

Book reviews

- Jürgen Helm and Annette Winkelmann (eds.), *Religious Confessions and the Sciences in the Sixteenth Century*. By Sachiko Kusakawa 363
- Richard Yeo, *Encyclopaedic Visions: Scientific Discoveries and Enlightenment Culture*. By Adrian Johns 365
- Louise E. Robbins, *Elephant Slaves and Pampered Parrots: Exotic Animals in Eighteenth-Century Paris*. By E. C. Spary 367
- Patricia Fara, *Newton: The Making of Genius*. By Rebekah Higgitt 368
- R. Angus Buchanan, *Brunel: The Life and Times of Isambard Kingdom Brunel*. By Ralph Harrington 370
- Roger Luckhurst and Josephine McDonagh (eds.), *Transactions and Encounters: Science and Culture in the Nineteenth Century*. By Elizabeth Green Musselman 371
- Nick Hopwood, *Embryos in Wax: Models from the Ziegler Studio. With a Reprint of Embryological Wax Models by Friedrich Ziegler*. By Samuel J. M. M. Alberti 372
- Nicole Hulin, *Les Femmes et l'enseignement scientifique*. By Cristina Chimisso 373
- Graham Richards, *Putting Psychology in its Place: A Critical Historical Overview*. By Roger Smith 374
- G. C. Bunn, A. D. Lovie and G. D. Richards (eds.), *Psychology in Britain: Historical Essays and Personal Reflections*. By Thomas Dixon 375
- Nikolai Kremontsov, *The Cure: A Story of Cancer and Politics from the Annals of the Cold War*. By Carsten Timmermann 377
- Richard Polenberg (ed.), *In the Matter of J. Robert Oppenheimer: The Security Clearance Hearing*. By Charles Thorpe 378
- G. I. Brown, *Invisible Rays: The History of Radioactivity*. By Arne Hassenbruch 379
- E. Roy Weintraub, *How Economics Became a Mathematical Science*. By I. Grattan-Guinness 380
- Philip Mirowski and Esther-Mirjam Sent (eds.), *Science Bought and Sold: Essays in the Economics of Science*. By Theodore M. Porter 381
- Stephen P. Turner, *Brains/Practices/Relativism: Social Theory after Cognitive Science*. By Cornelius Borck 383
- JÜRGEN HELM and ANNETTE WINKELMANN (eds.), **Religious Confessions and the Sciences in the Sixteenth Century**. Studies in European Judaism, 1. Leiden: Brill, 2001. Pp. xiv + 161. ISBN 90-04-12045-9. \$58.00, €49.00 (hardback). DOI: 10.1017/S0007087403215119
- This collection of essays on the relationship between ‘science and religion’ is in a series dedicated to the study of European Judaism and by including studies on Christian denominations, it provides a valuable comparative perspective. All the essays are in English and engage with two questions: to what extent was scientific thought influenced by religious traditions and beliefs? And did the achievements of sixteenth-century natural sciences and medicine have an effect on religious ideas?
- Jewish belief in the creation of the world, for instance, inspired Hasdai Cresca to develop an anti-Aristotelian physical theory, which in turn contributed to the critiques of Aristotelian philosophy by Gianfrancesco Pico and Giordano Bruno (as discussed in the article by Mauro Zonta); Jewish interest in the history of Israel, furthermore, shaped Jewish receptions of geographic discoveries throughout the Middle Ages, as well as the New World discoveries – as the so-called ‘Indians’ discovered

in America were identified with descendants of the ten lost tribes of Israel (Johann Maier). Yet it would be simplistic to characterize Jewish reactions to European learning and science as 'anti-rationalist': Abraham Portaleone and Azariah Figo could balance their objections against Aristotelian natural philosophy that denied the creation of the world with an interest in assimilating the practical sciences as the study of God's creation, with the help of the enlightenment of the Torah (Gianfranco Miletto). Profane knowledge could also be assimilated for cultural reasons. Portaleone compiled an encyclopaedic work in which he combined past and contemporary European insights into nature, warfare and music with the study of Jewish antiquities. It is a work that represented the cultural inheritance that Abraham Portaleone, coming from a family that served six Dukes of Mantua, wished to pass on to his son (Samuel S. Kottek). Contemporary humanist scholarship on history, on the other hand, was rejected by Rabbi Judah Loew of Prague, who was also involved in defending Moravian Jewish culture which was coming under increasing attack (Giuseppe Veltri). Acquainted with Tycho Brahe, Johannes Kepler and Rudolf II, Loew accepted the contemporary achievements of science but saw the need to have it integrated into traditional Jewish thought without denying rabbinical hermeneutics. An important fact to acknowledge here is that the Jewish people in early modern Europe were conversant with and understood their contemporary, European and profane learning, as can be gleaned from the Iberian Jews in Cairo with medical interests (Eleazar Gutwirth).

Analogous observations are also made with respect to Catholic and Protestant approaches. Thus the natural philosophy of Philip Melancthon is distinguished from theology through the Lutheran distinction of Law and Gospel, though still imbued with belief in the traces of a Creator, a sort of Platonic natural theology (Günther Frank). The Jesuit promotion of mathematics, philosophy and the sciences was not pursued for their intrinsic value, but for the sake of supporting theology and

evangelization. This in turn limited the application of mathematical demonstration to the physical world (Paul Richard Blum). In the area of medicine, anatomy, as a study of following the word of the body (Vesalius), struck a chord with Lutheran emphasis on following the word of God, and an intuitive and spiritual anatomy (Paracelsus) was inspired by the intuitive and spiritual approach of the radical reformers (Andrew Cunningham). Furthermore, institutional comparison shows that while the anatomical curricula at the Catholic Ingolstadt and Lutheran Wittenberg are virtually indistinguishable, the teaching of anatomy in the arts faculty was unique to Wittenberg (Jürgen Helm). The case of Calvinism is taken up in a study of Royal Prussia around 1600, where it is shown that patricians and burghers sought 'Gelehrte' as a precondition of the governing elite, because they believed that it was important to be learned in theology as well as science. This academic hegemony ended, however, with the Lutheran reconquista and the onset of the Counter-Reformation (Michael G. Mueller).

Much has been written about science and religion. The Victorian origin of the paradigm of the 'warfare between science and religion' has been acknowledged; the case has been made that science was not always against religion, and that religion not always against science. At times, the relationship appears all too variegated and complicated. This volume of collected essays starts off with the premise, historically obvious but all too often neglected in practice, that natural philosophers in early modern Europe were pious men well aware of their religious traditions and heritage. Indeed they could not have been more aware of it in the sixteenth century, that age of confession-alization through simultaneous impulses of dissociation and homogenization. Not only were confessional identities sought and fashioned but we must remember that such religious identities were also part of political, regional and cultural identities. In this sense, the confessional moves in Western Christianity share much with the concern among the European Jewish people to preserve and maintain their

identity. The study of nature could be part of an identity, if it helped to support, enhance and praise the deity; it could be threatening and alien, if it demonstrated contradiction against teachings that were perceived as central and defining.

SACHIKO KUSUKAWA
Trinity College, Cambridge

RICHARD YEO, *Encyclopaedic Visions: Scientific Discoveries and Enlightenment Culture*. Cambridge: Cambridge University Press, 2001. Pp. xxi + 336. ISBN 0-521-65191-3. £40.00 (hardback).
DOI: 10.1017/S0007087403225115

Everyone remembers the moment in *Dr No* when James Bond wakes up on a Caribbean beach to see Ursula Andress striding towards him out of the surf. Only inveterate academics will remember it for the curious philosophy of pedagogy it serves to introduce. Honeychile Rider turns out to be the orphaned child of a marine biologist. Dr No having murdered her parents, she has educated herself by the sole means of slogging sequentially through an old encyclopaedia she found in the ruins of their home. 'I started with A when I was about eight', she tells Bond. 'I've got as far as the middle of T. I bet I know more than you do about a lot of things.'

One of the many interesting questions posed by Richard Yeo's new book is that of what, exactly, a Honey Rider could be said to 'know'. A vast tranche of Gradgrindian facts, presumably – though even that might not be so obvious if the encyclopaedia were a really old one, dating from when her family first came to Jamaica (in the novel Rider is the last descendant of a judge who helped condemn Charles I to death and was rewarded with a plantation in the West Indies by a grateful Cromwell). Beyond that things are less clear. What notions would she get of the shape of knowledge – the union and division of its subjects, and its development over time? What critical skills would she accrue? And how would the experience shape her as a civilized being?

