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MICHAEL SHORTLAND and RICHARD YEO (eds.), Telling Lives in Science: Essays on Scientific Biography. Cambridge: Cambridge University Press, 1996. Pp. xiv+295. ISBN 0-521-43323-1. £50.00.

The late twentieth century has seen biography take a considerably larger slice of publishing life than ever before. The fates of the quick and the dead told with sufficient *élan* or prurience can yield rich profits. Histories of great scientists have long been produced for the mass market, but in recent years academic historians have begun to treat biography seriously. This, no doubt, is because it is now safe, or possible, to say that the life of a scientist might tell us something about the science he or she makes, not just about the conditions for its possibility. This volume collects a number of reflections on biography in general and in particular, and studies of biographical genres. The essays are of high quality although rather variable in their daring. After the editors' valuable introduction Thomas Söderqvist presses on us the need to write about the scientist's 'existential' project. Perhaps I missed something but the whole essay

seemed to read exactly the same when leaving out the very numerous existentials. Lots of old friends are here, all with excellent credentials for discussing biography: Dorinda Outram on the French Revolution, David Knight on Humphry Davy (with some curious omissions in the footnotes), Michael Hunter on Robert Boyle, Geoffrey Cantor on Michael Faraday and John Gascoigne on Joseph Banks. Richard Yeo turns in a splendid piece on scientific biographies in encyclopedias, which, before the nineteenth century, do not mirror other popular literature since their theme is not heroic struggle but biography only so far as it illuminates contributions to science. James Moore is autobiographical, reflective and interesting about his alter-ego (Charles Darwin) and Martha Vicinus has a most revealing study of biographies of Florence Nightingale for girls. The pick of the bunch for me, however, is Roy Porter, who turns in a bravura piece on Thomas Beddoes. Porter tackles the problem of whether medical biography is different from scientific biography and whether clinical work itself is like biography. In the process he plumbs the autobiographical element present in all biography and hints at Beddoes's secret life.

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ALAN IRWIN and BRIAN WYNNE (eds.), Misunderstanding Science? The Public Reconstruction of Science and Technology. Cambridge: Cambridge University Press, 1995. Pp. vii+229. ISBN 0-521-43268-5. £35.00, \$59.95.

This collection of essays is the fruit of an Environmental and Social Research Council/ Science Policy Support Group Research programme on 'public understanding of science'. All the contributors are concerned to explore what various particular publics thought about particular aspects of 'science' (or 'nature', or 'technology' or 'medicine'); and they all avoid deficit models which focus on what the public does not know (but ought too). But for all their common, positive features, the essays differ The best of the chapters, for me, were those which trace the evolution of local knowledges, or the diversity of attitudes to technical expertise. Brian Wynne contributes a fine essay showing how the response of Lakeland farmers to the local consequences of the Chernobyl explosion were developments of their previous attitudes to Windscale/Sellafield. His account reveals a natural history of hazard; local farmers could 'see' the problem: 'If you're up on the tops [of the fells] on a winter's day, you see the tops of the cooling towers [of Sellafield], the steam rises up and hits the fells just below the tops. It might be sheer coincidence, but where the hot spots are is just where the cloud of steam hits.'

Stephen Yearley dissects Britain's varied environmental organizations, showing when and how they have used (or refused) appeals to technical authorities. Here, as in Wynne's chapter, we are dealing with specific histories, from which we gain better maps of public attitudes and a better sense of change – a better feel for the intricacies of the 'public understandings' which we, as citizens, share partially with the informants and with the authors.

From these highpoints, the essays spread downwards towards the commonplace. Sharon MacDonald analyses how the 'food' exhibition was constructed at the (London) Science Museum. Alan Irwin and others analyse Mancunian responses to neighbouring chemical plants. Rosemary McKechnie takes us to the Isle of Man – scarcely reached by professional science, but not so remote from Sellafield effluent. And Harry Rothman *et al.* show that 'pure-science' models seem to have lost currency over recent decades.

The articles on 'discourse analysis' or medical sociology do little more than document familiar, widespread, attitudes and skills. An article based on a long series of interviews with Lakeland publics, shows that claims of 'ignorance' about radioactivity may be glossed as 'non-scientific mind', as 'not my job', or as 'not of interest/ relevance'. Why do we need such empiricist descriptions of a vocabulary which readers share with the informants? We can guess that women undergoing ultra-sound examinations do not like having to wait for a doctor to tell them the results, especially when the technician 'knows' already. Do the 'powers that be' need this kind of Martian empiricism in order to understand patients' wishes or the views of the general public? What could the publics gain therefrom?

Better, it would seem, to build on fellowfeeling and so to write such informal histories of science-and-publics as publics, along with scholars, might read with pleasure and with profit.

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GERMAN BERRIOS and ROY PORTER (eds.), A History of Clinical Psychiatry: The Origin and History of Psychiatric Disorders. London: Athlone Press, 1995. Pp. xx+684. ISBN 0-485-24011-4, £60.00 (hardback); 0-485-24211, £19.95 (paperback).

The inspiration for this edited collection seems to have come from a programmatic article which German Berrios published in History of Psychiatry in 1994. In that piece, parts of which are reproduced almost verbatim in the collection's introduction, Berrios complained that the history of psychiatry had fallen prey to 'migrant worker disease'. In his view, modern historians and social anthropologists had approached psychiatry as 'new age travellers', simply exploiting the discipline as a testing ground for the latest and most fashionable theories. It was an approach which alienated psychiatric and medical professionals as well as demonstrating a supreme indifference to the very real distress and suffering experienced by the mentally ill. As a remedy to this situation, Berrios and Porter have produced a volume in which professional historians and clinicians collaborate together in an examination of the actual mental disorders which have constituted the historical field of psychiatry. The overall method is one of tempered and critical realism, in which the history of psychiatry is seen as the interaction of semi-permanent 'clinical signals' with context-bound languages of description. At best, such an approach performs a

genuine service for modern clinical practitioners and historians, allowing them to 'determine which past "psychiatric" phenomena were noise, and which were actual expressions of biological signals modulated by individual grammars and cultural codes' (p. xviii). At worst, this method seems reminiscent of the empire-building histories of mental illness produced by nineteenth-century psychiatrists and neurologists such as Charcot, Tuke and William Wotherspoon Ireland.

The volume brings together the work of over forty contributors who provide brief histories of twenty-four major psychiatric disorders alongside short accounts of the systems developed by Kraepelin and Wernicke. Most of the chapters are organized into clinical and social sections, a format which will probably dismay social constructionists and theoretically minded historians. However, these groups may take solace from the fact that the essays of most of the contributors seem to confound the need for such a division. Clinical writers such as Andrew Hodgkiss, Edgar Miller, Harold Merskey and Berrios himself demonstrate a knowledge of the social context and implication of diseases such as neurasthenia, post-traumatic stress disorder and dementia. Likewise, professional historians, most notably Ian Dowbiggin, Ann Dally and Malcolm Nicolson, actively engage with the medical literature, revealing how the political decisions of the past have defined the scope and field of modern conceptions of delusion, pain and vascular disorders respectively. This refusal to be constrained by the volume's format pre-empts one of the most obvious criticisms of the work, which is its uneven treatment of disorders. Whereas mental retardation is blessed with four sections covering the clinico-psychological, clinico-psychiatric, social and social educational perspectives, disorders such as multiple sclerosis and cycloid psychoses (perhaps understandably) merit only a clinical section.

The ambitious scope of the volume presents further problems for the writers. With the contributions limited to around ten or twenty pages, many of the authors are forced to condense huge amounts of material into a succinct form. In order to achieve their goals, two main strategies have been adopted. First,

there is a global approach in which the essays function as critical bibliographies - offering sharp resumés of the main controversies surrounding a disorder. Berrios is an adept at this style, and his splendid essays on delirium, dementia and epilepsy manage to reference a vast array of material while remaining sensitive to questions of linguistic slippage and change. The second strategy, more usually deployed in the social sections, involves a more focused analysis of a set of issues in order to unpack the tensions inherent in the conceptualization of a disorder. The essays by Jacyna, Goodey and Turner provide good examples of this style. In his chapter on delirium, Jacyna traces the professionalizing strategies behind phenomenological and somaticist theories of madness. Likewise, in his work on mental retardation, Goodey demonstrates the slippage between legal and medical theories of idiocy, while Turner provides an engaged analysis of the public understanding of schizophrenia in modern Britain, showing how it draws upon a massive range of sources (from film to the tabloid newspapers) which exist outside the psychiatric canon. In contrast, Porter's many essays on dementia, Parkinson's disease, chorea, epilepsy and mood disorders, combine both literary and medical sources, skilfully demonstrating the symmetry between psychiatric knowledge and social context. Other essays deserving notice include those of Harold Mersey and E.M. Brown on post-traumatic stress disorder and those of Simon Wessley and Tom Lutz on neurasthenia. Helen King's brief history of hysteria is exemplary, as it manages to combine a comprehensive history while raising a host of critical issues.

Inevitably, with a volume of this size there are certain problems of organization and omission. The essays vary widely in the timespan covered, with most focusing on the nineteenth century while a few trace the various conceptualizations of a disorder into the contemporary literature. This chronological discrepancy is most apparent in the two essays by Porter and Berrios on mood disorder. Whereas Berrios persuasively undoes the link between depression and melancholia as disorders and thus concentrates upon nineteenthand twentieth-century material, Porter explores Classical and Renaissance material, with just a few closing references to the modern literature of depression. Secondly, some disorders seem to have been omitted. While the editors acknowledge the difficulty of finding anyone to write a history of sleep disorders, the subsumption of neurosyphilis (general paralysis of the insane) into a few paragraphs within the clinical section on dementia seems strange, given the disease's historical prominence. Lastly, the volume's organization reflects a specific realist conception of psychopathology, thus more nominalist approaches, such as the concept of unitary psychoses, are subsumed among the catalogue of diseases rather than being presented as alternative systems.

The distinctive format of this work could bewilder any reader hoping for a general history of psychiatry. Its eschewal of themes of institutionalization and professionalization leaves the clinical developments suspended within a very fragmented presentation. Perhaps this is a strength. Certainly there is a very modern feel to its refusal of any overarching grand narrative, a refusal which directs the reader's attention back onto local issues of confrontation and practice. The book works best as a source of information and ideas. For clinicians wishing to gain a historical perspective on their working conceptions of disorder and for historians seeking an accessible insight into the medical literature this work is indispensable. Combining a wealth of bibliographic information with an accessible style and an exhaustive index, A History of Clinical Psychiatry will guide both new and experienced researchers in this rapidly developing field.

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THOMAS L. HANKINS and ROBERT J. SILVERMAN, Instruments and the Imagination. Princeton: Princeton University Press. Pp. xiv+337. ISBN 0-691-02997-0. £33.50, \$39.50.

This delightful book focuses on the central role that instruments play in the construction of scientific knowledge. But far from assuming such knowledge to be an unproblematic object of analysis, the authors use their selection of weird and wonderful devices (both real and imaginary) to explore how the criteria for what counts as 'scientific' have never been fixed. Indeed, by making unusual instruments their point of departure they effectively demonstrate the highly ambiguous and constantly shifting relationship between science and natural magic (as well as literature and entertainment). In the process they introduce the reader to some fascinating artefacts created between the mid-seventeenth and late nineteenth centuries, and to the men who made, displayed and criticized them.

