance strongly in favour of web publication.

Taking these volumes as they stand, it is important to note two points. First, as Harman makes clear, this is an edition of Maxwell's scientific letters and papers; glimpses of Maxwell's personal life appear here and there, but only in relation to his scientific work. Second, these volumes are not meant to replace W. D. Niven's 1890 edition of Maxwell's *Scientific Papers*, but to supplement it with documents that remained unpublished during Maxwell's lifetime or were for some reason omitted by Niven. Like any editor, Harman could only work with what has survived, and in Maxwell's case much has been lost. When Lewis Campbell and William Garnett wrote their *Life of Maxwell* in the early 1880s they had access to troves of personal letters and papers that were later destroyed, presumably in a fire that struck Maxwell's Scottish estate some years after his death. Harman was thus often forced to rely, especially for Maxwell's early years, on extracts from Campbell and Garnett's book; indeed, he drew about a third of the documents reproduced in Volume I solely from Campbell and Garnett, since the originals no longer exist. For the periods covered by Volumes II and III, much more survives in manuscript and there is less reliance on previously published materials.

It is impossible in a brief review to address all of the issues raised by this massive edition. I will limit myself to two points, one about items Harman has included, the other about one he did not. The last section of Volume III contains a Supplement, thirteen documents that came to Harman's attention after he had passed their places in the chronological sequence. The most striking is a letter Maxwell sent to William Thomson (Lord Kelvin) in January 1868 that touched on the imaginary creature Thomson later dubbed 'Maxwell's demon'. As Harman recounts in his Preface, this letter survives only on a microfilm given to him by Edward Daub, who had obtained it from Edinburgh University Library in the 1960s – the library having in the meantime lost track of both the original manuscripts and the microfilm. The inclusion of another document in the Supplement reflects not the vicissitudes of archival access but the changing foci of historians' interests: Harman omitted from Volume I, but now reproduces in Volume III, Campbell and Garnett's extract from a letter Maxwell sent his wife Katherine in 1859 about scientists' wives, particularly how Roderick Murchison's wife first sparked his interest in geology. Easily overlooked in 1990, this is now seen to merit inclusion.

To my mind, the most regrettable of Harman's omissions is a paper 'On the elementary relations between electrical measurements' that Maxwell and the telegraph engineer Fleeming Jenkin wrote for the British Association Committee on Electrical Standards in 1863. Niven left it out as well, and the paper last appeared in print in a 1913 collection of the reports of the Standards Committee. Harman's decision to omit it is perhaps understandable – the paper is quite long, and Volume II is certainly thick enough without it – but including it would have helped make more accessible a paper that marks an important stage in the evolution of Maxwell's thinking.

'Elementary relations' was written just after Maxwell had completed his 1861–2 paper 'On physical lines of force', in which he focused on tracing the workings of his hypothetical vortex and idle-wheel model of the ether, and just before he produced his 1864 'Dynamical theory', in which, as in most of his later electrical writings, he instead emphasized the mathematical correlation of macroscopically defined states of the field. Closer study of Maxwell's work on the theory and practice of electrical measurement offers perhaps our best prospect for shedding light on this important transition in his thinking, and particularly of illuminating the part that Maxwell's close collaboration with Jenkin and other telegraph engineers played in his adoption of what was in a sense an 'engineering approach', in which reliance on hypothetical mechanisms is minimized in favour of formulating directly applicable equations.

*The Scientific Letters and Papers of James Clerk Maxwell* is a fine contribution to scholarship. If a way can be found to make its contents more widely accessible, perhaps through some form of web publication, workers in the 'Maxwell industry' will have additional reason to celebrate.

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John C. Thackray, **To See the Fellows Fight: Eye-Witness Accounts of Meetings of the Geological Society of London and its Club, 1822–1868**. BSHS Monographs, 12. London: British Society for the History of Science, 2003. Pp. xviii + 243. ISBN 0-906450-14-4. £15.00. $26.00 (paperback).
doi:10.1017/S0007087405347534

The Geological Society of London has two innovations to its credit. It was founded in 1807 as the first ever body devoted exclusively to earth science; and in the early 1820s it became the first learned society in Britain to have regular discussions of papers given at its meetings. By the 1830s the society was renowned for its lively debates which had no equivalent in any other scientific society in London. Until 1845 the ancient Royal Society shrank from permitting discussion, fearful that it would encourage irregularities and personalities injurious to the Society's scientific reputation. At the Linnean Society, founded in 1788, discussion was actively opposed until the 1850s as prospectively ruinous because it would degenerate into acrimonious and divisive controversy.