These would seem odd things to ask of a modern encyclopaedia. But they have not always seemed so strange. Originally the notion of an encyclopaedia referred specifically to a circle of learning, through which a reader passed in gaining a liberal education. Yeo's work opens with this concept, which manifested itself in the Renaissance in volumes which did indeed envisage their being read by a single individual, and valued the overall structure and end of knowledge at least as highly as technical accuracy or sheer coverage. But by the time mid-Victorian men of science like James Clerk Maxwell were contributing treatises on their specialist subjects to the multi-volume imperial *Encyclopaedia Britannica*, any such purpose was long gone. Not only could no one individual have composed a work of such sweep; no one individual was expected to read it either. Nor, if such a person did exist, was the work intended to lead her to a liberal education. (Yeo actually mentions one or two readers who tried to educate themselves *à la* Rider with these monsters, and failed.) The aim now was instead to encompass the current state of knowledge as presented by a collection of experts in discrete fields. Any mind capable of mastering the resulting work could only be what H. G. Wells, projecting his own version, would call a 'world brain'. This is the kind of encyclopaedia with which we today are more familiar – if one can ever really be said to be familiar with something so vast. This is surely what poor Rider had to deal with.

Yeo's history deals with the process linking those two points: the circle of learning and the world brain. Although its explicit subject is a sequence of books, it is no less centrally about the history of their makers and their ideal readers, from the gentleman of broad and liberal education to the scientist of narrow but deep expertise. It is a plain-spoken work, which is a relief because the history of encyclopaedias can sometimes seem a dry subject and almost as daunting as their physical bulk. It has novel and important things to tell us about the history of systems of knowledge, their construction and their consequences.

Yeo deals at his largest extent with the long Enlightenment, ranging from the late sixteenth century to the late nineteenth. But his story really begins after 1700 with the ‘dictionaries of arts and sciences’ issued by authors like John Harris and Ephraim Chambers. Chambers’s *Cyclopaedia* in particular he rescues from misrepresentation as a primitive *Encyclopédie*, placing it instead in the tradition of commonplacing extending back through the Renaissance to the ancient world. Beginning here, Yeo goes on to construct a novel schema for the process that saw such dictionaries change first into encyclopaedias, and then into the huge collective enterprises of the Victorians.

Encyclopaedic Visions divides its history into three broad stages. First come the early-Enlightenment dictionaries that emerged from a culture of patronage and dynastic rule. These had individual authors, were often presented to monarchs or other powerful patrons in return for recognition of that authorship (perhaps by privileges), and made appeal to a cosmopolitan republic of letters. They enshrined the objective of contributing to a liberal education, often by helping their ideal readers face without flinching the otherwise overwhelming mass of books created by print. Such dictionaries then retreated in the mid-eighteenth century before the rise of commercial society, the relative decline of patronage and (not least) the ever-increasing amount of material that must be compiled. In their place came projects that often had many joint authors and publishers, and appealed to national identity rather than cosmopolitan society – as most famously in the case of the *Britannica*. These projects were partly entrepreneurial. They sought to become valuable copyrights, and sometimes succeeded. In the meantime they were often financed through subscription, their lists of subscribers constituting a different kind of virtual community to which purchasers chose to sign up. Finally, after about 1800 the encyclopaedia became subject to the division of labour in the intellectual realm. Editors now commissioned leading specialists in discrete fields of knowledge to compose entries that

amounted to treatises on their particular subjects. Indeed, some of these entries were also published separately as textbooks. The aspiration now was not to facilitate the emergence of a gentleman reader but to capture the state of knowledge itself – a state that in an age of scientists nobody imagined any one reader could conquer. The scope of the encyclopaedia and its audience had both become universal.

That trajectory – simplified here, but I hope not too crudely so – makes encyclopaedias more interesting than their image as repositories of facts might imply. One is the prominent place it accords a principle of knowledge as a public good. Yeo proves that dictionaries and encyclopaedias became deeply implicated in the struggles over literary property out of which modern copyright emerged, but also that they offered an entirely distinctive contribution to those struggles that historians have not properly appreciated. They were themselves valuable copyrights, yet in their structure and content they both exemplified and explicitly advanced a claim that knowledge was a public good. This provides a valuable corrective to a current historiography that concentrates on prominent authors, canonical trials and the Romantic ideology of genius. The peculiarly compromised practice of authorship that encyclopaedias fostered, with its complex conventions of appropriation, acknowledgement and abridgement, was at the heart of this. But at the same time that practice clearly related to the identity of the scientific practitioner. A second unexpected point of interest is therefore that the process charted in Yeo’s book contributed to the cultural history of that identity – the history that extends from the patronized philosopher of the court to the professorial physicist of the Cavendish. It is not always clear whether encyclopaedias drove such change or responded to it. Both, presumably. But in raising these issues Yeo has certainly set a compelling agenda for the study of an unjustly neglected genre.

ADRIAN JOHNS
University of Chicago

LOUISE E. ROBBINS, **Elephant Slaves and Pampered Parrots: Exotic Animals in Eighteenth-Century Paris**. Animals, History, Culture. Baltimore and London: Johns Hopkins University Press, 2002. Pp. xiv + 349. ISBN 0-8018-6753-3. £33.00 (hardback). DOI: 10.1017/S0007087403235111

The bedroom which Frederick the Great prepared for his pet *philosophe*, Voltaire, at Sans-Souci in Potsdam is lavishly adorned with plaster reliefs of brightly coloured parrots, swinging from hoops. What Voltaire made of this exotic throng is doubtful, but reading Louise Robbins's book inclines one to make some rather unfortunate comparisons with ornamental captives admired for what was viewed as a purely mechanical ability to show off and speak.

Elephant Slaves and Pampered Parrots has rightly attracted plaudits for its richness and the fascinating subject – the multifarious worlds of animal trading and keeping in eighteenth-century Paris – which the author treats in extensive and well-researched detail. Full of colourful anecdotes and fascinating snippets, the book is an enjoyable read, well written and thorough, and undoubtedly contributes much to our understanding of a subject about which little was previously known. Where else could one learn that the Duc de Chartres, father of King Louis-Philippe, dressed up as a wild animal to gatecrash a dinner party? Or that Bougainville had a jaguar strangled in 1764? Exotic animals also provided materials for plays and satires, mediated diplomatic efforts and helped court paramours. We learn of the transformations of the Royal menagerie at Versailles, the Parisian shops selling exotic animals, the boulevard and fair booths and arenas. Robbins maps the geography of animal-keeping, from the palace to the salon, shipboard or street, and concerns herself with the social place of different sorts of animal display, from the monarch to the *bas peuple*. She shows how scientific practitioners and periodicals cooperated in weeding out fake exotic animals and, conversely, how animals long believed to be legendary could be reified

by the same means. Living exotic animals, it seems, could stand for many different things, from the concrete – gifts, ornaments, women's sexual organs – to the abstract – power, enlightenment, maternal devotion.

Through Robbins's wide-ranging surveys, we are introduced to the whole spectrum of animal trade, keeping and display in one particular culture. In this sense her book offers a cultural history of exotic animals; among other issues, she explores how the guilds, global trade routes and print variously mediated the place of exotic animals. One particular strength is her discussion of the significance of mimicry as embodied in animal behaviour. Another is her careful study of literary uses of Buffon, which was the original basis for the book. Robbins is good at teasing out the multiple uses of representations of, say, the caged animal: it could be an image of slavery, but also an image of freedom, of pastoral imaginings or a symbol of the King's role as liberator of his people. But the reader waits in vain for some discussion which might bring together all these apparently conflicting significances. Different meanings appear in one chapter, only to vanish in the next, and there is no account of how cultural work was done through juggling opposing ones. A deeper analysis of the themes raised is not infrequently swamped in her wealth of material. The exotic would, in the end, become utterly emblematic of the domestic in the form of the household canary, a rich man's craze in 1700, but ubiquitous by the end of the old regime and often synonymous with feminine chastity. Robbins too often carves a path through such tortuous issues, although, as her own sources show, female sexuality and political agency alike were increasingly managed through satirical reference and caricature involving animals. Here lies the heart of the difficulty of this rich book. Exotic animals are detachable from culture and, like mirrors, they merely reflect bigger analytical categories. Robbins's accounts of the diverse meanings of animals are thus asymmetrical: social or political reality is always a given, only animals are a construct.