From a pedagogical perspective, one of the attractive features of the book is its simple structure. Identifying their key conceptual and historiographical themes in chapter 1 ('Instruments and images'), the authors summarize their arguments in the concluding ninth chapter. Each of the seven intervening chapters can effectively stand alone as a case study of a single instrument (or category of instruments) that explores the complex cluster of ideas, values and beliefs associated with it. However, there are clear themes that run throughout the book. It is striking, for example, that most of the artefacts discussed were expressly made to imitate the human senses, above all the organs of speech, hearing and vision. Indeed, the chapters on speaking machines (chapter 8), automatic recording devices and related forms of graphic representation (chapter 6), the magic lantern (chapter 3) and the stereoscope and photographic depiction (chapter 7) show an overwhelming concern with newly invented (or reinvented) techniques for communicating, storing and retrieving aural and visual information. The links between these mostly forgotten technologies and supposedly more 'mainstream' experimental techniques used in newly emerging scientific disciplines such as acoustics and physiology are clearly underlined. So too are the multiple and ambiguous roles that instruments can play. For, apart from imitating or improving the senses, instruments can also be intended to affect them powerfully in a variety of ways. The desires to arouse wonder and delight, to deceive, and even to lead to a sense of the divine are exemplified in the case of Athanasius Kircher's sunflower clock

(chapter 2) and the Aeolian harp (chapter 5), which was also reputedly invented by Kircher, although similar ambiguous motives are evident in other chapters. Even imaginary instruments may serve these functions: Louise-Bertrand Castel's ocular harpsichord (chapter 4) was never actually constructed, but would have played colours instead of tones if it had been. As a thought experiment, however, it served Castel's own purposes perfectly well.

The authors draw attention to many other roles that instruments can play. The examples given here show us their power to mediate between the cognitive and material realms, their ability to create artificial worlds, to reveal truths about the natural world, and at the same time to change our understanding of nature. Thus acoustical devices and speaking machines, for example, can simultaneously extend the range of the senses while offering models of how these organs work. In sum, there is much that is new and stimulating about this book that will hopefully be taken up by scholars looking for ways of deepening our understanding of 'science' and its relationship to other spheres of human activity.

Here are two ways of taking this kind of approach further to start with. First, having explored these objects on a case-by-case basis, the next step is surely to locate them within a broader institutional, intellectual and social network. Many of the same men appear in several chapters as inventors and promoters of individual devices (for example Hermann von Helmholtz and Charles Wheatstone), and it would be revealing to see just how these were related to their activities and lives as a whole. Secondly, the subject of natural magic and its relationship to other spheres of knowledge and practice is an issue worth exploring further.

An implicit premise of this book is that natural magic had already become safely detached from other, more problematic, occult practices by the end of the seventeenth century and was chiefly devoted to wondrous effects using purely natural, rather than supernatural means. The category of natural magic itself may have been neutralized in this way, but this by no means resolved where the boundaries between good and evil, supernatural and natural were to lie. Another characteristic of natural magic, we are told, is that it diverged from experimental philosophy in that its goal was to emulate the wonders of nature rather than to establish 'matters of fact'. Tellingly, nowhere in this book do the authors talk about the shared goal of these two enterprises: the harnessing and exercise of effective *power*.

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LANCE DAY and IAN MCNEIL (eds.), **Biographical Dictionary of the History of Technology.** London: Routledge, 1996. Pp. xiii + 844. ISBN 0-415-06042-7. £85.00.

Over 1200 entries, in excess of 800 pages and 3 indexes - such are the parameters within which Day and McNeil have attempted to accommodate the stories of those individuals who have made a significant contribution to technological development. Conceived as a companion volume to McNeil's Encyclopaedia of the History of Technology, the aim of this biographical dictionary is to emphasize the human component of technological change by acknowledging individual contributions and examining the circumstances through which they came about. The range of coverage is impressive - no geographical or temporal restrictions were imposed, or branches of technology excluded. Between the entries for Frederick August Abel, an English explosives expert, and Vladimir Kosma Zworykin, Russian/American television pioneer, lie many tales of triumph and disaster, along with an abundance of personal and technical detail.

The fascination of this volume lies in the detailed entries, which provide a wealth of unexpected gems and nuggets of information. Close together in the depths of the 'C's, for example, we find Alan Cobham, inventor of an in-flight refuelling system for aircraft; Josephine Cochran, who produced the first commercially available dishwasher; Christopher Cockerell, hovercraft pioneer; and Hiram Codd, English inventor of a mineral-water bottle stopper. Each entry provides a brief summary of the education, appointments and achievements of the subject,

along with suggestions for further reading and additional biographical sources. Unfortunately neither of these is comprehensive, and they cannot always be relied upon to include even major pieces of recent scholarship. The length of contributions seems curiously random, and they are clearly not intended to provide a detailed or definitive account. Many lack any indication of the economic significance of the technologies under discussion, and deliberately exclude any non-technological activities engaged in by the subject. For those individuals included in standard biographical sources such as the Dictionary of National Biography or the Dictionary of Business Biography there is little which cannot easily be found elsewhere. Less prominent or familiar characters, are, however, rendered more visible as a result of the international scope of this work, combined with its cross-referencing and indexes.

Perhaps the most difficult task in compiling a volume of this kind is the choice of who to include and who to leave out, and every historian of technology is bound to find omissions they regard as particularly baffling. The approach adopted here is one of significance - individuals were included if they were considered to have been responsible for developments which 'reached the tip of the great iceberg of the world's inventive achievements' (p. x). Unfortunately it is not clear how this tip was defined, and a survey of the index suggests that while an effort has been made to define technology broadly and to include topics which have not always been regarded as central to the history of technology, in fact a bias towards the 'traditional' areas, encompassed by civil, mechanical and electrical engineering, remains. Compare, for example, 'medicine', which has six entries, with 'railways', eighty-seven entries, not including separate listings for 'locomotives' and 'locomotives, steam'.

Many scholars will also question the extent to which the biographical approach can in fact be used, as is suggested here, 'to build up a detailed picture of the development of technology' (back cover). As is readily acknowledged, some of the most significant innovations in history, including the wheel and the smelting furnace, cannot be traced to individuals, while more recently the

institutionalization of invention within large corporations where teamwork is the norm makes attribution impossible. The necessity to recognize individual contributions is also problematic when the technological achievements of non-Western cultures are discussed. In many cases those responsible cannot be named and thus their achievements are excluded, further reinforcing the bias towards a particular picture of the history of technology. In addition, many scholars now favour an approach to the processes of invention and innovation, through which a new technology eventually emerges, which treats them as inherently social, involving not only the technologist, but also potential manufacturers, retailers and users. This position is clearly at odds with the stress on personal achievement adopted here, a stress which constrains the picture of technological development which can be derived from these pages.

Despite its failure to live up to all of its claims, and the limitations inherent in the format, this book will provide a useful early port of call for researchers interested in individuals or specific technologies. It will, however, need to be supplemented with other sources, which should be sought beyond the references which it provides. This suggests that it is more likely to find favour as a sensible addition to an already well-stocked library rather than as a priority purchase for those with limited budgets.

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Jose María López Piñero and Víctor NAVARRO BROTONS, Història de la ciència al País Valencià. València: Edicions Alfons el Magnànim, 1995. Pp. 661, illus. ISBN 84-7822-154-9. No price given.

López Piñero, the dean of Spanish historians of modern science and medicine, and Víctor Navarro, one of his closest collaborators, present in this book an impressive amount of high quality information about the life of medicine and science in the País Valencià, a region on the Mediterranean coast south of Catalonia. What is now roughly its territory was a medieval

kingdom that lost its independent status, along with Catalonia, at the turn of the eighteenth century, in the Spanish War of Succession. In recent years it has gained political autonomy but is going through a sometimes painful process of refashioning its own cultural identity – a processing somehow mirroring the deep transformation Spanish society has been experiencing lately. It can be surmised that this book, written in Catalan, has been inspired by the tensions underlying this process.

The book is organized chronologically. It opens with an introductory chapter on the medieval background, which is followed by chapters on the Renaissance, the Scientific Revolution, the Enlightenment, the nineteenth century and the twentieth century - the historical narrative ending at the Spanish Civil War (1936-39). Within each period attention is paid in turn to political and social developments, to scientific institutions, and then to authors, teachers, practitioners and their output. Medicine and science are understood very broadly, including their most applied branches. Some of this information - on the astronomer Jeroni Muñoz (1520-91), on Benet (Benitus) Pereira (1535–1610), or on the first Megatherium skeleton assembled - may interest wide general audiences, but the strength of the book lies elsewhere. It is to be found rather in the rich. detailed picture it provides of the scientific microcosm of a provincial town on the European periphery. Drawing on their unparalleled knowledge of the primary sources of Spanish modern science and medicine, the authors take the reader to the local academies, to the university and its facilities (botanical gardens, laboratories, and so on), to the scientific societies, and to the scientific cabinets of the secondary school and private homes, and then set forth the curricula used, journals published, topics discussed and projects envisaged, and sometimes even implemented. The books and manuscript remains of many authors, from the local luminary to the figure of national or international standing, are then summarized and evaluated vis-à-vis the contemporary production of European centres. The work is clearly written and its material well organized, and includes some forty beautiful, well-chosen illustrations. To sound a negative note, it is to be regretted that the publisher could not afford to provide this 600-page encyclopedic book with a name or subject index. This is a book whose scholarly value is by no means diminished by its geographical focus. On the contrary, it will prove an invaluable source of information for anyone interested in the modern history of Spanish science and medicine.

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MARSHALL CLAGETT, Ancient Egyptian Science, Volume 2: Calendars, Clocks, and Astronomy. Philadelphia: American Philosophical Society, 1995. Pp. xiv+575, illus. ISBN 0-87169-214-7. No price given.

Clagett is a distinguished medievalist who is selftaught as far as Egyptology is concerned. The subject of his book has been well researched by Egyptologists and is comparatively non-technical, so that its interpretation requires only general scientific methodology and common sense. Reading the work I found some lexicographical errors – such as *ddsqd.f* for *sqdd.f* (p. 553) and a'akht rather than a'at (p. 527) and mistakes in translation (for example 'ntr wash' should be rendered 'the honoured god', not 'the Honoured of god', as on pp. 227 and 247). Other mistakes include the citation of the khet hieroglyph in the commentary to the rising of Sothis recorded in the Medinet Habu calendar when in fact the sign does not occur in the original text (fig. III 90). Note that the regnal year began in the New Kingdom not on New Year's Day (I akhet 1), as Clagett presumes, but was counted rather from the day of the king's accession. Such mistakes could mislead the reader who is no Egyptologist.

The book is divided into two parts. The first presents a historical and technical introduction to three main subjects; the calendars of ancient Egypt; the methods of and devices for timekeeping; and astronomy down through Hellenistic times. The section dealing with calendars essentially reviews the well-known ideas put forward by Richard Parker on the subjects of lunar calendars, the civil calendar and Sothic dating. Clagett's critical approach to Parker's work shows the author at his best.