The brethren of the hammer had no such qualms; within the walls of the Society, the leading forum for British geology, they encouraged urbane geological warfare carried out with manly and sportive vigour, tempered ideally by good will and manners. Such sparring was entertaining to Fellows and their guests. One of the latter, Lockhart, editor of the *Quarterly Review*, declared, 'Though I don't much care for geology, I do like to see the fellows fight'. Geological cuffing was also instructive for novices. Above all it provided peer-group evaluation of papers. As Murchison pointed out, the ordeal of discussion to which papers were subjected was the true safeguard of the society's scientific reputation because authors were obliged to reflect on their arguments and evidence. Until 1868 the society steadfastly refused to record or to report its discussions. It did so because their confidentiality permitted the uninhibited expression of disagreements in a private and exclusive learned society which was also a gentleman's geological club run by various coteries, which were based mainly on merit and not rank.

The society's refusal to permit independent reporting of its celebrated discussions contrasted sharply with the widespread reporting of their equivalent in the geology section of the British Association for the Advancement of Science founded in 1831. For decades the leaders of the Geological Society shone as discussants in Section C, helping to make it lively and popular, and did not object to their contributions being reported in literary weeklies and local newspapers. These researchers made a clear distinction between two arenas of geological skirmishing: the

society was a select, private and gentlemanly learned society controlled by adepts, who zealously guarded the confidentiality of its proceedings; the Association a relatively open, public and heterogeneous assembly, the success of which depended considerably on publicity. For eye-witness accounts of meetings of the former from 1822 to 1868 the only sources are, therefore, diaries, notebooks and letters of the participants.

*Fighting Fellows* draws on twenty-three manuscript sources, some well known while others, such as the R. C. Taylor papers, S. Woodward letters, R. T. W. L. Brickenden correspondence and T. Sopwith diary, are less so. It also uses secondary sources, such as standard biographies. All told, no fewer than 236 meetings are covered in chronological order, with the odd one being described by no less than four people, who did not always agree about what was valuable in the discussions. Most of the controversies which enlivened the Society for forty-six years are documented. It is clear that on many occasions the norm of perfect good humour in discussion was not followed and that leading geologists were not immune to fierce verbal scrimmaging. We learn that in 1846 Buckland, Dean of Westminster, attacked a paper of Murchison who replied that 'he had lately observed symptoms of the Dean having forgotten his geology'. In 1851 Murchison's views on Sussex drift received 'a fearful thrashing' from six of his peers. In 1860 Falconer's views on cave bones were subjected to 'a fierce onslaught' by Lyell and Austin, while Falconer himself launched a forty-minute 'onslaught' on Ramsay's 1862 paper about the excavating power of glaciers. As a bonus we also have accounts of the society's club, which was formally constituted in 1824. Its members, restricted to forty, dined together before the Society's meetings. In addition to its social and administrative uses, the club offered varied intellectual rewards, as Ramsay discovered. In 1847 he sat opposite Hopkins, with whom he enjoyed much discussion 'about ups and downs, lakes of fire inside the crust etc', but in 1855 his knightly neighbour Lyell bored him 'with heavy metamorphic talk'.

This welcome volume, entirely appropriate for publication as a BSHS monograph, offers an introduction, footnotes, a bibliography and two indexes. It is the last opus of John Thackray, who managed to complete it just before his death from cancer in 1999 aged only fifty-one. Knowing its importance, Janet Browne, Jim Secord and Hugh Torrens have seen it through the press. Anyone interested in nineteenth-century science will be grateful to them for ensuring that John's ambitious and valuable project has not been lost to posterity. All those who knew him will rejoice at its appearance and will continue to remember him with admiration, gratitude and affection.