Thus Robbins stops at characterizing Buffon's account of the wild state (appropriated by Rousseau for his famous discourse on inequality) as contradictory, without observing how the contradiction itself reveals that animals were discursive resources, serving now to contrast wildness with political sociability *à la* Montaigne, now to celebrate it as a resistance to degeneration into political tyranny *à la* Montesquieu. That animals might be instruments for intervening in culture – that they might be constituted by, and constitutive of, categories such as gender, social status or political agency – is not considered. Animals are 'metaphors' or 'symbols'; writing about them never changes or contributes to the many socio-political debates she touches on, such as slavery, luxury, exoticism, commerce or domesticity. As a result, certain sorts of historical issue are deemed worthy of extended discussion, such as the structure of the guild system, or the import trade in exotic animals, and these are fascinating and valuable. Others receive minimal attention; the account of animals as representative of different types of slavery is extended, but the account of contemporary writings on human slavery stops at a nod to the secondary literature. A broader trawl through the *Histoire naturelle*, taking in animals other than the exotic, or even humans, would surely have produced a richer account of the political purposes served by writing about animals as slaves, especially as Buffon was a renowned opponent of human slavery. One wishes Robbins had looked outside the boundaries of her project from time to time, and considered what happened to animals which ceased to be exotic, or which ceased to be alive. It seems clear that a royal need to immortalize the wondrous and exotic illuminates the origins of the Académie royale des sciences's programme for animal anatomy with its dissections of chameleons and beavers, yet neither that programme nor the issue of wonders in general is explored. Within the confines of her project it is not entirely clear why there is no sustained account of the wide range of issues raised by animal behaviour, including cognition, the origins of society and

language, the passions, and the status of man in relation to the animals. Animals are not so much, in her paraphrase of Lévi-Strauss, 'good for thinking with', as good for writing about. Ultimately, Louise Robbins's book leaves numerous questions about how the history of exotic animals might help to rewrite the history of eighteenth-century politics, gender, consumption or the sciences.

E. C. SPARY
University of Cambridge

PATRICIA FARA, *Newton: The Making of Genius*. London, Basingstoke and Oxford: Macmillan, 2002. Pp. xvi + 347. ISBN 0-333-90735-3. £20.00 (hardback).
DOI: 10.1017/S0007087403245118

This work is the most fully developed example, within the history of science, of what has recently been termed 'reputational studies' (David P. Miller, "'Puffing Jamie": the commercial and ideological importance of being a "philosopher" in the case of the reputation of James Watt (1736–1819)', *History of Science* (2000), 38, 1–24, 2). This field examines the 'basic insight' that 'characterizations of historical figures are clearly shaped by varying historical circumstances but also that reputations are often implicated in the justification and legitimation of action' (ibid.). This is not, therefore, a biography of Newton, but a cultural study of the development and uses of his reputation from the beginning of the eighteenth century to the end of the twentieth. Fara has produced a fascinating and meticulously researched study of Newton as 'not just another dead white male scientist, but a major figurehead who symbolizes individual brilliance and scientific achievement' (p. xvi).

Fara traces the development of Newton's image from the reclusive scholar, who wrote more on alchemy and theology than on science, to the modern scientific icon. Newton's life has been constantly reinterpreted in ways that reflect the concerns of succeeding historical periods. The structure of the book is broadly chronological and describes clearly the journey taken by Newton's posthumous

reputation. On this can be charted changes to scientific practice, the scientific community, its perception by outsiders and the concept of scientific genius. However, the path is never straight and the chapters are necessarily also partly thematic. A variety of conceptions of Newton coexisted within any particular period, highlighting differences in how scientific knowledge was gained and how its practitioners should be celebrated. The interpretation of particular groups or individuals could, as in the case of William Blake, be idiosyncratic, but the differences between, for example, the views of the Romantic poets and those advocating working-class education are instructive. While the first emphasized the progress of science through moments of inspiration, the second focused on hard work and perseverance. Newton had made statements that fed both viewpoints and could thus be moulded as a hero of more than one group.

In the chapter on 'Icons', and indeed throughout the rest of the text, Fara makes good use of visual and material evidence. Illustrations are generously selected from three centuries of drawings, paintings, prints and statues of Newton. In themselves they demonstrate the vast range of uses to which Newton's image has been and can be put, both literally and metaphorically. Identifications with his legacy are seen to be made for geographical, scientific, philosophical, social and educational reasons. However, they also show the extent to which Newton's image has entered our material world. The images typify the evocative words Fara has chosen as some of the chapter headings: Sanctity, Genius, Myths and Shrines. 'Myths' neatly dissects some of the stories surrounding Newton and particularly that of the apple. It demonstrates both how such stories gain currency and why they are of importance, whether or not they are historically true. The apple symbolizes the moment of inspiration and one understanding of discovery. Tales of absent-mindedness conform on the one hand to those told about the ancient Greek philosophers and on the other to a modern stereotype of genius.

Fara covers the period from the late seventeenth century, with Newton's self-presentation and the shoring-up of his reputation by supporters, to the 1990s. However, as with the study by Richard Yeo ('Genius, method, and morality: images of Newton in Britain 1760–1860', *Science in Context* (1988), 2, 257–84), it is the decades surrounding the turn of the eighteenth and nineteenth centuries that are the crux of the story. This was the period 'when science became consolidated and genius took on new meanings', when the production of printed texts and illustrations boomed and in which Newton's fame was firmly established. 'Science and Newton's fame grew together and fed on each other' (p. 14). Newton could not become an iconic scientist until the word 'scientist' was in common use, well after its coining by Whewell in 1833. Nor could he represent the mad genius until 'genius' was understood as an inspired individual rather than an aptitude or skill that one might possess. He could not be presented as a secular saint until the secularization of science was under way. But, as Fara suggests, the very meanings of these words have themselves been affected by perceptions of Newton.

In terms of both the historical period covered and the evidence marshalled, this book covers a great deal. One thing that becomes obvious about Newton is that his name is constantly before the reader of popular, scientific, educational, aspirational and inspirational texts, not to mention the fact that his face has been depicted on all manner of objects. Fara has dealt with this recipe for confusion with admirable clarity. Of necessity, however, a more detailed picture is sacrificed. The name of Newton was frequently a useful shorthand for a set of values that an author wished to identify himself with, but Newton's reputation could symbolize much more. There is no space to investigate fully the reasons – personal or professional – why an individual might devote a great deal of time to promoting an image of Newton or arguing against that pushed by another. The late nineteenth and twentieth centuries perhaps also receive a sketchier treatment than the earlier period.

Fara has, in a thoroughly readable book, convincingly described the beginnings of an understanding of Newton which essentially remains familiar today, and in the process added texture to themes fundamental to our understanding of the history of science.

REBEKAH HIGGITT
Imperial College London

R. ANGUS BUCHANAN, **Brunel: The Life and Times of Isambard Kingdom Brunel**. London and New York: Hambledon and London, 2002. Pp. xxiv + 294. ISBN 1-85285-331-X. £25.00 (hardback).

DOI: 10.1017/S0007087403255114

It is both a tribute to the quality and enduring value of L. T. C. Rolt's *Isambard Kingdom Brunel* (London, 1957) and a reflection on the inadequacies of more recent studies that Rolt's work continues to hold the field as the one indispensable modern biography of the great engineer. Certainly this latest 'life and times' from R. A. Buchanan is not going to challenge its status. It is to be welcomed, however, as a competent biography that updates and substantiates our understanding of Brunel's career and as a worthwhile if unsatisfactory attempt to place the man in his social, cultural and political context.

Buchanan's book includes a number of thematic chapters, but consists essentially of a narrative account of Brunel's life. As would be expected from this author, this is fluent and accurate, incorporating much detail without sacrificing readability. It differs from previous accounts in its scholarly approach and in its incorporation of the insights to be gained from the Brunel archives and collections at Bristol and elsewhere. Buchanan also seeks to pay as much attention to the means through which Brunel's projects came to be conceived and undertaken as to the final results; to put it another way, he is as concerned with process as with outcome, which in the artefact-centred and somewhat teleological world of engineering history is to be welcomed. This results, for example, in coverage of Brunel's involvement with the Great Western Railway which brings

some fresh insight to that familiar story, and in an account of the building of the *Great Eastern* which locates it as a complicated but comprehensible commercial and technical job rather than a vast tragedy or the final epic struggle of a lone genius. Many of the lesser-known aspects of Brunel's career are discussed, notably his overseas projects in Ireland, India, Italy and Australia and such works as the bridge at Balmoral and his contribution to the Crystal Palace, which are little covered elsewhere (indeed, the most useful discussion of both these projects is to be found in earlier published work by Buchanan himself, upon which this book draws). Brunel's relationships with his subordinates and collaborators are excellently analysed in this book and a much more rounded and balanced view than can be found anywhere else emerges as a result.