Since Clagett was a colleague of Parker's collaborator Otto Neugebauer, he must have learned at first hand that Parker's views enjoy a wide currency, even if they are anything but certain. Down into the 1980s Parker was a feared authority with whom one did not disagree. The Egyptologist Wolfgang Helck - who did not possess Parker's understanding of astronomy described Parker's reaction to criticism with the words 'der wirft mit harten harten Gegenständen'. In the interim, Parker's theses about the calendars of ancient Egypt have been challenged not only by Helck but also by the Egyptologists Ulrich Luft (Die chronologische Fixierung des ägyptischen Mittleren Reiches nach dem Tempelarchiv von Illahun, Vienna, 1992) and Christian Leitz (Studien zur ägyptischen Astronomie, Wiesbaden, 1989). But Clagett has scarcely taken note of this recent trend. Like Lynn Rose (Journal of Near Eastern Studies (1994), 53, 237-61), Clagett identifies the weak spot in Parker's methodology-namely that he tries to influence the reader with rhetoric and persuasion when logic does not suffice. But this insight amounts only to the realization that Parker was human after all. Whereas Clagett's criticism of Parker's treatment of the Illahun moon dates is nowadays outdated, his exposure of Parker's tortuous and misleading interpretation of details in the Ebers calendar remains justified.

After the section on calendars there follows consideration of rising and transit decanal clocks, in- and out-flow water clocks, shadow clocks, sundials and, finally, astronomical ceilings and zodiacs. Interspersed are sections about the counting of hours in general. These subjects, while not uncontroversial, have been well-known for some time and need not be reviewed here. The arrangement of themes follows the framework provided by Neugebauer and Parker in Egyptian Astronomical Texts, Volumes I-III (London, 1960-69). However, Clagett's personal style contrasts agreeably with the impersonal, no-nonsense approach of Neugebauer and Parker. Clagett also relies heavily on older literature; for example, he introduces the chapter on Ramesside star clocks with a lengthy citation from the pioneering nineteenth-century work of Le Page Renouf.

It is noteworthy that Clagett, like Neugebauer and Parker, has not attempted an interpretation of astronomical information included in the Pyramid and Coffin Texts, although for the Pyramid Texts he might have utilized R. O. Faulkner's study in *Journal of Near Eastern Studies* (1996), **25**, 153–61. (The reader who seeks information on this aspect of Egyptian astronomy may soon consult my *Astronomische Konzepte und Jenseitsvorstellungen in den Pyramidentexten*, in press.)

Part 2 presents the sources for lists of festivals; the Ebers calendar; the Medinet Habu calendar (excerpted); names of lunar days; astronomical ceilings in the tombs of Senemut and of King Seti I; tables of daylight and night-time; the 25-year lunar cycle; historical Sothic dates; decanal clocks on coffin lids; Ramesside star clocks; the 'Book of Nut' (cosmology of Seti I and Ramses IV); the dramatic text inscribed in the so-called Osireion at Abydos; water and shadow clocks; and examples of zodiacs. Each document is introduced and a translation with commentary is provided, supplemented by an explanation of any representations. Illustrations of sources, either complete or in a representative detail, cover about seventy pages.

With few exceptions, literature that appeared after the 1980s could not be taken into account. For example, Clagett was not able to include comment on Leitz's 'Studien', which he does, however, mention having seen. Locher's important work and its consequences for the localization of decanal stars and those of the northern sky (for example Archaeoastronomy (1985), 9, §§152-3) escaped Clagett's notice. Regardless, this book must be appreciated in the context of the compendium of sources for ancient Egyptian science that Clagett envisioned. It is the second of three volumes. Volume 1, which appeared in 1989 (see the review of John Baines in volume 24 of this journal) dealt with annals, onomastica, and religio-magical texts exemplifying Egyptian approaches to organizing knowledge. Volume 3, in preparation, is to cover mathematics, medicine and 'techniques of representing nature'. When complete, this collection will provide Egyptologists as well as non-

specialists with an unparalleled handbook on ancient Egyptian science.

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ROSHDI RASHED (ed.), Encyclopedia of the History of Arabic Science, in collaboration with Régis Morelon, 3 vols., London: Routledge, 1996. Pp. xiv + 1105. ISBN 0-415-02063-8. £160 (set).

This long-expected work has now appeared in the same year that Routledge published A History of Islamic Philosophy. This immediately highlights the problem of what is meant by 'Arabic' and whether 'Arabic' or 'Islamic' is the best word. Rashed deals with this in the first note of his preface, in which he explains that 'we mean science written in Arabic, in the sense that one speaks of Greek science or Latin science'. The authors were Christian and Jewish as well as Muslim, and ranged from Spanish to Persian in their nationhood. In the sciences covered by these books there is remarkably little that can be said to impinge directly on the Islamic religion (an exception is the chapter on 'Astronomy and Islamic society: Qibla, gnomonics and timekeeping' by David King). Most of the sciences can be viewed as having an intellectual development which is largely independent of the society in which they are pursued (Rashed looks forward to a 'social study of Arabic science' at a future date, p. xi). This is particularly true in the case of the exact sciences of astronomy (to which the first volume is devoted) and the mathematical and physical sciences (the subject of the second). The claims of Arabic writers for remarkable achievements in these fields no longer need to be justified, but the authors of this volume (under the clearly-present guiding hand of Rashed) have put into black-and-white the details of these achievements.

While every effort is made to explain the connotations of Arabic terms to the non-Arabic reader, little concession is made to the nonmathematical reader. Perhaps no concession is possible, but it is worth noting that the modern mathematical symbols employed liberally, especially in the chapters on arithmetic (Ahmad Saidan), algebra (Rashed), trigonometry (Marie-Thérèse Debarnot) and astronomy (Régis Morelon and George Saliba), have no counterpart in Arabic writings, where written-out expressions closer to every-day language are used instead. On the other hand, the visual demonstrations of geometry have hardly changed since Euclid, and the article on the subject by Boris Rosenfeld and Adolf Youschkevitch is more accessible to the general reader. This applies also to the articles on applied astronomy, including mathematical geography (Edward Kennedy) and nautical science (Henri Grosset-Grange and Henri Rouquette). The science of astrology - which, surely, is applied astronomy par excellence, and which was often the raison d'être for the study of astronomy has apparently been deliberately excluded. In the second volume music is dealt with as a mathematical science (Jean-Claude Chabrier), and chapters on statics (Mariam Rozhanskaya and I. S. Levinova) and optics (Rashed and Gül Russell) complete the volume. The third volume is less comprehensive and more miscellaneous in its contents, presenting chapters on engineering (Donald Hill), geography (André Miquel), botany and agriculture (Toufic Fahd), alchemy (Georges Anawati), medicine (Emilie Savage-Smith), scientific institutions in the medieval Near East (Francoise Micheau) and classifications of the sciences (Jean Jolivet). For most subjects the influence on the Latin West is detailed (by Henri Hugonnard-Roche for astronomy, André Allard for mathematics, David Lindberg for optics, Robert Halleux for alchemy and Danielle Jacquart for medicine). Roshdi Rashed's preface, which gives a brief history of scholarship on Arabic science, emphasizes the importance of studying Arabic science in itself, rather than as a source for western European science, and dispels the common notions that science was a marginal pursuit in the Islamic world and that there was a 'scientific decadence from the twelfth century onward as the effect of an imaginary theological counter-revolution' (p. xiii). Muhsin Mahdi provides a concluding chapter which encourages us to alter our preconceptions about Arabic science and to replace new questions for old. Each volume has

its own bibliography, and commendably rich indexes of proper names, subjects and treatises conclude the third volume.

The native language of most of the contributers is French or Arabic, and we are grateful to Routledge for arranging the translation into English of many of the articles. One would have liked this to have been done with more care, since the result is usually a rather awkward style of English and occasionally plain wrong (for example 'too many' for 'very many' (p. 332, line 8); 'whatever' for 'any' (p. 349, line 2), etc.). Also, it would have been nice to have had notes at the bottom of the page. The word 'encyclopedia' in the title suggests an exhaustive textbook with the material arranged alphabetically, which these three volumes are not. Nevertheless, they provide what has never been available to the general public before.

As more than one contributor has noted, there is an embarras de richesse in the number of manuscript sources available and unstudied in the field of Arabic science. These volumes cannot claim to provide the definitive history. But it is worth noting that in certain fields the study of Arabic science has now outstripped that of the medieval Latin science which was so indebted to it. I think especially of algebra, mathematical astronomy, astronomical geometry (longitudes and latitudes of cities) and astrolabe studies. This is due to some very gifted and pioneering scholars, most of whom, fortunately, are included in these volumes. It is thanks to the enterprise of Roshdi Rashed that the results have been brought together under the covers of one work.

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A. C. CROMBIE, Science, Art and Nature in Medieval and Modern Thought. London: Hambledon Press, 1996. Pp. xvi+516. ISBN 1-85285-067-1. £40.00.

Alistair C. Crombie, who died in 1996, is probably best known for maintaining that scientific thought developed continuously from the Greeks, through the Middle Ages, and into the period of the Scientific Revolution. The present volume is the second collection of his papers, originally published in a variety of journals and books, to complement his major books, the classic *Medieval and Early Modern Science* (1953, 1959) and the massive *Styles of Scientific Thinking in the European Tradition* (1994).

These essays, originally published in the period spanning 1956-91, develop Crombie's notion of 'natural science' as 'a specific vision created within Western culture, at once of knowledge and of the object of that knowledge, a vision at once of natural science and of nature? (p. 1). He traces this notion to the ancient Greeks who 'introduced the conception of a rational scientific system, a system in which formal reasoning matched natural causation, so that natural events must follow exactly from scientific principles, just as logical and mathematical conclusions must follow from their premises' (p. 1). It is this characterization of science that Crombie claims passed in a continuous line from the Greeks through the Middle Ages to Galileo and beyond. In maintaining such continuity, Crombie disagrees with historians like Kovré and Westfall who argued for a dramatic intellectual rupture during the Scientific Revolution.

Four long essays (two of them co-authored with Adriano Carugo) form the centrepiece of this collection. In a detailed examination of Galileo's early writings on natural philosophy, Crombie argues that the sources for Galileo's ideas were three Jesuits teaching at the Collegio Romano: Benito Pereira (c. 1535-1610), Francisco de Toledo (1532-96) and Christopher Clavius (1527-1612). Crombie and Carugo identified these sources by making a detailed comparison between Galileo's manuscripts and books written by the Jesuits. The discovery of the Jesuit sources of Galileo's natural philosophy is significant because it demonstrates a direct link between Galileo's ideas and late Scholasticism, thus providing specific evidence for Crombie's larger continuity thesis. This work is closely related to William Wallace's groundbreaking studies of Galileo's Jesuit sources. Indeed, Crombie and Wallace had an unpleasant priority dispute over this work, a dispute presented from Crombie's standpoint alone in some lengthy footnotes and appendices.

Crombie's essays contain frequent references to a forthcoming book, *Galileo's Natural Philosophy*, which he was writing with Carugo. To my knowledge, such a book had not yet been published at the time of Crombie's death.