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LAWRENCE GOLDMAN, **Science, Reform and Politics in Victorian Britain: The Social Science Association, 1857–1886**. Cambridge: Cambridge University Press, 2002. Pp. 419+index. ISBN 0-521-33053.
doi:10.1017/S0007087405357530

Most historians of Victorian science are familiar with the British Association for the Advancement of Science, founded in 1831. But far fewer know about the BA's 'companion' in the reform movement, the National Association for the Promotion of Social Science, known to contemporaries as the Social Science Association, which was founded a quarter century later, in 1857. Their similarities and differences are significant. If the BA was fostered by 'gentlemen' of science, the founders of the SSA were decidedly 'players'; if the BA was a metaphorical 'parliament' of science, the SSA was a 'parliament out of session', staffed, according to *The Spectator*, by some of the most persuasive 'volunteer legislators of Great Britain'. For just under thirty years, from 1857 to 1886, the SSA met annually, like the BA, in its peregrinations across Britain, bringing in its train a spirit of enquiry and investigation. Led by Lord Brougham, praised by Lord John Russell,

encouraged by Edwin Chadwick and John Stuart Mill, the SSA became, in the words of *The Times*, a 'centre for the communication and interchange of ideas on current topics of political and social interest'. Its purpose: to reduce hard realities to scientific analysis.

Working through five departments – legal reform, penal policy, education, public health and 'social economy' – the SSA maintained an office in London, all the better to coordinate lobbies that would 'speak knowledge to power'. Its results were impressive. Borrowing from the contemporary forms that the BA also used to good effect, the SSA used its large public meetings to direct attention towards prevalent abuses or fraying edges in the social fabric. Like the BA, it linked 'top and bottom', 'metropolis and province', and thereby spoke to the new political relationships of industrial Britain. It proved a nursery for the new professionals, doctors, teachers, penal reformers, and those committed less (if at all) to ideas and ideology than to the secular ideals of professional commitment. Its insistence upon the application of 'social science' to the study of working conditions led to the recognition of organized labour. Its representations led to the Taunton Commission of 1865–8 – from which flowed the Endowed Schools Act of 1869 and the reform of secondary education – as well as to the Habitual Criminals Act of 1869, the Married Women's Property Act of 1870 and the Prevention of Crimes Act of 1871. One of its most impressive achievements was in setting up the Sanitary Commission of 1869–71, which led to the comprehensive Public Health Act of 1875, the cornerstone of subsequent public health legislation in Britain. Its work went well beyond reforming rhetoric, and its implications were far-reaching. Over 126 women gave papers at its congresses – some 269 of three thousand papers delivered. Less than ten per cent of the total, perhaps; but more than a hundred of those papers were on women's issues, broadly conceived, and so charted the past and claimed the future for the women's movement.

A record of this distinction is surely enough to ornament any organization, and ensure its survival. Yet the SSA came to an end, and its passing was soon forgotten, its achievements neglected. Why? In this masterful and long-awaited account, Lawrence Goldman, building upon the earlier work of Eileen Yeo, examines the rise and fall of this formidable instrument of reform. In its time, the SSA was a British benchmark of a universal movement, replicated in a variety of countries from Madrid to Melbourne, Bombay to Boston, and culminating in the International Social Science Association in Brussels in 1862. In three sections, devoted respectively to 'Politics', 'Reform' and Science', he devotes eleven chapters to the evolution of what he calls 'social knowledge'. By reconstructing the detail of debates, he shows how social policies were generated and how the association contributed to their outcome. In the process, he sheds new light on late Victorian England, on the formation of law-making opinion, on the machinery of government, and on Britain's very English translation of the language and tools of social science.

In 1884 the SSA held its last congress, as its first, in Birmingham. Overall, a combination of factors – compounded by economic depression and rising class tensions – destroyed the idea that science was a social emollient. Even by the late 1870s its audiences had begun to fall away. The initial attraction of the SSA in the 1860s, Goldman suggests, lay in its appeal to prominent public men, who would come to lecture and stay to meet questions. But twenty years on, this generation had passed away, and its successors proved less attractive. Ironically, its very success may have contributed to its undoing. It had won early victories, but no organization could keep up the pace without permanent support. Worse, the SSA moved away from issues of the moment, and fell prey to competing interests. Moderate reformism was no longer relevant to the harsher and more polarized political climate of the 1880s. By the late 1880s the SSA's influence had ebbed. Its final end Goldman sees in terms of the dissolution of settled social and political structures, and the rise of the apparatus of the Victorian state. The SSA was an institution whose time had gone.