The inadequacies of this book become clearer the further Buchanan moves from the world of engineering. As an attempt to place Brunel in the context of his times, this book is a worthy effort in a noble cause, but cannot be considered successful. Buchanan's account of the wider historical context is generally clumsy and outdated. His picture of the 'age of revolution' into which Brunel was born draws on no work more recent than 1975 and relies largely on David Thomson's *Europe since Napoleon* (London, 1957) and Eric Hobsbawm's *The Age of Revolution* (London, 1965). The historiographical foundations of Buchanan's account of the industrial revolution extend no further than Peter Mathias's *The First Industrial Nation* (London, 1969) and the works of Sir John Clapham, while his view of the intellectual history of the time relies on Owen Chadwick and Herbert Butterfield. The result of this limited and superficial approach is that claims such as that the proceedings of the 1789 National Assembly 'undermine[d] the absolute monarchy in France' (p. 2), that by 1800 Britain 'had become a fully industrialized society' (p. 5), and that the entire spectrum of political and social change across Europe from the French Revolution to the unification of Germany can be seen as part of the same phenomenon and ascribed to something called

'modern nationalism' (pp. 2–3) are unproblematically deployed. Elsewhere we find casual generalizations about the Victorian 'middling classes' being fully committed to the idea of 'laissez-faire' and an equally casual dismissal of recent and sophisticated arguments to the contrary (p. 174). A similar superficiality infects Buchanan's observations on the aesthetics of Brunel's architecture, in which a claim that Brunel was 'probably reflecting the Victorian reaction against the Palladian Classicism of the eighteenth century' in his preference for the Italianate style (p. 136) is anachronistic and simplistic, riding roughshod over an entire landscape of aesthetic, cultural and political complexity.

Such limitations prevent this book from being other than a competent and useful survey of Brunel's life and work. Buchanan writes, correctly, in his introduction that 'there is room for a book which aims at a scholarly assessment of the whole of Brunel's career, placing him firmly in the historical context to which he belongs' (p. xviii). Buchanan's biography can be welcomed as a more successful attempt at such a work than any we have yet seen, but the need for such a book remains.

RALPH HARRINGTON
University of York

ROGER LUCKHURST and JOSEPHINE McDONAGH (eds.), **Transactions and Encounters: Science and Culture in the Nineteenth Century**. Manchester and New York: Manchester University Press, 2002. Pp. ix + 239. ISBN 0-7190-5911-9. £15.99 (paperback).
DOI: 10.1017/S0007087403265110

Paradoxically, the Victorian period acts as a benchmark both of the rising professionalization of scientific disciplines and of the deep embeddedness of the sciences in culture. Like many others before them, this volume's contributors explain that C. P. Snow's 'two cultures' divide, to the extent that it ever existed, developed only through an arduous process of persuasion. In other words, the paradox outlined above is no paradox at all; the rhetorical device of separation has thinly masked

hybridities between science and the rest of human experience.

The last time multiple Victorianists addressed science in one volume, the result was Bernard Lightman's *Victorian Science in Context* (Chicago, 1997). The two books make for an instructive comparison, as most of the contributors to Lightman's volume are historians of science, while all but one of the *Transactions and Encounters* contributors are English literature scholars. This difference manifests itself obviously in some papers that focus more exclusively on discursive matters, but there are a number of papers that historians of science will find quite comfortable reading (White, Luckhurst, Turner, Burdett) and others that gently push the historian of science out of her usual comfort zone (Connor, Stott).

The editors have divided the volume's nine papers among three themes: mediating technologies, the limits of scientific knowledge and ideas of progress in evolutionary science. The first set of papers considers the importance of visual and aural technologies in Victorian culture. Steven Connor argues that hearing in the second half of the nineteenth century underwent a process like Jonathan Crary's 'autonomization of sight' (*Techniques of the Observer* (Cambridge, MA, 1990)). The invention of the telephone, phonograph and similar devices allowed sound to be dissociated from the original human producer, thus both confirming the spiritualist's belief in our ability to communicate with the disembodied and inspiring new spiritualist practices of communication. Isobel Armstrong further comments on Crary by delineating competing, mid-century epistemologies of the microscopic world. Lindsay Smith offers a novel reading on the much-trammelled subject of photography when she uses the work of twentieth-century photographers to expose how artificial photography's monochromatism was to early Victorians.

Literally and conceptually, the second section provides a fulcrum for the book as a whole. Both Paul White and David Amigoni discuss Victorian writers' attempts to define science and literature within a single, Arnoldian

culture. White describes well the awkward dance of extra-Oxbridge men who earned much of their living through periodical-writing, but who also struggled to transcend the stigma of being 'mere' literary men. Amigoni's discussion of the rhetoric of imitation neatly plays off White's thesis. Amigoni notes that where men of science like Huxley might have insisted on good writing's ability to imitate nature, a closer look reveals that mimesis, like biological evolution, contained within it the need for invention. Even some nineteenth-century science writers realized the deep impossibilities of perfect mimesis – a realization that prefigures postmodernism. Meanwhile, Roger Luckhurst argues that some late Victorian mind-readers allied themselves with materialist science (claiming that their skill was a matter of interpreting muscular movement) while others allied with spiritualists (claiming that they could read thoughts without touching their subjects). He then argues, similarly to White and Amigoni, that ultimately these men had imperfect control over how their actions were interpreted, and that their work thereby attained a hybrid status across lines of demarcation between science and superstition. This section of *Transactions and Encounters* thus most clearly elaborates the book's thesis about the untenability of the two cultures thesis, even for the nineteenth century.

The last, and equally intriguing, section on evolutionary science includes Rebecca Stott's witty examination of the 'marine grotesque' in evolutionary biology. She shows that the marine invertebrate provided a comic, grotesque foil in evolutionary tales, an image that would be transformed by the dominance of the ape after the 1860s. Where Stott's men of science read sexual anxieties onto grotesque invertebrates, Lynette Turner describes how the late Victorian ethnologist Otis Tufton Mason bucked the trend of hypersexualizing the female 'savage' by instead constructing her as an ahistorical angel of the hut. Finally, Carolyn Burdett connects Karl Pearson's biometrics and eugenics with his keen interest in German romanticism, one in which the male and female principles of the intellect were united or, in

more eerily prescient terms, science instilled a mercilessly moral progress into the human race.

Non-specialists will find much of the material in this volume opaque. In fact some papers, like Armstrong's and Amigoni's, are virtually unintelligible without specialized knowledge of critical theory and the secondary literature on Victorian science and culture. However, Manchester University Press has made the book accessible in another sense by making it relatively affordable and cleanly produced.

Though this will concern *BJHS* readers less than others, it is worth noting that the book deals almost exclusively with English science, despite a title that might suggest a larger geographic scope.

ELIZABETH GREEN MUSSELMAN
Southwestern University

NICK HOPWOOD, *Embryos in Wax: Models from the Ziegler Studio. With a Reprint of Embryological Wax Models by Friedrich Ziegler*. Cambridge: Whipple Museum of the History of Science and Bern: Institute of Medical History, 2002. Pp. ix + 206. ISBN 0-906271-18-5. £13.50 (paperback). DOI: 10.1017/S0007087403275117

A century ago, models from the studio of Adolf and Friedrich Ziegler could be found in cabinets across the world, from Sydney to Owens College, Manchester. Adolf, born in 1820, trained first as an apothecary and then as a physician, and began to model in wax as a zootomical assistant at the physiological institute of Freiberg University. By 1867 he was devoting himself entirely to modelling, setting up the business that he was to hand over to his artist son Friedrich. From 1860 to the Great War, their hand-finished embryological celloplastics were among the most respected scientific models in Europe, an integral part of the shift in the centre of gravity of wax modelling from Italy to the German states.

Nick Hopwood's *Embryos in Wax* is a sumptuously illustrated account of the Zieglers' work. Nine brief chapters outline the lives

of Adolf and Friedrich, the intellectual contexts of their work and the uses to which their models were put, from laboratory to fair-ground. Following this essay are twenty-seven full-colour plates of the surviving Ziegler models, from Adolf's early work with Alexander Ecker on the development of the frog to Friedrich's complex cross-sections of human foetal urogenital apparatus. Then, boldly, Hopwood reproduces in its entirety Friedrich's last catalogue (dating from the mid-1920s). One might argue that the magnificent plates render the subsequent reprint redundant but the latter does give a glimpse of some of the models that have not survived, as well as a taste of the commercial environment in which the Zieglers worked. The dedication with which Hopwood has pursued Ziegler models across national boundaries is demonstrated by the comprehensive listing of the Ziegler series and the relevant documentation. Finally, an ample bibliography places this book in its historiographical context. It includes of course many German-language items – in which modelling is far better represented than in Anglophone scholarship – and secondary sources from mainstream history of biology to the cultural history of sculpture.

Coffee-table good looks should not distract from the scholarly significance of this work. Just as the Zieglers expended great efforts to increase the prestige of plastic publishing, so Hopwood, drawing on his extensive ongoing research in the history of embryology, is at pains to point out the importance of the third dimension in our text-obsessive field. He stresses the role played by models in the emergence of the radically de-contextualized embryo as an object of study – 'the work that turned puzzling and unique specimens into vivid and widely distributed icons of development' (pp. 2–3). We learn how models were used to train students how to see and the importance of the developmental series. Cero-plastics were critical in the dissemination of embryological thought; but not only that, the models were crucial to the cutting-edge developments within embryology. The Zieglers worked with some of the most influential

biologists of their time, including Ernst Haeckel, August Weismann and Anton de Bary. The process of model-making, argues Hopwood, was integral to the development of embryological thought – the visualization of their object of study. But it is his attention to everyday practices that is particularly refreshing, giving voice to the too-often silent *mouleurs*, detailing the processes of model-making from first collaboration with the 'authors' to the salesmanship involved in trying to distribute them. Hopwood is adept at weaving together craft, business and science.