Several other essays in this volume are of particular interest. In 'Infinite power and the laws of nature: a medieval speculation', Crombie argues that the concept of the laws of nature was a product of the merging of Greek philosophy, which sought the fundamental principles underlying the world, with Judaeo-Christian theology, which ascribed the origin of the world to an omnipotent creator. This brief essay, originally published in Italian, covers much of the same ground as Francis Oakley's Omnipotence, Covenant, and Power and Amos Funkenstein's Theology and the Scientific Imagination, but it does so in a way accessible to students or scholars not intimately acquainted with the detailed scholarship on this important topic. In another essay, 'Experimental science and the rational arts in early modern Europe', Crombie traces the origins of the experimental approach in science to the methods of the rational artist, contributing to our understanding of the relationship between art and nature in ancient, medieval and early modern thought.

Although Crombie's writing is always thought-provoking, it is not beyond criticism. One of his unexamined presuppositions is that the definition of science has remained constant throughout history. There are many problems with this assumption. The term 'science' did not have the same meaning in every historical era, and the search for historical instances of what we in the twentieth century would call science prevents us from acquiring a contextualized understanding of the preoccupations of our historical subjects. Because of this presupposition, Crombie dismisses such topics as magic and demonology as 'irrelevant...to the history of the problems solved by science or art' (p. 114). In so doing, he ignores some of the most important new scholarship on early modern natural philosophy. Finally, his emphasis on the impact of Greek philosophy leads him to underrate the impact of the biblical tradition on the development of science.

Despite currents of presentism running through Crombie's writing, these essays are

interesting and provocative, providing much food for thought.

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Four Treatises of Theophrastus Von Hohenheim Called Paracelsus, translated from the original German, with introductory essays by C. Lilian Temkin, George Rosen, Gregory Zilboorg and Henry E. Sigerist. Edited, with a preface by Henry E. Sigerist, Baltimore: Johns Hopkins University Press, 1996. ISBN 0-8018-5523-3. £13.00, \$15.95 (paperback edition).

Originally published in hardback in 1941 to mark the 400th anniversary of the death of Paracelsus, this paperback edition of four Paracelsian treatises is a welcome addition to collections of his work which have appeared in recent years. Making no claims to be representatives of the entire Paracelsian corpus, or indeed of any particular chronological progression, the texts are eclectically chosen, and translated with explanatory introductions, by four very eminent past historians of medicine. Indeed the collection is as much a tribute to their contribution to the understanding of Paracelsus as it is a celebration of Paracelsus himself.

The first treatise, Seven Defensiones, the Reply to Certain Calumniations of His Enemies, is translated and introduced by C. Lilian Temkin and includes an explanation of the difficulties (sometimes apparent) of translating early sixteenth-century German, 'a very imperfect instrument of literary expression' into English. Nevertheless, in keeping with his unconventional approach to scholarship, German, not Latin, was the language chosen by Paracelsus to respond to the adverse reception of his startlingly innovative ideas, and in which to defend his 'strange manners and wrathful ways'. For the student of Paracelsus, and the medical philosophy which challenged entrenched Aristotelian and Galenic views of nature, there is much to be learned from Paracelsus' Discovery of the New Medicine ... [and his reasons for] reject[ing] ... False Physicians and False Company. Within these defensiones Paracelsus reveals his most deeply held beliefs about the sacred duty of the physician to study 'nature [which] God created

[as] a great gift for the good of man' and his conviction that 'God himself is [both] the physician and the medicine'.

The second treatise, On the Miners' Sickness and Other Miners' Diseases is translated and introduced by George Rosen. Recognizing the inevitability of a rise in occupational diseases resulting from increased industrial development, Paracelsus attempted to group and classify poisons and their effects. There is much to learn about his approach to nature in this treatise, including the astral influences which produce diseases and poisons, and changes which take place within the body producing 'tartarus' effects, and a discussion of the 'arcana' which was central to his therapeutic theory: 'For thus is the quicksilver within itself, it contains the good and the evil united, so that they are not to be separated from each other.' Rosen's commentary on this difficult treatise is both helpful and enlightening, although his reminder that 'Paracelsus lacked any clear cut theoretical concepts and an adequate terminology with which to express his ideas', leads on occasion, to an attempt to provide him with both.

The third treatise, The Diseases that Deprive Man of his Reason, such as St. Vitus' Dance, Falling Sickness, Melancholy, and Insanity, and Their Correct Treatment is translated and introduced by Gregory Zilboorg who, with a plea to the reader to 'bear in mind the historical and cultural atmosphere in which Paracelsus lived', describes the treatise as 'perhaps more recondite and diffuse than any of [Paracelsus'] medical writings'. Indeed they appear to be a remarkable rejection of the more usual sixteenthcentury explanation for mental disorders, the malign activity of demons, and show Paracelsus interested not only in the particular features and cures of various manifestations of madness, but also in the sufferers as individuals. Of particular interest to those wishing to understand Paracelsian therapeutics there are lengthy sections on cure. For example, 'On soothing and curing falling sickness' includes a very detailed 'Recipe for epilepsy', which incorporates 'the spiritual medicines which cure epileptic patients... [which] are not called remedies or medicines but arcana, because of their wonderful and noble virtues'. And in common with the other three

treatises in the collection is the familiar refrain that 'much depends on what is shown and taught by experience...[and that] there is no disease with the power to kill, for all diseases are curable without exception, even those illnesses which we do not understand'.

The fourth treatise, A Book on Nymphs, Sylphs, Pygmies, and Salamanders, And On The Other Spirits is translated by Henry E. Sigerist, who describes it as 'at times written in a style that reminds us of fairy tales'. Choosing to oppose theological teaching rather than medical, Paracelsus shows in this treatise that he 'had totally different views' about the nature of the 'strange beings ... which had survived the twilight of paganism'... which the theologians had 'declared ... to be devils ... [and whose] existence they could not deny'. Discussing 'the four kinds of spirit-men', namely the water people, the mountain people, the fire people and the wind people, Paracelsus explains that he believes them 'to be man, although not from Adam, but other creatures apart from man...that have come among us'. Perhaps more than any others, these topics may have been responsible for encouraging Paracelsus' reputation as a blasphemous, heterodox dabbler in witchcraft, particularly as he chose to defend his passionate Christianity via so controversial a medium. And adhering to the beliefs which characterized his life and work, Paracelsus declares in the final paragraph of the treatise: 'when the end of the world will come...then the fake scholars will be exposed, those who are highly learned in name only but know nothing by experience. Then the thorough scholars and those who are mere talkers will be recognised for what they are, those who wrote truthfully and those who traded in lies, and the thorough and the shallow ... to each will be measured according to his diligence, earnest endeavour and truth ... For that time I also recommend my writings for judgement, asking that nothing be with-held.'

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PENELOPE GOUK (ed.), Wellsprings of Achievement: Cultural and Economic Dynamics in Early Modern England and Japan. Aldershot: Variorum, 1996. Pp. viii+271. ISBN 0-86078-465-7. £42.50.

The Renaissance Trust, founded and funded by the industrialist and engineer Gerry Martin, underwrote the five-year programme of seminars and interdisciplinary discussions from which the papers in this excellently edited and produced, though very expensive, volume of essays have been derived. Martin believes that 'we may be debarred from making much further progress in the understanding of the complexities of sociallydetermined activity until the humanities and social sciences involve a structured team approach' (p. 4). A sceptical response to that statement would be that collaborative work is certainly well adapted to numerous interdisciplinary research tasks and already more frequently practised than Martin appears to assume. In itself, however, 'structured' investigation is no more likely to deliver the goods than the musings of the traditional lone scholar, labouring away in splendid isolation.

In her introduction, Penelope Gouk touches intriguingly on the potential value of studies of 'achievement' centred on the creative activities of individuals. Unfortunately, none of the essays in the volume follows that course. Either provisionally defining, or cannily avoiding, definition of 'achievement' within specific socioeconomic contexts, almost all the contributors concern themselves with collective experience. Too many-Steven Shapin in his otherwise exemplary "Achievement" and the macrosociology of culture', Michael Lynch in 'Springs of action or vocabularies of motive?', Rob Iliffe in an intense essay on 'Working bodies: Protestantism, the productive individual, and the politics of idleness' and Alan Macfarlane and Wolfgang Schwentker in thought-provoking pieces on Japanese work and cultural mentalités - repetitiously engage with the Weber thesis.

Macfarlane adopts the right attitude when he footnotes the ways in which other contributors have attempted to deal with the problem (p. 203) and then moves swiftly on to a summary of standard 'undergraduate' demolitions of what is

now surely best depicted as an early twentiethcentury cultural representation, rather than empirically rooted explanation, of historical relationships between religion, conscience and work. Whether or not positivistic variants of the Weber thesis will soon be declared brain-dead, Macfarlane is right to test them against non-European experience. Having said that, one should add that his Japan comes across as a curiously ahistorical place. The anguished 'networks of debts' that he ably and empathetically describes, are certainly much less pervasive than they were a generation or more ago. A fictionbased way of illustrating precisely that point would be to compare the writings of Shusako Endo and Kenzaburo Oe. Western literary experts were convinced that the Catholic Endo ought to have won the Nobel Prize: but it is Oe's work that has more accurately portrayed Japan's postmodernistic - and 'post-Weberian'? - malaise.

Together with Weber, David McClelland is a permanent, lurking presence in this volume. It is good to hear from Deborah Christie in her informative 'Towards an understanding of intelligence, creativity and achievement' that the author of the Achieving Society was simultaneously attracted to Freudian psychodynamics, Wittgensteinian language games and Hullian behaviourism (p. 32). But very few social scientific paradigms can ever have been as transparently ideological as those current in American social psychology during the arctic period of the cold war. And it is undeniably difficult seriously to engage with a thinker who believed that nature 'might constitute a "mother substitute" in the fantasies of young boys who went on to become scientists': and, finding that notion untenable, hypothesized that 'scientists work so hard and love their work so much to satisfy not sexual but aggressive needs' (p. 67). Maybe, but almost certainly not.

This summary is taken from Shapin's compelling journey through the works of major though now neglected authors – Toynbee, Zilsel, Sorokin – who confronted the issue of why particular societies (or 'civilizations') followed specific cultural paths at specific historical junctures. (The late Joseph Needham who, as Shapin correctly notes, was deeply influenced by Zilsel (p. 60) might have been added to this list of 'macro-cultural' thinkers.) Devoting a final section to Mary Douglas's impressive writings on the formation and multiple meanings of culture, Shapin concludes in somewhat overoptimistic style that:

Effectiveness at innovation does not need to be referred to genes or individuals' psychological traits: right in front of us are quite ordinary social structures and modes of social interaction that provide incentive and encourage the mundane relationships in which new culture is made, transmitted and modified [p. 76].

Shapin is one of the few contributors to the collection who starts at first base and argues his way to theoretically compelling conclusions. Several other pieces - notably Ian Inkster's typically adventurous 'Culture, action and institutions: on exploring the historical economic successes of England and Japan', which, together with Macfarlane's and Schwentker's essays, might have provided the basis for a genuinely comparative collection - are excellent. But few and certainly not Donald McCloskey's overobvious assault on British and north American economic declinist ideologies - belong to a book bearing this particular subtitle. (Paul Seaver's piece on 'Work, discipline, and the apprentice in early modern London', and David Zaret's 'Printing and the invention of public opinion in seventeenth century England' seem to have strayed in from a quite different seminar series.) As for interdisciplinary research into 'achievement', this reviewer regretfully declares himself under-motivated.