In some ways, the story of the SSA invites comparison with the BAAS, which had to deal no less urgently with social and political change, yet which survived (and survives yet) into the

twenty-first century. This is territory, however, into which Goldman does not venture. We may speculate why the BAAS, but not the SSA, somehow found its way through the collapse of the 'common context', managing to fend off the fissiparous tendencies of newly professionalizing disciplines. Possibly the BAAS proved a more robust defender of the 'unity' of the sciences. Answers will be welcome. In the meantime, we are left with the explanation that the SSA's end came with the demise of its political authority and its broadly based empirical approach to reform.

The end of the SSA marked, of course, not so much an end in itself, as the end of a beginning in the history of the social sciences in Britain. Nonetheless, its passing does record a turning point in the perception of science as an advocate of social change, in a period that saw voluntarism give way to professionals and their pressure groups. Conceptually, its limitations were conspicuous. As one pundit put it, the SSA 'was certainly very Social, but it never got the length of Science' (p. 364). It derived its strength from its capacity to bridge a historical gap between personal, arbitrary forms of government and an increasingly recognizable Weberian professional bureaucracy. Still, during its lifetime, it was an achievement. And so it remains today, symbolizing the prospect of a synthesis between science and social improvement. Goldman has done us a signal service in recalling its place in mid-Victorian England – a time of hope and promise, in which science was to be a source of solutions, and the idea of progress might still escape its contradictions.

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Roger Cooter and John Pickstone (eds.), **Companion to Medicine in the Twentieth Century**. Routledge World Reference. London and New York: Routledge, 2003. Pp. xix + 756. ISBN 0-415-28603-4. £24.99 (paperback).
doi:10.1017/S0007087405367537

Cooter and Pickstone have provided a much-needed resource that will certainly prove very useful for undergraduates, research students and teachers in several fields, including history, the social sciences and medicine, for some years to come. The book was first published by Harwood in 2000 and the new paperback edition is especially welcome. The forty-six chapters are divided into three sections entitled 'Power', 'Bodies' and 'Experiences', and are written by over fifty of the foremost scholars of the history of twentieth-century medicine. Despite the impressive range of chapters, there are some gaps. As Cooter and Pickstone admit, the medical experiences of different ethnic, racial and religious groups have not been covered in detail. Likewise, they were unable to secure chapters on philanthropy and the insurance industry, or to represent the perspectives of anthropology, linguistics, discourse analysis and political theory. Most chapters are footnoted lightly, sometimes frustratingly so, but all include useful bibliographies.

The book is much more than a reference source. The opening chapter by Pickstone provides an innovative analysis of twentieth-century medicine, based on the definition of three 'types' of medicine – 'productionist', 'communitarian' and 'consumerist' (p. 2). He uses these categories to map changing trends in medicine and to link them with wider economic and political histories. Broadly speaking, 'productionist' medicine rose to prominence in the early decades of the twentieth century, was superseded by 'communitarian' medicine in mid-century, while there were strong trends towards 'consumerist' medicine near the century's end. Pickstone's analysis is based largely on Britain, with only gestures towards other countries, but he suggests that his themes could form the basis for comparative histories. The value of Pickstone's framework is soon apparent within not only the 'Power' section but also other sections of the book, where there are numerous resonances between his concepts and the material covered. The second

chapter, 'The golden age of medicine' by Allan Brandt and Martha Gardner, similarly provides an outline making later chapters more accessible, by summarizing the rise of, and subsequent challenges to, biomedical science during the twentieth century. Other chapters in the 'Power' section survey, for example, 'Soviet medicine', 'Colonial' and 'Post-colonial medicine', 'Medicine and the counter culture', and 'Medicine and the Welfare State'.

Cooter and Pickstone explain that the section on 'Bodies' is concerned with 'the changing concepts, representations, and discursive frameworks of medicine in the twentieth century', or 'bodies of knowledge and practice' (p. xviii). However, the first chapter of the section, 'The Historiographical body', by Mark Jenner and Bertrand Taithe, will appear to the average undergraduate reader as a mind-boggling list of names, book titles and concepts. If such a reader is to make sense of the chapter, he/she will have to tackle a bibliography of thirty-eight items. Fortunately, the chapters that follow, the 'Healthy body' by Dorothy Porter and the 'Industrial body' by Steve Sturdy, are much more accessible. Pickstone's themes of productionist, communitarian and consumerist medicine again have obvious application here. The rest of the section includes excellent chapters on, for example, the 'Psychological body' and the 'Sexual body', as well as Cooter's own characteristically lucid and challenging contributions on the 'Disabled', 'Ethical' and 'Dead' bodies.