Embryos in Wax has a broad potential readership. Historians of modern biomedical science should have it on their shelves, certainly, but anyone interested in nineteenth- and twentieth-century cultures of display – within the scientific community or elsewhere – will also be enthralled by this paper museum.

SAMUEL J. M. M. ALBERTI
University of Manchester

NICOLE HULIN, *Les Femmes et l'enseignement scientifique*. Science, histoire, société. Paris: Presses universitaires de France, 2002. Pp. xi + 227. ISBN 2-13-052659-4. €23.50 (paperback). DOI: 10.1017/S0007087403285113

Les Femmes et l'enseignement scientifique follows the slow closure of the 'gap' between male and female scientific education in France, to be found 'at different levels: organization, conception, programmes, timetables, etc.' (p. 1). It does so from two perspectives that correspond to the two main parts into which this volume is divided. The first part narrates the creation and evolution of girls' secondary schools in France, starting from Minister Victor Duruy's attempt in the 1860s, and Minister Camille Sée's more successful and lasting establishment of female secondary education, sanctioned by the Sée law (1878). The second part examines the training of teachers, starting with the creation of the *École normale de Sèvres* (1881) – which was the female counterpart of the *École normale* of the rue d'Ulm, founded in 1808 – and of the female *agrégation*, in 1883. The two parts end at different dates: the first

concludes with the removal of differences between male and female education that took place in the late 1920s, although some brief references to events in the 1950s is made in the last short chapter 'Un bilan'. The second part, on the other hand, prolongs its narrative up to the 1970s, when the male and female *agrégations* were finally unified.

The book also includes two appendices. The first reproduces the extract from the famous Condorcet report to the Convention national, as published in 1881 by the *Revue internationale de l'enseignement*. It is interesting that the *Revue* chose to remind its readers of that passionate defence of gender equality in education at the time in which girls' secondary schools and the *École normale* were established. Appendix 2 lists the French essay exam questions of female scientific *agrégations* between 1884 and 1937. It is interesting to note that in 1937 history of science appears: the candidates were asked about the importance of the history of the sciences for the sciences themselves, and whether scientists and science students should learn it.

The reader may wonder why in a book dedicated to 'women and scientific teaching' the narrative should stop in the 1920s as far as schools are concerned, and in the 1970s as far as teacher-training is concerned, without mention of this limitation in the title. Surely there are still many issues concerning women and sciences in education, as Nicole Hulin is well aware, for she chose to start her volume by mentioning the current achievements made by women in science and the still low percentage of female students in engineering in 1996. Moreover, Claudine Hermann's 'Postface' ('De la mixité décidée à la mixité des faits', pp. 175–190) offers some statistics and brief analysis of female participation in education since the 1970s. The answer to this minor puzzle is that this book's approach is strictly institutional and legislative: the narrative stops when the differences between female and male teaching disappeared from that point of view. If this were a history of scientific theories, we would call it 'internalist'. This is not a work for those looking for a social history of

education, nor for those who are interested in the links between education and politics, nor even for those who are merely curious about the people mentioned in it, as we are given very little information. *Les Femmes et l'enseignement scientifique* is a traditional history of education.

In its genre, though, it is a remarkable book: the wealth and organization of information is admirable, and the many well-chosen quotations give a sense of the tone of the discussions around education. This study is extremely useful for anyone interested not only in girls' scientific education, but also in French education between the 1880s and the 1970s in general. All the important reforms and regulations are considered, as well as teachers' and families' reactions, as expressed in specialized publications. The many tables allow the reader quickly to grasp the number of hours dedicated to the various subjects, the structure of examinations and their pass rates. Given the value of the book as a reference tool and source of information, it is regrettable that the Presses universitaires de France have not decided to depart from their custom and include a full list of references. Nonetheless, I think that anyone in the field will need to consult this book.

CRISTINA CHIMISSO
The Open University

GRAHAM RICHARDS, **Putting Psychology in its Place: A Critical Historical Overview**. Second edition. New York: Routledge and Hove: Psychology Press, 2002. Pp. xiv + 368. ISBN 1-84169-234-4. £16.60 (paperback). DOI: 10.1017/S000708740329511X

Doing justice to the scope of psychology as a state of being human and as a cluster of disciplines daunts the brightest. It is a field, or perhaps better to say cluster of related fields, in which the social character of conventions about subject headings, areas of core teaching, divisions between 'science' and 'application', and so forth, are particularly visible. Yet there has been a tendency to provide the domain with a simplified history, as if to say, in spite of all the difficulties, there is still a unified

endeavour. By contrast, Graham Richards, from the vantage point of a psychologist, has long been seeking ways to use history to enrich understanding of the complexities of the domain – notably by examining the ‘reflexivity’ of psychology; that is, the situation in which it is both a subject matter (our psychological selves) and a discipline (the science of psychology).

Putting Psychology in its Place is a substantially revised and updated edition of the book first published in 1996, here repackaged in the manner publishers believe is attractive and accessible to students, and with new material on applied psychology, psychology and religion, language, memory and personality, as well as a glossary, summaries, guides to reading and, not least, a number of unfamiliar but pertinent illustrations. It really is extremely readable and, far from ‘dumbing down’, tackles theoretical issues through historical material with verve, persistent good humour and clarity. It will be very interesting to know whether, as is the intention, introductory students in psychology can indeed have their learning enriched in this way. They would indeed gain perspective on their field. There is a great opportunity to find out, since the British Psychological Society has recently changed what it requires of core teaching in the psychology degree, making history and theory of psychology a core option. It is, of course, students and teachers, not a reviewer who is a historian of science, who will finally judge the book.

What I can say clearly, however, is that the book will be found readable and enlightening to anyone, not only students, both to those who know something about the history of psychology and to those who do not. It is not a book that pretends to be systematic or to give even coverage; rather, it pursues the topics that the author thinks matter to make critical points about what sort of activity psychologists engage in, and the result is a historically informed assessment of where psychology has got to and how it is enmeshed in social change, rather than some set of claims about the state of knowledge. The book is written very much from a British perspective, with a rich, perhaps

unique, knowledge of British history of psychology to hand. There is scope for this among the range of texts currently available. Non-British readers may well find more of interest in the story than they thought, and Richards of course provides substantial parts of the international context. The text ranges in time from the mid-nineteenth century to the present, though most of the material is in fact twentieth century and highly relevant to contemporary interests. The author balances expository and critical intent. It is thematically arranged: Part I – origins and theories (e.g. evolution, cognitive psychology) – is the most conventional; Part II deals with mainstream topics like perception, psychology and the brain, memory and social psychology; Part III opens up psychology in relation to the insane, animals, children and gender; Part IV tackles the two huge cross-cutting topics of measurement and language; and Part V launches into ‘three cultural entanglements’ – psychology and religion, ‘race’ and war. Richards wonderfully succeeds in opening up discussion of psychology’s ‘place’.

ROGER SMITH

*Institute for History of Science and
Technology of the Russian Academy of
Sciences*

G. C. BUNN, A. D. LOVIE and G. D. RICHARDS (eds.), **Psychology in Britain: Historical Essays and Personal Reflections**. Leicester: British Psychological Society, 2001. Pp. xvi + 495. ISBN 1-85433-332-1. £26.95 (paperback). DOI: 10.1017/S0007087403305114

On 24 September 1901, while the nation still mourned the death of Queen Victoria and the Boer War rumbled on, ten people met, at the invitation of James Sully, University College London’s Grote Professor of Mind and Logic, to create a ‘psychological society’. It is the centenary of the foundation of that organization, later to become the British Psychological Society (BPS), that this stimulating and informative volume marks.

Of the twenty-six chapters of *Psychology in Britain*, fifteen are ‘historical essays’; the other

eleven are 'personal reflections' by contributors to twentieth-century British psychology, including Michael Argyle, Margaret Boden, Richard Gregory, Rom Harré and Peter Wason. In his introduction, Geoffrey Bunn expresses the hope that these autobiographical pieces will not only give a sense of 'what it was actually like to be a practising psychologist' in Britain from the 1950s onwards, but also will serve as primary sources for future historians (pp. 26–7). Certainly some of the reminiscences in these essays are informative and entertaining. However, autobiography is a notoriously slippery genre for the historian to handle and it is one that can descend into both score-settling and self-congratulation. Readers of this journal will probably find more to interest them in the historical essays that comprise the first section of the book.