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SUZANNE B. BUTTERS, The Triumph of Vulcan: Sculptors' Tools, Porphyry, and the Prince in Ducal Florence, 2 vols. Florence: Leo S. Olschki, 1996. Pp. 724, illus. ISBN 88-222-4411-7. 320,000 lire (set).

'This book is not a systematic study of how porphyry was worked in Renaissance Italy, nor an attempt to categorize and describe the tools used by its stoneworkers... The Triumph of Vulcan focuses on a series of intersections between spheres political, artistic and scientific' (p. 29). By showing the Medici's ruthless practice of harnessing newly available technologies in the pursuit of power, this work admirably complements recent studies of Renaissance courtly patronage (for example Bruce Moran's Patronage and Institutions (Woodbridge, Suffolk, 1991), Mario Biagioli's Galileo, Courtier (Chicago, 1992), Paula Findlen's Possessing Nature (Princeton, 1994) and Pamela Smith's Business of Alchemy (Princeton, 1994). At its heart is the problematic relationship between practitioners and patrons in the production and legitimation of scientific knowledge.

According to Giorgio Vasari, it was his patron Duke Cosimo de Medici who discovered experimentally a herbal liquor which 'tempered' steel tools so effectively that they were hard enough to carve porphyry. Before 1555 sculptors had been unable to work this precious material effectively, but armed with Cosimo's secret recipe, a stonecutter and ornamental carver named Francesco del Tadda was now able to execute a classical porphyry fountain to Vasari's design. But was this breakthrough really due to Cosimo's celebrated skills in distillation, as Medici propagandists and historians claimed? Benvenuto Cellini did not think so, for example, but instead attributed the discovery to Tadda. The ambiguity surrounding this episode has led Butters to ask the following deceptively simple questions which define the structure of her book: was it possible to develop a steel hard enough to carve porphyry in the Renaissance, and if it was, how was it done and by whom (p. 29)?

The wealth of fascinating material presented in the second volume has been assembled as a means of tackling these complex problems. It includes twenty-six appendices comprising littleknown documents (for example of alchemical recipes) and technical asides for non-specialists, more than two hundred photographs (sixtyseven in colour) locating porphyry artefacts in their broader cultural context, and a couple of maps showing the principal sites mentioned in the first volume. Here, besides the more familiar landmarks of Renaissance Florence, are located the shops and residences of apothecaries, blacksmiths, physicians, armorers, clockmakers and other places where relevant skills, tools and knowledge were produced and exchanged.

It is in volume 1 that the answers to Butters's questions are found. The first section 'An ancient stone and its connoisseurs' shows how highly prized porphyry was. Because of its extreme rarity, its lustre and colour (purple), and durability, this material had long been associated with imperial power and served as a metaphor for spiritual and moral integrity. Porphyry artefacts plundered from Egypt and the Roman Empire were acquired by wealthy patrons whose own status was thereby enhanced. But sculptors sought to emulate the artistic achievements of the ancients in vain.

The second part looks at the tools and methods used for working porphyry, both in the sixteenth century and antiquity. Renaissance investigations into ancient metallurgical techniques were limited to textual sources. Butters herself, however, draws on the empirical knowledge of twentieth-century York stonemasons and Japanese sword-makers to reconstruct the mechanics of 'tempering' steel. The extent to which sculptors, stonemasons and even surgeons were expected to maintain and even make their own instruments has largely been forgotten in modern society, where the local blacksmith no longer exists.

Part 3, 'Tempering and its experimental setting' will perhaps be the most interesting section for Journal readers. This looks closely at the diverse occupational and societal groups which had a vested interest in finding a recipe for hardening steel. Clockmakers, armourers and assayers as well as medical practitioners of all kinds were among those who experimented with and exchanged recipes, but so too were the Medici dukes. Like other princes of the age (Maurice of Hesse-Kassel springs to mind) Cosimo himself was keenly aware of the power which might be harnessed through the manipulation of metal. Butters concludes that Cosimo did indeed have the technical skills to concoct a new herbal temper, but had a limited experience of working iron and steel with his own hands. And here is where the limits of Vasari's claim are eventually revealed: Butters ends up showing that the 'real' source of the recipe's success lay in the correct sequence of operations rather than in the intrinsic merits of the recipe alone. In a literary *tour de force* she reconstructs how Tadda would have actually made and used his tempered tools, and the technical and artistic judgements he applied in working particular pieces of porphyry.

Part 4 reveals the collusion which took place between all three protagonists in this story, both to Tadda's advantage as well as that of his patron. There was a price to be paid for Tadda's recognition at court and his admission to its new Academy of Design. To be identified as a proper artist by this body, his accomplishments had to be cast in poetic terms, in the way Michaelangelo was eulogized. But 'while this abstraction should have borne fruit for Tadda, the very act of transforming physical "tempering" into metaphorical "tempering" assumed that it would bear none...Being unable, or unwilling to claim the practical metallurgical skills which had made possible the deployment of a new temper for tools to work porphyry, Tadda made it easier for Cosimo's historians to appropriate the technical invention as a form of speculative knowledge for their princely patron, and with it the resuscitation of a genre of ancient sculpture' (p. 376).

Nearly large enough to *be* a coffee table, this lavishly illustrated and beautifully designed pair of volumes displays Butters's own intellectual and technical skills to advantage. Apart from being a desirable acquisition for connoisseurs and bibliophiles (the only ones who will be able to afford it), the work will be of value to historians of early modern science and technology, and I recommend that you try to get it for your library.

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MICHAEL HEYD, 'Be Sober and Reasonable': The Critique of Enthusiasm in the Seventeenth and Early Eighteenth Centuries. Leiden: E. J. Brill, 1996. Pp. xi+312. ISBN 90-04-10118-7. \$92.00. Dfl. 142.00.

In 1980, Michael Heyd published a useful article synthesizing work on the reaction against enthusiasm and its significance for late seventeenthcentury thought that has been widely and appreciatively cited. Since then, in addition to a book on university teaching in Geneva in the period, he has published various articles on related themes. The current work draws together a good deal of this material and adds more. The result is to provide a helpful survey of hostility to 'enthusiasm' from the sixteenth to the early eighteenth centuries that incorporates discursive accounts of a number of ancillary topics. The book opens with an account of the theological reaction against the radical reformation in the sixteenth century, and its echoes in the seventeenth. It goes on to deal with the roots of the medical critique of enthusiasm, stressing the importance of Burton's Anatomy of Melancholy for investing this with newly powerful polemical purposes in a religious context. Heyd then deals with the classic anti-enthusiast texts published by Henry More and Meric Casaubon in the 1650s, in which a naturalistic critique of enthusiasm came to the fore. Then, he indicates the ambivalence on this issue of Cartesianism and of the new philosophy more generally: while some saw such positions as an answer to enthusiasm, others saw the iconoclasm towards earlier intellectual traditions that they entailed as itself akin to enthusiasm. Later chapters deal at length with Shaftesbury's Letter concerning Enthusiasm (1708) and its context, not least in relation to the debate over the French Prophets in early eighteenth-century England. In these, Heyd comments interestingly on the extent to which orthodox spokesmen focused less on doctrine and more on the question of authorization; he also indicates the increasingly rationalistic criteria that were invoked in judging such issues. Perhaps the most unexpected section of the book is the last, which draws on Heyd's own researchers in Genevan sources to throw new light on Newton's protégé Fatio de Duillers and his context, including a strange aftermath in which one of his Genevan successors, George-Louis La Sage, sought to illustrate the integrity of enthusiasm to true genius.

The book is worth while not only for providing a survey of these themes, but also for giving a European perspective to developments that have all too often been studied solely in their English emanation, with particular reference to the Netherlands and Switzerland. On the other hand, the coverage of so long a period within a single volume has at times resulted in a certain narrowness of conception. Thus Heyd says surprisingly little about the nature of the 'enthusiasm' against which the reaction occurred, and hence fails to explore the ways in which the two interrelated. The book also suffers from its failure to give adequate consideration to the anxiety about 'atheism' that, as its author more than once notes, existed in a kind of counterpoint with hostility to enthusiasm. Though he indicates the shared anticlericalism of the two positions, it would have been helpful if the ambivalence of the appeal to 'reason' that was so central to polemics against enthusiasm had been more fully investigated, thus making better sense of the reactions to Shaftesbury's ideas that are here outlined. Spinoza is mentioned only cursorily, while Toland does not appear at all. The book's ambitious chronological scope evidently also explains the fact that the work on which it is based is at times a little dated for a volume with a 1996 imprint, since relevant publications of the early 1990s are only haphazardly cited. However, almost any attempted synthesis of so large a subject would be open to some degree of criticism of this kind, and Heyd has undoubtedly made a valuable contribution to the literature.

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MARGARET LUCAS CAVENDISH, Grounds of Natural Philosophy, with an introduction by Colette V. Michael. West Cornwall, CT: Locust Hill Press, 1995. Pp. xx+311. ISBN 0-933951-66-3. \$38.00.

That a seventeenth-century duchess should have published on natural philosophy is remarkable, as Colette Michael tells us in her introduction; but unfortunately she does not go very far in placing the ideas contained in the book in their context, or in handling them critically. The book begins with a dedication – perhaps ironic, since she could not have attended one – to the Universities of Europe, in which the book is 'this beloved Child of my Brain', which had never been put 'to suck at the Breast of some Learned Nurse, whom I might have got from among your Students'. Clearly she could have fun with gender.

The edition reprinted is the second, of 1668. In contrast to Boyle, she sees Nature as God's servant, and believes that vacuum is impossible. The whole book is some way from empiricism, being thoroughly rationalistic and unexperimental; and it is marked by a curious splitmindedness, associated no doubt with a faculty psychology, in which the parts of her mind engage in dramatic debates about metaphysical questions in the 'appendix': persons are like a society (p. 60), in a reversal of the metaphor familiar to us from *Coriolanus* or Hobbes.

In her system, the only immaterial is God; and even God appears elsewhere to be immanent: 'God lives in no other ways amongst his Creatures, but in their Rational Thoughts, and Sensitive Worship' (p. 71). The system is thus materialistic; thoughts are motions in the mind, and diseases (of which she gives a formidable list) are the motions of vapours. While seeing otters as partly beast and partly fish (p. 171), and other creatures as similar mixtures, she cannot believe in the transformations of witches (p. 176); she has mysterious views about the ebbing and flowing of the sea (pp. 199ff); and she supposes that the particles of water are circular, of snow triangular, and of ice square (p. 201). She discusses whether the Blessed eat and evacuate in Heaven, and whether they ever sleep. She ends with another witty passage, about the futility of alchemy. It is good that we should have her work in print again, because it is interesting to compare with that of her contemporaries who, no doubt unfairly, thought her mad.

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GEOFFREY V. SUTTON, Science for a Polite Society: Gender, Culture, and the Demonstration of Enlightenment. Oxford: Westview Press, 1995. Pp. xiii + 391. ISBN 0-8133-1575-1. £22.50.