The final section, Cooter and Pickstone explain, 'engages with the major sites where medicine has been encountered in the twentieth century' and attempts to view medicine from the 'bottom up' (p. xviii). The latter approach is evident in, for example, chapters on 'Hospitals', 'Children's experiences of illness', 'Childbirth and maternity', 'Supported lives' and 'Mental illness'. But the section is really more of a miscellaneous selection of papers – other chapters included cover 'Nurses', 'Surgeons', 'Malaria' and 'The Chinese experience'. Once again, Pickstone's categories prove helpful, in, for example, Virginia Berridge's chapter on 'AIDS and patient-support groups' and Patrice Pinell's chapter on 'Cancer'. The first chapter of the section, 'Media', by Susan Lederer and Naomi Rogers, provides a discussion of the means by which many aspects of medicine came to be 'experienced' by wide sections of the population during the twentieth century. The authors conclude by pointing out that the media's 'complex, multi-faceted and crucial' relationship with medicine is relatively under-researched (p. 501). It is to be hoped that not only this chapter, but also the book as a whole, will stimulate and facilitate further interest and research in the many still-unexplored dimensions of the history of medicine of the twentieth century.

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Georgina Ferry, **A Computer Called LEO: Lyons Teashops and the World's First Office Computer**. London: Fourth Estate, 2003. Pp. xi + 221. ISBN 1-84115-185-8. £15.99 (hardback).
doi:10.1017/S0007087405377533

In recent years there have been several accounts of the LEO story, by personnel who worked on the project, business historians and historians of science and technology, but none have contextualized the project as well as this engaging book by Georgina Ferry. Ferry has interviewed many people who worked on the LEO project and closely examined the existing archival material to produce a fascinating account of how Lyons, with its network of teashops the length and breadth of Britain, became the first commercial company to appreciate exactly how the computer could be used to cut its clerical budget and provide valuable management information. Ferry gives us a close look at the management culture behind Lyons's bid to automate management systems.

LEO (Lyons Electronic Office) was the first electronic computer to be built specifically for commercial applications. From the outset, the machine was conceived as an office tool to perform

functions such as payroll and stock distribution as well as provide management information. In this respect it was years ahead of its time, since most other computers of the early 1950s were designed for mathematical or scientific purposes. While scientists clamoured for access to these new devices, most businesses, including office machinery companies, adopted a wait-and-see policy. Following a visit to the United States to investigate possible ways of automating their huge clerical operation, however, the management team at Lyons very quickly grasped the potential of electronic computers for helping to manage a business whose profitability depended on thousands of very small daily transactions. The company made contact with Maurice Wilkes at Cambridge University and, in order to gain early entry into the technology, invested both funds and staff in the EDSAC computer project. As a result of the success of EDSAC, Lyons went on to build its own electronic computer, LEO, heavily based on the EDSAC design. LEO Computers Ltd. was created in 1954 as a subsidiary of Lyons to design and build computers for commercial sale.

Many of the chapters in *A Computer Called LEO* are real page-turners, with the reader being drawn into the world of Lyons teashops and their managerial problems. Ferry ably demonstrates why, for a caterer and grocer such as Lyons, building its own computer was not an outlandish extravagance but a perfectly logical next step. Into the main story of the development of LEO Ferry weaves an overarching, accurate summary of the wider history of computing, thus further contextualizing the LEO story. As the book progresses, the impending doom of the British computer industry is well told and expertly intertwined with what was happening at Lyons and to the main protagonists of the story. While some readers would prefer footnotes and academic references, Ferry must be congratulated on producing a very fine, searching and attractive book which, while aimed at the popular market, makes a welcome addition to the LEO and wider history-of-computing literature.