The first three cover the period between 1870 and 1910. Graham Richards asks why the Psychological Society of Great Britain (PSGB), founded in 1875, did not flourish in the way that the BPS ultimately did. Among the answers Richards suggests are that the society lacked a university base, and that its members' interests in spiritualism excluded them from the metropolitan scientific elite. Francis Neary's excellent study of the beginnings of the journal *Mind* examines how one part of that London elite dealt with the question of the scientific standing of psychology in the 1870s. Lyubov Gurjeva's chapter looks at how BPS-founder James Sully dealt with tensions between the professional and the popular. Together these chapters raise key questions about professionalization and discipline-formation: when did psychology become an autonomous discipline in Britain? How did its exponents seek to demarcate their enterprise from philosophy, physiology and psychiatry? What roles did journals and professional bodies play in this process? In what measures were vocation, qualification, technical expertise or payment considered the marks of a professional? These are familiar questions to the historian of science and it is good to see them now being asked with new sophistication about British psychology.

It is perhaps inevitable that a book produced to celebrate the centenary of the founding of the BPS will have the twentieth-century career of that organization and its members as its primary focus. It is still a cause for some regret, however, that what is presented in this volume as the 'prehistory of British psychology' (p. 15) is traced no earlier than 1870, and even then only in three of the twenty-six chapters. As a result, significant continuities with eighteenth- and nineteenth-century natural history, physiology, medicine, literature, philosophy and theology are only rarely mentioned. There is a connected limitation in the scope of the historical essays – namely their general failure to extend the canon of the history of psychology beyond university psychologists and their departments, laboratories, theories and publications. Matthew Thomson's is something of a lone voice in this collection, calling for the history of psychology to be extended beyond 'telling the story of the theoretical and professional development of the discipline' so that it might become a fuller 'history of the psychological', which investigated organizations and cultural identities created outside the academy (p. 115). In his chapter, entitled 'The popular, the practical and the professional: psychological identities in Britain, 1901–1950', Thomson recounts, to take one example, how London in 1901 saw the founding not only of the BPS but also of a rather different, less academic, society devoted to psychological investigations. The London Psycho-Therapeutic Society was a much broader church, welcoming Spiritualists, Theosophists and Christian Scientists who, like many in this period, combined their religious commitments with a devotion to the scientific study of mind. Apart from Thomson's excellent chapter, and the three chapters of 'prehistory', however, the 'psychology' of the title of this collection is a twentieth-century university-based academic discipline, not a broader or older cultural enterprise.

Within those parameters, however, this book has much to offer. It depicts psychologists in twentieth-century Britain 'Bringing Psychology to Society' (the BPS centenary slogan),

especially in military, educational and industrial contexts. The multitude of connections between psychology and warfare become apparent not only in Joanna Bourke's chapter on 'Psychology at war, 1914–1945' but also in many of the other contributions. Psychological ideas about the 'beast within' and 'herd instinct' proved to be particularly useful in preparing men for combat situations, in which emotional responses had to be tightly managed. Psychiatric work was also driven by the demands of the military; for example by the desire to define homosexuality as a form of psychopathology, and by the need to decide whether 'shell shock' was a normal or a pathological response to the horrors of the battlefield. Sandy Lovie notes that after the First World War the Royal Army Medical Corps provided C. S. Myers, the then BPS president, with a 'readymade ... source of new members to exploit' (p. 106). And Rhodri Hayward explains how work on anti-aircraft gunnery during the Second World War (which required human pilots' decision-making to be represented and predicted mechanically) sowed the seeds for later developments in cybernetics, computational psychology and artificial intelligence.

Perhaps the most striking thing that emerges from this collection is how persistently the same set of methodological and philosophical problems has dogged each new generation of psychologists. Questions about the autonomy and scientific status of the discipline of psychology that preoccupied professionalizers in the late nineteenth century – questions that the journal *Mind* was founded to try to resolve in 1876 – continued to unsettle psychologists in Britain at least until the middle of the twentieth century. Roger Smith's chapter, for example, focuses on C. S. Sherrington's attempts to integrate physiology and psychology during the first half of the twentieth century, at a time when these disciplines seemed to be 'separated by language, by subject matter and by experimental expertise' (p. 238). Smith communicates the dilemma faced by Sherrington and his colleagues particularly well: if mental states were ultimately the states of physical systems

then why was there a need for a science of psychology in addition to sciences of the body such as neurophysiology?

Readers of these essays and reflections will learn much about the different ways that professional psychologists, past and present, have struggled with this mystery of the relationship between mind and body and how each should be scientifically investigated; how they have looked to engineering and technology for models of how the mind might be understood; and how they have sought to apply that understanding to the tasks of developing, educating, healing, controlling, predicting and simulating individual human minds.

THOMAS DIXON
University of Cambridge

NIKOLAI KREMENTSOV, *The Cure: A Story of Cancer and Politics from the Annals of the Cold War*. Chicago and London: University of Chicago Press, 2002. Pp. xvi + 261. ISBN 0-226-45284-0. £16.50, \$26.00 (hardback). DOI: 10.1017/S0007087403315110

Socialist realism was the artistic style favoured by Soviet officials from the 1930s onwards. Nikolai Krementsov's fascinating book presents a picture of Soviet medical science that looks more like surrealism. He tells the story of a promising cancer cure and its two creators, Grigorii Roskin, a cytologist, protozoologist and histologist, and Nina Kliueva, a microbiologist and immunologist, who find themselves caught up in the power struggles of Stalinist Russia at the beginning of the Cold War. As in all good surrealist works, things look at the same time familiar and very strange. Fittingly, Krementsov has divided the book into 'acts' rather than chapters. Its two protagonists not only find themselves subjected to a Kafkaesque staged trial before a court of honour for 'striving for personal glory' (p. 114) and 'slavishness and servility toward the west' (p. 147), the story of their trial is even turned into a theatre play and a movie, with an end scripted by 'the Great Critic' (p. 151), Stalin himself. The sentence that Stalin had in mind for them, however, was not death or detention,

as so often in the show trials of the 1930s, but a life sentence: life in a laboratory, dedicated to work on a cure for cancer. This research was to be carried out in great secrecy, just as other Cold War science projects.

When he became interested in cancer in the mid-1920s, Roskin was a young professor in Moscow, studying various protozoa that were associated with a wide range of diseases. Stalin's 'Great Break' with reforms of all areas of life in the Soviet Union also led to a complete reorganization of the universities and provided Roskin with the opportunity to combine work in histology and microbiology to pursue his idea of a 'biotherapy' for cancer. He experimented with trypanosomes, a group of aggressive parasites which cause a variety of fatal diseases in animals and humans. He found that a treatment with a preparation of the South American microbe *Trypanosoma cruzi* stalled the growth of tumours in mice. He tested the toxin on himself, showing that it was harmless, and on three cancer patients. The results were promising but Roskin had neither the means nor the expertise to scale up the production of the rather unstable preparation. However, Nina Kliueva, whom he met and fell in love with during a vacation at a Black Sea resort in 1939, had this expertise.

Kliueva was an able bacteriologist and a good manager. When she met Roskin she was head of the microbiology department in a public health institute, working on the production of vaccines. In 1940 Roskin gave Kliueva a reprint of a recently published article of his. They decided that she was going to work towards the creation of a clinically active and standardizable preparation, while he was going to continue with his histological and cytological studies of the effects of the preparation. As Kremmentsov put it, 'Science had married practice' (p. 48). He characterizes Kliueva as a developer and Roskin as a puzzle-solver. What was missing in their team was a dedicated clinician to link the bench with the bedside.

Their work on the preparation was at first widely unnoticed amongst Soviet officials. But the effects of the war and the rapid

institutional expansion of Soviet science triggered the chain of events that ultimately led to their trial in the court of honour. Collaboration with colleagues in the West helped Roskin and Kliueva to continue their work – they needed fresh cultures of *Trypanosoma cruzi* to replace those that they had lost when the Moscow institutes were evacuated – but it also contributed to their problems. A public conflict with the ambitious director of the Mechnikov Institute, who tried to profit from their work and insisted on being included in the list of authors, brought their potential anti-cancer drug to the attention of powerful players in the Soviet administration. When it became clear that American researchers were scaling up cancer research following the big science principles that had been used in the atom bomb project, Roskin and Kliueva and their alleged contacts with the West turned into objects of big politics. While their trial was being made into a film, Roskin and Kliueva were given a new, large research institute, which they lost a few years later, after a turf war with the top oncologists of the country.

Kremmentsov's well-researched book not only tells a good story of two lives and careers in turbulent times but also contains a wealth of information on early twentieth-century cancer research and on Stalinist science. If you want to know how the story of Grigorii Roskin and Nina Kliueva ends, read the book.