It has been some time now since historians perceived the Enlightenment in terms of a high, technical science and a low, vulgar, derivative or

popular science. Many historians now consider the science of the popular lecturer was as important as that carried out by the closeted mathematician and which was destined for fellow savants alone. Most of the time these days such distinctions are not even helpful. Private science was often a rehearsal for the public stage. All these sorts of new assumptions inform Geoffrey Sutton's study of French science in the seventeenth and eighteenth centuries. The odd thing is that he seems to have arrived at these conclusions independently. Sutton's study is a lucid account of the career of science in distinct social settings. He begins by describing the scientific discourses held at a 'strange institution', the Bureau d'adresse (p. 21). Here the educated public discussed cosmological questions from a variety of viewpoints, dispelling any presumptions the historian might have that early seventeenth-century French folk lived in an uncomplicated Aristotelian universe. Sutton then charts Descartes' career and describes the adoption of Cartesianism in the literary salons of midseventeenth-century Paris. He argues that the adoption of Cartesianism itself, and the manner in which it was adopted, owed much to 'the attraction that natural history and philosophy held for women' (p. 140). Sutton then charts the transfer of Cartesianism to Versailles and its conversion into an absolutist ideology under the gaze of Fontanelle. He then returns with it to the salons of Enlightenment Paris and again, stressing the role of women, watches its eclipse by Newtonianism: an eclipse exemplified in the electrical domain by the triumph of Franklin over Nollet. Throughout, Sutton keeps drawing the reader's attention to the importance of spectacle and display and stressing that they were not derivative but forms of scientific practice in their own right. He draws attention, too, to the inadequacies of the term Newtonianism and points to its variations. In this connection he points out how scholars needed to avoid being labelled as pedants and bores when demonstrating in the salon.

Nothing odd in all this, the historian at the coal face might mutter. No nothing at all; except where is the work of historians who have long been playing with these ideas? The studies of Jan Golinski, Simon Schaffer and Larry Stewart on popular science pass without mention. Schaffer on Newtonianism goes unobserved. Steven Shapin on the scholar is unnoticed. Leviathan and the Air Pump gets a word but only with regard to a specific experimental issue. Admittedly these studies all pertain to British experimental science but Sutton has much to say about that too. It is notable that Sutton's bibliography contains references to only a dozen works published since his doctoral thesis of 1982 on the subject. Odd too is the identification of Newton's idea of interparticulate forces solely with the Principia. The Opticks and its Queries merit no mention. An earlier literature is missing here too: Arnold Thackray, Robert Schofield and no I. B. Cohen on Franklin and Newton. Oddest of all is the unsubstantiated suggestion that Descartes arrived, independently, at a theory of the circulation of the blood (p. 63). This is a well-crafted, highly readable study which addresses important issues about the uses of science in specific social contexts. The gender in the title perhaps magnifies the role women play in the book. But it remains surprising that referees, if there were any, did not pick up the oddities.

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DAVID J. STURDY, Science and Social Status: The Members of the Académie des Sciences, 1666–1750. Woodbridge, Suffolk: Boydell Press, 1995. Pp. xvi+461. ISBN 0-85115-395-X. £65.00, \$117.00.

This is an elegantly produced work, painstakingly and thoroughly researched, a veritable treasure trove of biographical information about the members of the French Royal Academy of Science, 1666–1750. Historians familiar with the notarial records in the Minutier Central in Paris will recognize and sympathize with the long hours of sheer hard work the author has put in, not merely disentangling the very difficult handwriting of seventeenth- and eighteenthcentury Parisian lawyers, but the way his prosopographical nose has sniffed out his prey from such a rich variety of sources.

The work is divided into five essentially chronological parts: parts 1 and 2 (pp. 3-142) begin with a masterly analysis of the origins of the Academy, demonstrating most clearly the ways that scientific and political trends intersected with a culture of patronage to select the Academy's first members. This is followed by a fascinating profile of the founding members, looked at from a variety of standpoints. The author devotes a chapter to those 'with backgrounds in law', the astronomer Adrien Auzout and secretary J. B. Du Hamel, for example; others to individuals such as mathematician Gilles Personne de Roberval, sometime critic of Descartes, and the iatrochemist Samuel Cottereau Du Clos, now remembered for the fact that he burned most of his papers. Part 2 finishes with a chapter on 'the majority, academicians in their forties' and one on the first five élèves, or technical officers, Couplet, Picard, Niquet, for example.

Part 3 (pp. 145-277) begins with an examination of the institutional procedures, material resources and Baconian ethos of the young Academy. It traverses the period of royal patronage of ministers Colbert, the founder, Louvois, the utilitarian, and Pontchartrain, the reformer, and describes the personal history and social status of individuals appointed to the Academy between 1669 and 1698. Rich detail is provided for the polymath Nicolas Blondel, and for Denis Dodart, J. B. Du Verney and the La Hire dynasty before we come to Pontchartrain's appointees, Abbé Bignon, Bernard de Fontenelle and others, who prepared the way for the 'Reform of 1699'. Part 3 finishes (chapter 16, 'The formation, social status and mentality of an academician, 1666-1669') by pulling together what the author sees as the major themes of his work, namely a focus on academicians as individuals rather than 'The Academy as institution'; concentration on the ways detailed examination of these individuals' social origins, family ties, education, careers, patronage, marriages, fortunes, reading habits and other cultural interests influenced their social status; and, finally, deliberation on the question how far 'homo academicus' was a reality by 1699 and how far such a being took his persona outside the confines of the Academy (p. 275).

In parts 4 and 5 (pp. 281-412), as elsewhere, questions of more general interest (about government intervention in scientific affairs, whether the new statutes of 1699 amounted to a revolutionary break with the past, the nature of the relationship between the Academy's mathematicians and the 'philosophes' of the early Enlightenment) are interspersed with what we cannot help feeling is voyeuristic information about individual academicians. This time, reflecting early eighteenth-century reforms, our academicians are separated into those in the life sciences, those in the mathematical sciences, the secretaries and those chosen from among Parisian apothecaries. The work finishes in 1750, a somewhat arbitrary date, since there exist already a number of excellent works dealing with the later eighteenth century.

David Sturdy has given a virtuoso performance, hugely industrious, comprehensive, well organized and sensibly cautious in the conclusions he draws. Whether he has successfully taken up the challenge, outlined on the very first page of the book, 'to search for a way to connect history of science with social and cultural history at the bottom [level of scientists] rather than at the top [the level of philosophical debate about science and culture]' (T. L. Hankins) is another matter. A connection is certainly made but how successful it will be, remains to be seen. Dampening this reader's enthusiasm is the fact that prosopography is too often a banal and tedious science, where every piece of information is treated as if it were of equal importance; by its very nature, it inhibits creative flair. The reader sometimes senses this in Science and Social Status. Perhaps we should acknowledge that, for some, the more pressing, indeed, more interesting challenge is to search for ways to bridge the gap between sociology of scientific knowledge (Steven Shapin, A Social History of Truth, Chicago, 1995), history and philosophy of science (Peter Dear, Discipline and Experience, Chicago, 1995) and the work of mere(?) historians.

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JULIEN OFFRAY DE LA METTRIE, Machine Man and Other Writings, translated and edited by Ann Thomson, Cambridge Texts in the History of Philosophy. Cambridge: Cambridge University Press, 1996. Pp. xxx+179. ISBN 0-521-47258-X, £35.00, \$54.95 (hardback, 0-521-47849-9, £12.95, \$18.95 (paperback).

Julien Offray de la Mettrie (1709-51) is an interesting historical figure. Though admittedly La Mettrie's works are largely polemical, presenting little in the way of arguments in defence of positions that he takes, his distinctive materialism and hedonism are striking as philosophical positions and useful for understanding the history of ideas of the eighteenth century. After centuries with no translation of La Mettrie's works into English except a 1912 edition of L'Homme machine (Man a Machine (tr. Gertrude C. Bussey), Open Court) two new translations of selections from his writings have appeared since 1994. Both include translations of L'Homme machine and L'Homme plante; the alternative translation (Man a Machine and Man a Plant (tr. Watson and Ribalka), Indianapolis, 1994) includes in addition only La Mettrie's polemical dedication to Albrecht Haller (which is not translated by Thomson or Bussey).

Ann Thomson's translation is of great value for it makes available in English in one small volume an excellent collection of La Mettrie's writings. This provides perspective on the evolution of La Mettrie's thought, from, for example, his view of a corporeal soul in his Natural History of the Soul (the first half of a revision of this work, Treatise on the Soul, is included here), to the account of sensitivity without soul of his well-known L'Homme machine (here translated as Machine Man). It allows consideration of the various strands of La Mettrie's thought, including his defence of Epicureanism and his opposition to Stoicism, seen, for example, in his account of the origin of life in The System of Epicurus and in his view of morality in Anti-Seneca or the Sovereign Good (again, the first half of which is included). Also included is the introduction to La Mettrie's Philosophical Works of 1750, his Preliminary Discourse, in which he defends his materialism and responds

to his adversaries' claims that his works are a threat to religion and morality.

Ann Thomson, in her introduction, briefly points out various influences on La Mettrie, including, for example, the anti-religious thought of clandestine treatises, and the related Spinozist and Libertin traditions. She notes, in addition, the importance for La Mettrie of Gassendi's account and, in particular, of the account of his followers, Willis and Lamy, of a corporeal sensitive soul. Also presented is a useful summary account of each work of La Mettrie that is included in the volume. Further, Thomson provides an interesting and informative exploration of why, since the end of the eighteenth century, La Mettrie's works have received little attention. She argues that La Mettrie's relative obscurity and infamy since the late eighteenth century is due, at least in part, to the reception of his writings on moral philosophy, especially by such materialists as Diderot and D'Holbach. In this context, it might also be helpful to consider the association (noted, for example, by E.G. Hundert, The Enlightenment's Fable: Bernard Mandeville and the Discovery of Society, Cambridge, 1994, p. 58) between La Mettrie's moral views and those presented in Mandeville's well-known and notorious 'Fable of the bees', which was translated into French in 1740.

La Mettrie's writing is vigorous, provocative, combative and colourful, qualities that contributed to the initial popularity of his works during the eighteenth century, which continue to delight and, along with his development of a consistent materialism, to make him an interesting figure. This translation is overall very readable and accurate, and it does a reasonable job of preserving the verve and vigour of the original. Thomson's notes, bibliography and chronology of La Mettrie's life are brief but, for the most part, reasonably well chosen and helpful. While this is clearly not a critical edition, Thomson's analysis and notes are informed by the relevant critical editions, that is, those of A. Vartanian (L'Homme machine), T. Verbeek (Traité de l'âme), and J. Falvey (Anti-Senèque). Further, the description of La Mettrie, in Vartanian's 1960 critical edition of L'Homme machine, as the culmination of Epicureanism, the logical conclusion of Cartesianism, and as the foundation of psychology as a science of man might be seen as an overstatement of La Mettrie's significance. Thomson's account benefits from her reasonable and balanced assessment of La Mettrie's achievements.

Ann Thomson's translation is a welcome contribution to teachers and students concerned with an understanding of the eighteenth-century Enlightenment. La Mettrie's writings draw together, from one extreme and compelling perspective, many strands of Enlightenment thought, and Ann Thomson's translation makes this available to an English speaking audience.