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Maxime Schwartz, **How the Cows Turned Mad**. Translated by Edward Schneider. Berkeley and London: University of California Press, 2003. Pp. viii + 238. ISBN 0-520-23531-2. £17.95, $24.95 (hardback).
doi:10.1017/S000708740538753X

In his prologue, Maxime Schwartz, a molecular biologist at (and former head of) the Pasteur Institute in Paris, explains that due to the recent epidemic of bovine spongiform encephalopathy (BSE), Creutzfeldt-Jakob disease (CJD) has become highly publicized and a matter of concern for every one of us. His book examines the history of 'TSE science' in the last three centuries with a view to assessing whether TSEs are on the way towards being eliminated. 'TSEs' stands for transmissible spongiform encephalopathies, a group of fatal animal and human neurological disorders. In order to give the book a detective-story tone, Schwartz has grouped TSEs together under the catchy phrase 'the Disease'. His twenty-seven short chapters review TSE science chronologically, starting with the discovery of scrapie in British sheep flocks in the eighteenth century. Throughout he pays a great deal of attention to the dramas associated with these strange diseases, the latest one being the potential epidemic of the new variant of Creutzfeldt-Jakob disease (vCJD).

The first chapters discuss the early work on scrapie, the suspicion that it was infectious, the failed attempts at transmitting it experimentally, and the contradictory observations leading to the then-paradoxical conclusion that it was both infectious and genetic. The discovery of CJD and GSS, a very similar human disease, in the 1920s and 1930s is then described, and Schwartz emphasizes that these observations were ignored by the medical community for forty years.

He then turns to the advances made in the study of scrapie between 1936 and the early 1960s. In 1936 two veterinarians demonstrated that it was indeed transmissible (to sheep) and postulated that it was caused by a virus located in the nervous system. Thereafter, vets conducted several studies, and successfully transmitted scrapie to mice – a milestone in TSE science, since it enabled a number of experiments previously impossible to carry out. The story continues through the discovery in the late 1950s of kuru, a TSE raging in the allegedly cannibalistic Fore tribe in New Guinea; the noting of similarities between kuru and scrapie; the demonstration that kuru and CJD were transmissible to monkeys; and the creation of the category 'TSEs' in the 1960s. Schwartz devotes much space to the iatrogenic contamination of patients with CJD, and especially to the contamination of children whose dwarfism was treated with human growth hormone from the late 1950s until 1985.

From the middle of the book, the work of Stanley Prusiner and colleagues, devoted mainly to BSE and vCJD, is pervasive. In 1982 Prusiner set out to substantiate the hypothesis, first put forward in the 1960s, that the causative agent consists only of protein. The protein-only hypothesis came from researchers puzzled by the strange behaviour of scrapie, including the scrapie agent's resistance to treatments that destroy nucleic acid and the apparent failure of the disease to induce immune reaction in the host. Prusiner's own 'prion' hypothesis holds that TSEs are caused not by a virus but by the misfolded isoform ($PrP^{Sc}$) of the prion protein (PrP), a protein his team discovered and later showed to be encoded by a gene present in all mammals. Though Schwartz discusses in detail the many aspects of TSE aetiology that remain unexplained in the prion theoretical framework, he assumes that TSEs are caused by a protein. The book's main conclusion is that, thanks to the prion theory, 'the Disease has been unmasked' (p. 179).

Schwartz does a remarkable job of telling the rather complicated technical history of TSE science. Descriptions of both human and synthetic growth hormone, of Prusiner's early work on PrP, and of many other topics are very enlightening. As a result, the book is extremely interesting and informative, not only for readers who want to understand TSEs, but also for those unfamiliar with such disciplines as molecular biology, genetics or genetic engineering. Unfortunately, however, it fails to take account of the advances made in science studies in the last forty years or so. The prion hypothesis has generated a heated controversy, not yet resolved, in the TSE field. Though prions are now widely depicted as the infectious agents of TSEs, in 2000 a Yale CJD expert reviewing Prusiner's *Prion Biology and Diseases* (Cold Spring Harbor, 1999) wrote, 'There are indeed many extraordinary aspects of this new biology of prions, not the least of which is their possible non-existence' (Laura Manuelidis, 'The Force of Prions', *Lancet* 355, 10 June 2000, p. 2083). Schwartz only mentions in passing that some researchers disagree with the prion hypothesis, and the controversy is left out of his account. One could argue that scientists are seldom competent historians of science, yet it should be stressed that other books, also written by scientists, give a somewhat different version of TSE research.