CARSTEN TIMMERMANN
University of Manchester

RICHARD POLENBERG (ed.), *In the Matter of J. Robert Oppenheimer: The Security Clearance Hearing*. Ithaca and London: Cornell University Press, 2002. Pp. xxxii + 409. ISBN 0-8014-8661-0. \$13.50 (paperback). DOI: 10.1017/S0007087403325117

Testimony given before the Personnel Security Board (PSB) of the Atomic Energy Commission (AEC) 'In the Matter of J. Robert Oppenheimer' was supposed to be confidential. That is perhaps why the transcript makes such good reading. The hearing has often, and quite

appropriately, been likened to a tragic drama. It was made into theatre by playwright Heinar Kipphardt. But the transcript was also a glimpse back-stage, revealing the very human machinations, politics and frailties behind the secrecy and technocratic façade of the Cold War military–technological state. In more ways than one, reading the transcript might be compared with Dorothy pulling back the curtain to reveal a disappointingly mortal Wizard of Oz. Neither Oppenheimer nor his accusers appear in a particularly flattering light.

The supposedly confidential document was released as part of a struggle for public opinion. Soon after the PSB's finding against the physicist, Oppenheimer's attorney leaked the Board's report to the press, hoping to highlight passages favourable to his client – the PSB had found Oppenheimer to be a security risk, but not disloyal. Not long after that, one of the atomic energy commissioners left on a train from Washington to Connecticut a copy of extracts of the testimony. Though it was safely recovered, the danger of unauthorized leak provided an excuse for the AEC to release the entire document in advance of their final verdict. They correctly anticipated that the Eisenhower-era public would agree with them that it revealed 'defects of character' that made Oppenheimer a security risk. But the document also provided the first public inside look into the politics and conflicts within the technocratic sanctum of the AEC, permanently damaging the organization's claim to political neutrality.

This book is an edited selection of the original thousand-page transcript. Polenberg's editing is skilful and well thought out and his introduction and conclusion, though brief, provide the essential historical context. All the really key moments of the hearing are represented. The day-by-day structure of the chapters maintains the experience of the unfolding drama and the use of exciting and pithy quotations as section headings is highly engaging. Reading over these quotations in the table of contents, one already has a good idea of the characters involved and of the complex intersection of science, government and

secrecy, as well as emotions, loyalties and betrayals. Researchers working on topics involving Oppenheimer, the security system, McCarthyism and the Cold War will still want to get their hands on the original full-length transcript. But anyone having read through this edition will certainly be in a better position to more fruitfully navigate their way through the original. Above all, however, this book is a wonderful resource for teaching. It is ideal for use as a core text in courses on twentieth-century American history and on the history of modern science. And it should appeal also to the general reader as an accessible version of an authentic and pivotal historical drama.

CHARLES THORPE
Cardiff University

G. I. BROWN, *Invisible Rays: The History of Radioactivity*. Stroud: Sutton, 2002. Pp. viii+248. ISBN 0-7509-2667-8. £19.99 (hardback).

DOI: 10.1017/S0007087403335113

This is a very pleasant coffee-table book dealing with radioactivity and with nuclear power for military and civilian use. The emphasis is on Britain. The black-and-white images are interesting and diverse: photographs of nuclear establishments and individuals mentioned in the text, technical diagrams, a coat of arms, adverts, statistics, maps, radiochemical labels and nuclear-related artwork. The writing is clear if at times a little heavy on the factual details. Do we really need to know, for example, that one public enquiry 'began on 11 January and went on until 26 January' (p. 148)?

The author was a technical officer during the Second World War and subsequently a chemistry teacher and housemaster at Eton College. He takes us through the first half of the twentieth century in a straightforwardly Whiggish narrative. This part is by and large a history of progress due to individual scientists, most of whom are British. The atomic and hydrogen bomb research of the mid-twentieth century is covered along with a description of scientists'

pangs of conscience after Hiroshima and Nagasaki.

I found this first half of the book dull because it rehashes familiar narratives and exhibits the usual prejudice of heroic pure science. Brown adheres to the common ahistorical interpretation of early radioactivity through the knowledge of a not-yet existing bomb. But, I dare say, it is much better fare for a coffee-table format than any of the *recherché* articles produced on the topic by professional historians of science. In the second, and much more interesting, half Brown charts the gradual development of nuclear power for civilian purposes in the 1950s, gives a (most lucid) description of radiation protection and takes us through the current uses of radioactive isotopes, the most severe nuclear accidents and the problems in nuclear waste management. He also speculates on the outlook for energy policy. In this part the reader is no longer faced with a gallery of heroes but with the momentous and complex issues of modern society. Brown even-handedly presents the views on nuclear power, giving a sketch of the most important anti-nuclear organizations: Pugwash, Greenpeace and Friends of the Earth. He does so within a narrative replete with 'facts'. For example, the various designs of nuclear power stations are explained very clearly. (But there are small factual errors: Brown has the German Green Party acting in 1975, several years before its foundation, p. 210.) The book takes the reader up to a government report published in February 2002 in anticipation of a White Paper, finishing, appropriately I find, with the open-ended conclusion of the report as a 'start of a debate rather than its conclusion' (p. 219).

Brown's own attitude is perhaps best reflected in his statement that 'over the years there has been an alarming decline in [the public's] readiness to accept what any expert says on almost any issue' (p. 211). Seemingly, while not longing for the days of technocracy without democratic control, he does prefer what many historians and sociologists of science have been at pains to undermine: the notion that disinterestedness and objectivity

lead to the establishment of facts that may then guide decision-making.

ARNE HESSENBRUCH
Dibner Institute

E. ROY WEINTRAUB, **How Economics Became a Mathematical Science**. Science and Cultural Theory. Durham, NC and London: Duke University Press, 2002. Pp. xiii + 313. ISBN 0-8223-2871-2. £14.50 (paperback). DOI: 10.1017/S000708740334511X

This book deals with the parallel developments of mathematics and of economics. The title specifies no period; most of the book deals with economics from the 1900s to the 1960s but the account of mathematics goes back further, with a discussion of the Mathematical Tripos at Cambridge and its impact upon Alfred Marshall. However, the mathematical economics of that earlier time is not treated; for example, the pioneering use of the calculus by Stanley Jevons, or the profound influence of mechanics upon Léon Walras and others. Did such figures not help to make economics mathematical?

The character of the book seems to be influenced by its origin in various articles. The bibliography is rich in primary and secondary sources, though the index is rather spare both in the location of names and choice of subjects. In a common but irritating non-utility of modern books, the endnotes are identified only by chapter number on the headers while the chapters themselves are identified *in situ* only by title.

Each chapter provides nice examples of the connections between mathematics and economics, and sometimes of the tensions between them. For example, in mid-century many economists regarded mathematics merely as a language, an ignorant stance that the author rightly rejects; mathematics is a collection of theories that has various languages.

The book is as concerned with historiography as with history; the main lines of the development of economics are taken as known. The author nicely deploys the historiographical distinction between the content of a

mathematical theory and its image(s) as projected by practitioners and observers. A main example is the 'Bourbaki' group of French mathematicians, who especially from the 1940s proclaimed mathematical structures (but then often just got on with their mathematics) and lauded pure mathematics far above applications. The main economist to follow this philosophy was Gerard Debreu, who is interviewed by the author. Debreu proved a general equilibrium theorem using a Bourbakist recipe of linear programming served on a bed of topology and set theory; it replaced the traditional one using the theory of systems of linear equations. This change formed a notable manner in which economics pushed up its mathematics and gave him and similar provers (such as John Nash) much prestige.

Economists chosen for detailed attention include Griffith C. Evans, who learnt the new functional analysis from Vito Volterra and deployed it; Cecil G. Phipps, a traditionalist mathematician who opposed Debreu's proof; the author's father, an economist who came rather late to mathematics via large books on the calculus and advice from his mathematician brother; and his own arrival in economics in reaction to a rather purish mathematical training. The accounts are graced by the use of manuscripts and correspondence. However, more general context is wanting, such as the stature of these chosen economists or the (un)typicality of their careers relative to those of contemporaries.

Another historiographical point that is well used here notes that around 1900 a mathematical theory was often regarded as 'rigorous' if its purpose and reference were clearly constrained, and thus differed from 'axiomatization', which was a matter of relatively free choice. Nowadays a close link is made between these two metaproperties, a change due especially to the influence of David Hilbert's work on the foundations of mathematics. The author devotes a chapter to it, mainly in the period from 1918 to 1933. He correctly supports the claim that Hilbert was not a formalist, for whom mathematics is just the manipulation of symbols or signs according

to given laws. He could have strengthened this claim by remarking that Hilbert never once used '*Formalismus*' to describe his stance, neither in print nor (at least in my perusal) in manuscripts, and by noting the close alliance of Hilbert's position to the development of model theory in mathematics, which heightens the links to economics. Hilbert did not work in economics, but his position came to influence several economists; some of them misunderstood it as formalism, partly because of the Bourbaki group, who imaged themselves as formalists.