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JOHN HEDLEY BROOKE, Thinking About Matter: Studies in the History of Chemical Philosophy. Aldershot: Variorum, 1995. Pp. xii+290. ISBN 0-86078-464-9. £47.50.

A book composed of selected papers may or may not be more than the sum of its parts. It makes available publications otherwise accessible only in the stacks of libraries, where those of us who like to look up-to-date in our citations never bother to go; but it may also reveal a mind gaining ground upon the dark, while exploring problems from different directions over time.

John Brooke's papers here are not in chronological order; which is perhaps a sign that he has not had to change his mind much, or that he has not sought always to wear the latest intellectual fashions. We find old and new friends, from 1968 to 1993, and running through them there are certain very characteristic threads, giving clues to all of us when stuck in labyrinths. The title for the collection has been chosen carefully: this is chemical philosophy, the transcendental part of chemistry, investigating beliefs within, and about, chemistry. It is context which is crucial in all the papers, some of which are chapters from collective volumes, and thus removed from their own contexts - perhaps into one in which they work better.

John Brooke's strategy is often to seek some received opinion or verdict, and then to look behind it and see whether a keen eye for oxymoron, paradox, irony and ambiguity can find a more interesting story, where the winners

and losers (if we can use such vulgar terms) look rather different when hindsight and authority are replaced by close study of contemporary writings and practices. This is well illustrated in the oldest paper here, on Wöhler's urea and its vital force: the generally accepted view, that this synthesis did (or should have) put an end to vitalism is traced back to its origins in battles long ago, and the effect upon contemporaries (excited about isomerism) recovered. Sometimes a newer consensus is challenged, as in the most recent paper in the book: here Kekulé's probable priority with respect to the benzene ring, and even the likelihood that he may have hit upon it in a dream of a snake swallowing its tail, is vindicated against the suggestion that he was anticipated by Laurent or Loschmidt.

Such corrections are made with tact as well as firmness; the rebukes are invariably polite, and where coals of fire are poured upon offending heads, as in a 1981 essay on the failure of the kind of case studies beloved by philosophers of science, they are poured gently. Indeed, a characteristic of John Brooke is his generosity: not merely paying all his intellectual debts, he goes out of his way to draw attention to the work of others. Bishop Charles Gore was supposed to have said that he had never heard a sermon so bad that he had learned nothing from it; John Brooke might feel the same about learned papers, relishing also the irony which can be read into the remark.

We see his interests in religion coming out in his discussions of Priestley's 'Ministry of Reform' (1990), and of vitalism and natural theology (1989); but essentially these are all papers which focus upon the history of chemistry, and which will be essential (re)reading for anybody seriously concerned with it. The paper on Davy and his ideas on acidity is a tour de force in its exploration of multiple ironies, as part of a story in which nobody was (or could have been) 'right' in achieving the 'modern' theory of acidity with which Davy was in the past often credited. Another paper (1981) indicates how absurd it would have been for chemists to accept Avogadro's Hypothesis in the second decade of the nineteenth century, for all sorts of reasons: 'if only' history is always beset with problems, here elegantly demonstrated.

Two papers from the 1970s explore relationships between Berzelius, Laurent and Gerhardt during that transformation of chemistry in the mid-century. Berzelius used often to be represented as clinging blindly and angrily to the insights of his youth: an elderly Canute trying to stem the tide of types and radicals threatening his beloved dual monarchy, armed only with feeble *ad hoc* hypotheses. Brooke's close and careful analysis, and his characteristic fine taxonomy (he is always a splitter rather than a lumper) brings out what an interesting story it is when carefully reappraised, rather than used as a vehicle for praise *or blame*.

Another paper (1971) searches for a beginning: when did organic chemistry cease to be extraordinary, and the unity of chemistry become evident? This gives him a chance to examine the variety of vitalisms; to see which reactions go *in vitro* under conditions approaching those *in vivo*; and thus to look at contexts, analogies and regulative beliefs with customary sensitivity. Historians of chemistry, in suddenly rather a booming field, are likely in these days to be looking at laboratories, industrial links and professional formation; John Brooke knows about these things, but his focus on ideas in chemistry is salutary.

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THEODORE W. PIETSCH (ed.), Fishes, Crayfishes, and Crabs: Louis Renard's Natural History of the Rarest Curiosities of the Seas of the Indies, 2 vols. Baltimore: Johns Hopkins University Press, 1996. Pp. viii+224, xxii+214, illus. ISBN 0-8018-4790-7. £78.50 (set).

In a time when academic presses are reluctant to commit themselves to large, lavishly illustrated works, a book such as this is something of a rarity. It includes a facsimile reproduction of the second edition of Louis Renard's *Poissons*, *ecrevisses et crabes* (1754, originally 1719). The choice of this work, now extremely rare, is not explained, but Pietsch's introduction reveals something of the author's nature. Unlike Renard's natural history specimens, which are

Ornate volumes of this sort are often described as 'coffee table books'. Whether applied to books of the eighteenth or twentieth century, this phrase immediately denies the work a serious purpose. Since the second half of the eighteenth century, expensive, lavish decoration has been viewed as threatening the scientific standing of a work. Despite Renard's claims that the specimens were painted 'after Nature', their existence attested to by 'authentic Certifications and Attestations', his illustrations were criticized by naturalists such as Pallas as 'histrionic and monstrous representations'. Pietsch begins volume 1 by recalling this condemnation, but then seeks to rehabilitate Renard's enterprise for taxonomy by establishing that all of the depicted species can be traced to known species, a systematic list of which fills the second half of volume 1. Thus, he claims, 'the work must be considered a part of the scientific literature of the eighteenth century, a publication which was meant to be reckoned with by the professionals of that time' (i, p. xvii).

Yet Renard's work presents particular problems for the historian of science. The adverse judgement of his natural historical peers, after all, persisted for nearly two hundred years. Against it one must set the support of his Dutch patrons, including naturalists of the standing of Aernout Vosmaer, who wrote the preface to the second edition, and Sir Hans Sloane, who helped to sell a quarter of the original print run to the Fellows of the Royal Society. Both sides agreed that Renard's work contained 'extraordinary and rare animals', in Vosmaer's words; but the ability to engender wonder at the spectacle of nature, so desirable at the very start of the eighteenth century, was of questionable scientific value for later naturalists. The King Crab, Crake Radja, appeared with an intricate adornment upon its carapace (ii, p. 86). Other specimens were similarly depicted as highly ornamented productions of the sort used by naturalists as the basis for reflections upon the skill of the Creator. It is now widely accepted that the selection of features which shall count as scientific in illustrations is culturally determined. Pietsch can perceive Renard's illustrations as enabling the taxonomic act because of the detail of the drawings. Naturalists of the 1770s and later could not, because they were labouring to distance their science from the tasteful aesthetic which had opened the way for natural historical commentary by members of polite society.

It was thus in the fashioning of a natural historical 'profession' that Renard's effort was lost to histories of taxonomy. In the process, Renard's trustworthiness as naturalist came into question. On whose authority were claims about nature to be believed? Renard was an expert in negotiating trust; Pietsch's biography reveals that while he was writing to the curator of Peter the Great's natural history collection promising the finest specimens of books for the Czar's Westernization package, he was simultaneously denouncing Russian xenophobia and territorial ambitions to British ministers for an annual pension of several hundred pounds. Juggling patrons and protégés continued into the manufacture of natural historical trustworthiness: high-ranking Dutch colonial officials were not only Renard's patrons and readers, but also his sources for specimens. His was a work produced within a particular frame of interpretation of 'Nature', and it did not transplant well.

Pietsch's definitions of the terms 'science' and 'profession' thus colour his own image of Renard's work, which includes a most valuable account of the production of the book and illustrations. Pietsch locates Renard's scientific enterprise at the origin of an Enlightenment defined as the age of sceptical materialism, empiricist philosophy and rational secularism. In such a world, many of Renard's natural historical and book-selling practices look a little odd, even deceitful. This reflects the fact that for eighteenth-century natural history, there is no secondary literature equivalent to that lately produced for natural philosophy, in which scientific, religious and political concerns are shown to be closely interwoven within the fabric of the daily lives of scientific practitioners. Until such a history exists we can merely speculate about how Renard's life as Hanoverian spy, Huguenot news peddler, or protégé of Dutch

colonial governors might have shaped his natural history. Pietsch's meticulous researches, however, will make a valuable contribution to such an account.

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DAVID PHILIP MILLER and PETER HANNS REILL (eds.), Visions of Empire: Voyages, Botany, and Representations of Nature. Cambridge: Cambridge University Press, 1996. Pp. xix + 370. ISBN 0-521-48303-4. £40.00, \$59.95.

In the late eighteenth century, Joseph Banks had copper plates cut in preparation for printing lavish illustrations of thousands of plants collected from the South Seas. The first full set of colour prints was finally produced in the 1980s. The contributions for this volume were initially offered at a 1991 conference of the book's title at UCLA to celebrate the acquisition of its set of prints which constitute the Florilegium. Visions of Empire is a collection of sixteen articles, including the introduction by David Miller, the afterword by Simon Schaffer, and two shorter end-of-section commentaries, one by John Gascoigne and the other by Peter Hanns Reill. While the publication of the volume itself seems to have been slightly delayed, the contributions have been updated since the conference and were able to include historiography up to 1994. While Banks is not in the title, he figures prominently in the volume, which for the most part indicates the periodization of the book, save two interesting essays on anthropology and exploration by Ingjerd Hoëm (mid-nineteenth century) and Alessandro Duranti (twentieth century). However, this is not a book about Banks, but about a range of issues important to studies of eighteenth-century travel, economy, natural history and art.

A central question asked is what was the relationship between voyages of exploration, natural history and the political economy of imperialism by the late eighteenth century? A number of contributors discuss commercial and imperial 'designs' behind state-funded voyages of exploration. David Mackay presents a thorough list of 'Banksian collectors' and considers how commercial interest in places such as

China or Latin America was exploited through schemes for collecting and transplanting plants of medicinal and even aesthetic value to Kew Gardens. Alan Frost further points out ways that exhaustive trade in all sorts of raw materials necessary for imperial expansion relied on connections between the maintenance of navigational networks, instructions guiding gardeners' missions, and the careful cultivation of areas like New South Wales.

Internal maintenance on voyages of exploration was also important. Christopher Lawrence looks at how shipboard life was 'disciplined' in order to control outbreaks of scurvy, and to keep sailors clean and fed. Lawrence examines how a patriarchal model of medical management developed in the Navy's fleets to promote the improvement of health and morality. Searching for new forms of medical knowledge was an important element to imperial visions, but forms of medical treatment were fundamental to keeping the men upon whom such visions were entrusted alive. In a detailed account of Linnaeus' political economy and natural history, Lisbet Koerner offers an analysis of ways that concerns over a changing Swedish economy and national scientific programme shaped Linnaeus' and his students' visions of nature. Another portrait of an imperial natural philosopher is given by Michael Dettelbach in his interesting account of Alexander von Humboldt, whose global visions and philosophy of the unity of nature were represented in his measurements of physical forces and innovative maps of isothermal lines.