Schwartz himself is not entirely oblivious to the fact that science is a social undertaking. When, for instance, he considers nineteenth-century authors who regarded the sex life of rams as a key element in the causation of scrapie, he points out that such theories 'inevitably reflected the writers' moral or religious beliefs' (p. 12). He also acknowledges the role of the scientific community in the success of the prion theory: 'It is obvious that the prion theory leaves many questions unanswered. But by and large it is convincing, so convincing that it is accepted by a great majority of specialists in the field' (p. 179). And that is precisely where the shoe rubs: Schwartz makes no attempt at explaining this power of conviction and its implications.

Why is it that Prusiner succeeded in promoting the protein-only hypothesis when his predecessors had failed in the 1960s and when initially his own prion hypothesis was almost

universally labelled a heretical view in biology? Why are alternative explanations of TSE causation such as the virino hypothesis seemingly unable to compete? Have numbers (of publications, of dollars, of laboratories, of citations, of techniques, of actors external to the TSE community) played a role in the acceptance of the prion hypothesis? Has the iconographic and discursive functioning of prion research been instrumental in establishing its hegemony within the TSE field? Why has Prusiner been awarded the 1997 Nobel Prize for medicine when it had previously never been granted to a still-disputed theory? What are the consequences of the hegemony of prion research on the work of scientists who believe the agent contains nucleic acid? Is there a link between the Nobel award and the BSE crisis of March 1996? Did prion research carry political weight?

In failing to tackle such questions, Schwartz offers a sanitized account of contemporary TSE research. The book's internal jacket claims that the history of TSEs 'illuminates the remarkable progression of science'. Indeed, this is an accurate picture of the book's orientation. It is a picture that historians, philosophers and sociologists of science are all too familiar with.

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John A. Moore, **From Genesis to Genetics: The Case of Evolution and Creationism**. Berkeley, Los Angeles and London: University of California Press, 2002. Pp. xvi + 223. ISBN 0-520-22441-8. £19.95, $27.50 (hardback).
doi:10.1017/S0007087405397536

As I write this, parents in Doncaster are protesting that the Vardy Foundation has taken over a local secondary school, as they rightly fear that their children will be taught Young Earth Creationism (YEC) instead of science. What was regarded as a purely American affair now has worldwide ramifications, so much so that secular Britain has allowed the teaching of YEC in state schools before the USA. My own observation after over thirty years of being involved in YEC is that most people simply do not understand the YEC movement.

Having been a biology professor in California with some experience of the movement, John Moore has written a book to explain what YEC is and why it is so repellent. There is a great dearth of books dealing constructively with the movement, and none from a popular perspective, so there is certainly an opportunity here. Unfortunately, this book does not live up to the recommendations on the dust cover. Moore's scientific credentials are impeccable, and where he explains aspects of evolutionary science, his book is excellent. But his understanding of both the nineteenth-century situation and the 'Rise of Creation science' is inadequate. He wrongly draws parallels between theology and 'anti-evolution' in the nineteenth century and Intelligent Design and YEC today. There are superficial morphological similarities, but no genetic relationship, since today's YEC is not a continuation of Darwin's predecessors but a new phenomenon deriving from Seventh Day Adventism, as Ronald Numbers showed with great clarity in *The Creationists* (1993). Although Moore dates the rise of Creation science to 1963, with the formation of the Creation Research Society, the antecedents go back to McCready Price and others before the war. The most significant event – the publication of Morris and Whitcomb's *The Genesis Flood* (1961) – is not even mentioned. As for the account of the last forty years, it is full of gaps. There is, for instance, little mention of the Institute for Creation Research and no mention of Ken Ham's Answers in Genesis, though these are the two largest YEC pressure groups. Moore likewise deals inadequately with the Intelligent Design movement, wrongly including Steven Austin among its supporters. In a chapter devoted to Genesis, Moore treats the outmoded literary criticism of thirty years ago as the answer to YEC use of the Bible. It will convince no one.

I cannot recommend this book at all, as it is a golden opportunity squandered. Moore fails to grasp both the religious appeal of Young Earth Creationism and its political clout. All his book does is to confirm prejudices, whether 'evolutionist' or 'creationist'. For the history of YEC up to 1992, Numbers's book remains the only guide. The best popular treatment is probably Larry Witham's *Where Darwin Meets the Bible* (Oxford, 2002). These are written from an American perspective, however. Nothing has been written on the British situation, which grows every day.