This interest in Hilbert could have informed the author's own historiographical stance. He states that there is 'no view from nowhere, no platform on which I, the historian, can stand apart and aloof from the materials on which I work' (p. 269), a position regarded as 'unasailable' (endnote, p. 289). However, Hilbert's work helped to open up an alternative historiography, namely to take as fundamental the distinction between a theory (of any kind) and its metatheory, and regard history as a kind of metatheory. Then the historian's own concerns are quite independent of those of his historical figures; the desired aloofness is achieved.

I. GRATTAN-GUINNESS

Middlesex University at Enfield

PHILIP MIROWSKI and ESTHER-MIRJAM SENT (eds.), *Science Bought and Sold: Essays in the Economics of Science*. Chicago and London: University of Chicago Press, 2002. Pp. ix + 573. ISBN 0-226-53857-5. £21.00, \$33.00 (paperback).

DOI: 10.1017/S0007087403355116

The economics of science might mean any of a variety of things and the editors of this collection have not chosen to imprison their field within overly strict definitions. They train their telescope not only on natural science but equally on the economic discipline, whose perspectives on science reveal much about its ambitions and identity. The editors are critical of much writing on the economics of science, including some of the papers they include here. The volume combines, in a way, the anthology

(of recognized, influential papers) with the collection (of new ones), and the tone of the editors' introduction is critical of mainstream writings on science from within the economic tradition. Economics, they suggest, has been caught up in the subject it aims to study, and seems often to supply rationalizations for each successive regime of the funding and government of science. So, for example, most economics in the Cold War and since took for granted a fundamental distinction between basic and applied science and organized its data around this divide. Nations were (and are) ranked on the basis of the percentage of national production that they devoted to basic science, on the presumption that this was an important underlying cause of long-term economic growth. The economics of science thus participates in these policy discussions but perhaps never gains a sufficient critical distance. Mirowski and Sent complain particularly of the failure of economics to grasp the significance of the post-Cold War regime of 'globalized privatization', the forced incorporation, as it were, of university science into the corporate search for profits, and they hope for a revitalized economics of science that will attend to such crucial matters.

This vision of the economics of science in terms of recent economic history is a valuable one and one that leads into important issues in history of science, technology and medicine. The economics of science, like most post-war neoclassical economics, has rarely addressed itself to specific historical situations, seeking instead something timeless and universal. This was true already of Charles Sanders Peirce's remarkable mathematical model of the utility of diminishing probable errors, published in 1879 in an annual volume of the United States Coast Survey, three quarters of a century before the economics of scientific research began to be developed as an economic speciality. Chronologically, the volume skips from Peirce all the way to papers by Richard Nelson (1959) and Kenneth Arrow (1962), both of whom were concerned with economic reasons why public money might appropriately be devoted to scientific research. Arrow supposed that

there were special risks associated with basic research and both argued that basic science could not easily be appropriated for private profit, and thus could not attract investment capital in proportion to its worth.

Real economic returns, however, are not the main concern of the essays, most of which deal with more figurative senses of the economic. The appropriateness of metaphors such as 'trade' in scientific communication is explored by Michel Callon, who points convincingly to the limits of the analogy, and by Mario Biagioli, whose economic simile of 'credit' seems rather a throwaway line in a fascinating essay on authorship and attributions of responsibility. Paul Forman's woolly jeremiad about 'postmodern knowledge production' rests on a somewhat reductive account of academic expansion and specialization: 'To wit: Overproduction of knowledge, and insuperability of the literature embodying it, must inevitably make "incommensurability" attractive as a strategy and excuse for ignoring the greatest part of it' (p. 128).

Contemporary economics, as represented here, is less concerned with the financing of science or its contribution to the creation of wealth than with its validity, and with its standing as public information rather than commercial secrets. The disembodiment of this economic language, the separation from instruments, skills, quantitative tools and discourses, will appear alien to historians of the present generation, including this reviewer, who ought nevertheless to appreciate that economists such as Paul David have engaged seriously with historical writings on science. The shared approach of Philip Kitcher, philosopher, and William A. Brock and Stephen Durlauf, economists, reveals to me a fascinating similarity between the modelling practices of these superficially disparate disciplines. Brock and Durlauf develop a model based on the communication of spins in statistical mechanics to show how consensus might develop within science when scientists are influenced by the views of their neighbours, independently of reasoned arguments. The point, which is also Kitcher's, is to show how the rationality of

science might be social rather than individual. I have trouble comprehending what is gained by a model that is so much more reductive, and so much less persuasive, than the conclusion to which it ostensibly leads.

A more practical issue, and one treated interestingly by several authors here, is how accounts and economic analysis have become an idiom for assessing science and regulating universities. This 'audit culture', as Michael Power has termed it, has been developed to a high art in Britain, where annual, quantified reviews have become standard in every discipline. In the United States, particularly, the digital university has been advocated as the basis for a cheap and widely accessible education. The nefarious motives of academic administrators who would dispense with real teachers are here condemned by David Noble in a lively piece. Michael Polanyi, famously, opposed all such efforts to reduce research and teaching to the transmission of information and one of his essays is reprinted in the volume. Steve Fuller appears to regard this talk of tacit knowledge as obfuscation and supports here, in the name of democracy, a revival of the 'New Deal' project that would organize science for the solution of pressing social problems. But is it the democratic public, or big business, that will call the tune when economic regulation of universities is intensified?

THEODORE M. PORTER

University of California, Los Angeles

STEPHEN P. TURNER, *Brains/Practices/Relativism: Social Theory after Cognitive Science*. Chicago and London: University of Chicago Press, 2002. Pp. ix + 214. ISBN 0-226-81740-7. £12.00, \$19.00 (paperback). DOI: 10.1017/S0007087403365112

Does one need a brain for doing history of science? Probably yes. But does one have to have a proper understanding of the brain's modes of operation in order to do it? Most of this journal's contributors, lacking a proper training in the neurosciences, would probably say no. Stephen Turner, however, intends his new book as a response to what he sees as the

'central challenge for social theory today: ... the lessons and implications of cognitive science, especially connectionism' (p. 1).

Before going into the details of Turner's book, one should consider this opening statement. There certainly are conflicting concepts in the various branches of scientific work, not only between social and brain theory, but also within the neurosciences or the social sciences themselves. Some of these conflicts stimulate research to construct a more coherent framework. But why do conflicting theories pose a one-sided 'challenge to social theory' and not to cognitive science? It may well be that social theory will change due to the dominance of cognitive science, but what kind of scientific superiority would be exemplified by such a process?

Turner announces the book as a sequel to his *The Social Theory of Practices* (Chicago, 1994). And indeed, he continues his fight against collective terms, such as practices, cultures, shared assumptions, implicit knowledge and learned rules, as basic concepts of social theory which he wants to replace by a strictly individualistic vocabulary. He is certainly right in this critique, when he argues that collective terms have a difficult epistemological foundation and cause ontological problems. As alternative, Turner suggests an integration of social theory into evolutionary psychology, which he sees in line with current trends in cognitive science, explaining complex forms of behaviour as the outcome of contingent and individual patterns of learning. But are theories based on 'different weighted patterns of synaptic connections' (p. 99) better defined than those based on practices? Such descriptions are certainly as far away from what 'really' goes on in a brain as are tenets about a 'habitus' as basis of group behaviour.

Apart from the Introduction and one further chapter, Turner's new book consists of previously published essays (among others, an analysis of Searle's concept of the social, Turner's differentiation between 'hot' and 'cold' constructionism, an essay review of Pickering's *Mangle of Practice* (Chicago, 1995)) and a commemorative article on Edward Shils,

somewhat awkwardly placed as the book's concluding chapter. This strategy causes the typical problems: reiterations and some uneasiness in the development of argument. A more serious problem is that Turner does not fully deliver what he promises. There is no in-depth discussion of brain theory, let alone its historical development and epistemological foundation.

Alas, Turner should not be mistaken as a naive realist. The book's new chapter on relativism suggests what Turner calls a 'Jesuitical conclusion' to the stalemates between relativism and realism. Subscribing to a Weberian notion of universal rationality, he suggests an explanation of cultural differences and fundamental disagreements as the results of contingent but divergent trajectories of historical

processes from a joint past. Just as individual patterns of learning do not result, according to Turner, in identical and collectively shared assumptions about the world, groups develop in historically different directions although every single step of change may be rational and as such explainable. This is certainly in coherence with his evolutionary framework, but does such a dissolution of social theory into contingent patterns of learning provide enough explanatory substance for a detailed understanding of the emergence of specific social phenomena? The current interest in connectionism appears at least to the reviewer as a case too sophisticated for this framework.

CORNELIUS BORCK
Bauhaus University Weimar