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ALAN H. GOODMAN, DEBORAH HEATH and M. SUSAN LINDEE (eds.), **Genetic Nature/Culture: Anthropology and Science beyond the Two-Culture Divide**. Berkeley, Los Angeles and London: University of California Press, 2003. Pp. xvii + 311. ISBN 0-520-23793-5. £16.95, $24.95 (paperback).
doi:10.1017/S0007087405407530

*Genetic Nature/Culture* explores the relationship between anthropology and genetics in the current age of geneticization. The book is divided into four parts. The first considers the formation of knowledge about human genetics and the ways in which people are recruited (or forced) into networks of knowledge creation. The second part focuses on animals and their role in making knowledge. The third part looks at how groups of people redefine knowledge to fit their culture. The fourth part examines the genetics of race. A major theme running throughout is ethics: in genetics, in anthropology, and more generally in the power relationships surrounding knowledge. As such, the book speaks more directly to science studies professionals than to historians of science. However, some of the issues surrounding the genetics of today also apply to the genetics – and more widely to the science – of the past. The book therefore provides ideas for writing non-standard histories of science that address present concerns.

The opening essays use historical cases to investigate the ethics of using people to create knowledge. The first tells the story of the major human population-genetics project that James Neel conducted during the 1960s and 1970s. In the second, Susan Lindee discusses how Victor McKusick recruited Amish people into a network of informants about the health of community members. Her essay can be profitably compared with that of Donna Haraway, in the second part, on dogs. Haraway shows that animal fanciers have collected information about inheritance which geneticists have neither the inclination nor the means to collect. At the same time, as she reveals, fanciers have had to enrol scientists to turn their information into knowledge. When Haraway's analysis is considered alongside Lindee's story of a geneticist recruiting people to gain information, it appears that only geneticists can create genetic knowledge, but that they often use information gained from others to do so.

Another interesting comparison between these two essays concerns the question of audience, of whom the knowledge was created for – a second theme that runs throughout the book. Lindee points out that while McKusick took advantage of the Amish's interest in health issues, the results of his research were not intended for Amish eyes; similarly, Haraway shows that many fanciers did not want to recognize their stock as diseased. In the book's animal-oriented second part, Haraway's essay is placed alongside those of Sarah Franklin and Jonathan Marks. While Haraway considers animal genetics in connection with fancying, Franklin looks at that science in the context of agriculture, and Marks in the context of comparative anthropology. None of these contexts have received much consideration by historians of genetics. The general lesson I drew from these essays was that historians need to pay more attention to the roles that non-geneticists have played in creating genetic knowledge. We have begun to investigate the people and animals

that geneticists have studied, but have much to learn about what fanciers, agriculturalists and anthropologists have contributed.

Where the first half of the book deals with knowledge creation, the second half turns to the meanings given to knowledge and the uses to which it is put. In the third part, the focus is on cultural meanings among traditionally opressed groups. For example, Chaia Heller and Arturo Escobar look at how the people of the Pacific rainforest have reinterpreted biodiversity to include different ways of living, in order to preserve their land (and other) rights. Joan Fujimura and Himla Soodyall's essays go further, arguing that cultural meanings can be the reason for knowledge formation. In Fujimura's example, Japanese scientists believe that the results of genetics are more compatible with Eastern culture than Western. In Soodyall's case, the very act of doing anthropological genetics in South Africa is seen to restore a sense of pride to the South African people.

The final essays, on race, looks at the question of whom knowledge serves and the surrounding social, ethical and legal issues. We learn, for example, that though studies of disease in African Americans might be supposed to benefit the health care of that group, its social situation means that its members tend to lack access to health care, so that being defined as high risk for certain diseases in fact threatens access to health insurance and employment. In Troy Duster's contribution, he argues that, while we can disprove the existence of biological races, denying their social existence amounts to denying racial discrimination.

Despite historians' protestations that science must be studied because it affects many aspects of everyday life, the use and meanings surrounding genetic knowledge have so far been little examined. This book is not a history of genetics, anthropology or other sciences. However, in discussing genetics from a wide range of perspectives (anthropological, methodological, ethical), it suggests that perhaps historians should broaden their view of genetics, from one concentrating on a single scientific discipline, to one which encompasses the multiple and diverse influences of genetics on individuals' lives.

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