In different ways these articles scrutinize practical aspects of life as an imperial naturalist to offer us an accurate characterization of these voyages: we have a catalogue of people, cargo and crops which crowded decks; we are offered accounts of the high levels of scientific and medical training and skill these travellers possessed; the reader is left with a clear sense of the express commercial interests which were at the heart of these endeavours. All this information, as well as multiple drawings of specimens and maps, is offered to illustrate how a close alliance between natural historical and maritime 'visions' managed to cultivate places such as Botany Bay into important imperial resources. What strikes me is the lack of hard financial

figures to chart the activities of the (other) allimportant bank. What was the cost of the voyages and what were the projected or real returns on the investments?

Janet Browne and Alan Bewell shift focus from themes of empire and economy and look at eroticism in botany as stimulated by Linnean sexual taxonomy. Browne offers a novel look at Erasmus Darwin and his contemporaries' treatment of garden spaces and asks to what extent the boundaries between wild and domestic varieties of life were blurred in an attempt to naturalize 'human nature' and humans' surrounding environment. Bewell looks at the work of Linnaeus, Banks and a number of their contemporary writers, and develops the argument that botany became an explicit and public discourse on sexuality in the eighteenth century.

Martin Kemp and Barbara Stafford each write on natural historical illustration: Kemp on graphic tricks and representational techniques in the production of botanical books, and Stafford on the problems of visualizing the 'ambiguous' life-forms presented in microscopy. Both articles offer well-balanced and important connections between art history and the history of science.

David Miller, in his own article which situates Banks at the centre of immense natural historical activity, calls for a detailed study of the ways practices in the natural historical sciences developed. These well-researched essays, in addition to another recent collection of essays in *Cultures of Natural History* (ed. N. Jardine, J. Secord and E. Spary, Cambridge, 1996, reviewed in *BJHS*, **30**, 241), are significant contributions to meet this desideratum in the historiography. *Visions of Empire* is a richly illustrated, wellbalanced and useful volume for those interested in imperial exploration and natural historical practices.

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ANN B. SHTEIR, Cultivating Women, Cultivating Science: Flora's Daughters and Botany in England 1760 to 1860. Baltimore: Johns Hopkins University Press, 1996. Pp. xi + 301, illus. ISBN 0-8018-5141-6. £25.00.

Shteir has written a charming book about late eighteenth-century and early nineteenth-century women botanists. She begins with the introduction of botanical study as part of polite culture in the eighteenth century with the adoption of Linnaeus' sexual system of classification. One of her points of departure is an investigation of the gradual gendering of botany so that the professional botanist becomes increasingly gendered as male and the 'botanophile' as female. At the same time, from 1820 on, botanists replaced Linnaeus' system with the 'natural system' proposed by French and Swiss male botanists. She sees botany changing gradually, according with conventional views of women's nature and roles, with the cultivated woman as gardener in the fields and woods around her husband's or her father's lands, and occasionally in the greenhouse. Women, she suggests, could collect plants, identify and illustrate them, but not participate in public institutions.

The charm of this book is in its details, in descriptions of women like Elizabeth Blackwell (the eighteenth-century herbalist not the later physician) who produced a herbal that could be used for medical purposes, and who extended into print the tradition of the collection of simples by careful housewives. When Shteir discusses women illustrators, she does not limit the discussion to those who drew flowers, but includes women who illustrated plants for use on clothing and cushions. The aristocratic Mary Delaney, friend of Lady Mary Wortley Montagu as well as of many other writers and 'wits', produced a series of very accurate botanical 'paper mosaiks'. Her friend, the eccentric but interesting Mary Bentinck, Duchess of Portland, sponsored various collectors and collections for her home museum (described elsewhere as containing the largest natural history collections before the British Museum was opened), and collected her own plant specimens. Mary Delaney portrays Bentinck's alarm as a distinguished visitor approaches while she and Delaney are eating dinner surrounded by their collection of mushrooms spread out in sieves, pans and platters covering the tables, couch and chairs with reference books 'opened in their useful places'.

Other women botanized as natural historians or collected on their travels to India, and other colonial areas, sending their collections to Linnaeus, who on occasion named unusual plants after them. Like his own daughter, Elisabeth Linnea, who made an important botanical observation before she married, other daughters of botanizing fathers helped compile important lists of local plants, as did Jane Colden in colonial New York, Ann Lee who made water colours of important exotics from other botanical gardens, and Anna Blackurne who collected many natural history specimens and sent unusual specimens provided by her brother in New York. Wives of course were of major importance although not always publicly recognized, like Sarah Abbot, wife of Charles Abbott, who first published a book on country flora. The women were linked by their interest in and willingness to learn Latin terminology on which scientific nomenclature was based.

Some women popularized the science of botany (in a more genteel manner than Erasmus Darwin's erotic Loves of the Plants) either by publishing botany books for women or books on the garden as part of genteel culture. Professional writers like Charlotte Smith included botanical landscapes in novels, or branched out into children's literature and botanical verse. Sometimes, like Sarah Hoare, they had an ideological purpose to 'shape mothers' by teaching botany that they felt would carry religious and moral lessons as part of the education of their children. Shteir uses these examples not to emphasize the repressive nature of such tales or the relegation of women to the role of teacher or mother but as examples of the way women writers 'made maternal and domestic ideology work for them as social intellectual and economic resources'.

Delightful examples of these educational books are those instructional books written as conversations between a mother or a governess and children (both boys and girls). Priscilla Wakefield was one of the best known writers,

whose Quaker and home-centred ideology was reflected in her non-technical books. An interesting factor not fully explored here is the rejection of any explicit discussion of plant sexuality in most of these examples, and the subject is hinted at as the basis for plant classification as something that could be discussed 'if your mamma approves'. Sarah Fitton, who wrote her books with her sister Elizabeth Fitton, had a link to 'professional' or 'gentlemanly science' through her brother; Harriet Beaufort through her father. Jane Haldimand Marcet, one of the latest and best known of these writers was part of a scientific circle in Geneva and wrote her conversations on 'vegetable physiology' as one part of her series of instructional books on science.

Among these botanizing ladies, I found Shteir's depiction of the life of Margaret Scott Gatty, a scientific collector of seaweeds and writer of the scholarly *British Seaweeds* (1862), the most delightful. Her daughter composed an amusing poem about her obsession, describing the children vainly calling her home from the seashore as the tide comes in, while she 'grasping Laminaria's root' chants in reply: 'Were ever pools so deep or day so fair / There's nothing like the sea.' The poem ends: 'For still at night the Gattys call their mother home / And save her from the sea.'

In an epilogue to her book, Shteir passes beyond the time-frame of her study to discuss the botanical research of Beatrix Potter, whose children's books we all know but who is shown here to have been deeply interested in fungi, coming to botany 'through polite culture' of Victorian bourgeois life. She also notes briefly Marie Stopes, who wrote a number of elementary botanical texts, serving as a 'cultural mediator' of science.

A question about Shteir's interpretation arises only when she deals with women who attempted to bridge the gap between public and private botanical study at the very end of the time period she discusses. Although she often speaks of the gendering of botany and the attempts of women to work within the cultural codes of their time during most of the period she discusses, she falls into the very trap that she has so beautifully detailed. For example, she speaks with regret of the loss of the voice of female authority in botany around 1830 although she shows us that authority (the voice of the mother or governess) to have been an extremely limited one. She is perhaps most unkind to those women who at the beginning of the 1860s did aspire to be botanical scientists. Lydia Becker, feminist and botanist, who attempted to break outside the strictures of prevalent social codes by delivering papers herself at meetings of the British Association for the Advancement of Science and who corresponded with Charles Darwin about her original observations, is described by Shteir as adopting 'masculine science'. The many women (some quiet, some insistent on their contributions) who worked as collectors, or illustrators, are not so described, although their specimens went into collections at the British Museum, or illustrated the works of professional male botanists. Like the Victorian males whom she decries, Shteir apparently prefers to see her women botanizing in quiet voices, perhaps brush or pencil in hand, around the breakfast table, or collecting with delight, but isolated, in the field.

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GILLIAN BEER, Open Fields, Science in Cultural Encounter. Oxford: Oxford University Press, 1996. Pp. x + 342. ISBN 0-19-818369-0. £25.00.

Revealing her wide reading, Gillian Beer cites an essay by the analyst W. R. Bion, on the personality that eschews connections. She comments 'Darwin's bent seems to have been at the opposite end of the spectrum, seeking kinship in the unlike, making links' (p. 29). This is more than an observation, and the reader is being invited to join in a joke. For Professor Beer's essay itself is an exercise in making links. In this instance between four bodies, three referred to by Darwin in a letter sent while on the *Beagle* voyage: a naked Fuegian, Titian's Venus and the corpse of an animal he was about to dissect. The fourth body was Darwin's own.

The essay is paradigmatic of the collection. All the papers collected here are devoted to linking science and the arts and other things too. All have previously been published. The essays in

the first half of the book orbit around Darwin, anthropology, savagery and the like, and connect with Thomas Hardy, George Eliot, Charles Dickens and many others. In the second half the essays revolve around the physical sciences, connecting wave theory, solar death and much more with, for instance, the poems of Gerard Manley Hopkins and accounts of gambling in Victorian fiction. En route, Beer takes in contemporary anthropological theory, the philosophy of science and any other 'field' that offers insights and connections. There is much to reward the reader prepared for unexpected links here - links of two sorts. First there are the huge numbers of hints at, and explicit references to, scientific theory and practice that Beer has found in literature. There are examples on nearly every page, such as the account of Hardy's The Return of the Native and his reference to 'Franklin underfoot' and, for the knowing reader, Hardy's invocation of the alleged cannibalism of Sir John Franklin's last Arctic expedition (p. 46). Secondly, there are the links that Beer herself makes, such as those between the four bodies on the Beagle noted above. The sorts of link she makes vary, although not all readers may wish to travel with her when she goes down the psychohistorical road. For example, 'Thus [Darwin in his letter]', she observes, 'half-consciously protects the innocence of his own touching eye, which in memory glances between male and female, between wild body and uncultured body, both of them become teasing objects of desire and consternation' (p. 28).

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NOOR GIOVANNI MAZHAR, Catholic Attitudes to Evolution in Nineteenth-Century Italian Literature. Memorie di Scienze Morali, Lettere ed Arti, 60. Venice: Istituto Veneto di Scienze, Lettere ed Arti, 1995. Pp. 284. ISBN 88-86166-24-9. 35,000 lire.

The Istituto Veneto di Scienze, Lettere ed Arti, a 'gloriosus' institution in the history of Italian culture, has the great merit of having sponsored

an extremely useful publication on the spread of evolutionary ideas in nineteenth-century Venice. The author concentrates on Catholic reactions to evolution - Catholicism being deeply rooted in that area - and deals with some poets and writers active throughout the nineteenth century and the beginning of the twentieth. As he explains, his study is in the history of ideas rather than literary criticism. The Istituto represents the common ground on which all the important names that appear in this study operated - whether they were scientists, theologians or writers, they were all its members - a fact that introduces a welcome element of institutional history into the picture. Moreover, from the very title, which mentions evolution rather than Darwinism, we are informed of what Noor's study is about in the first instance: it was evolution rather than Darwin's special contribution (natural selection) that intrigued and motivated the characters in this story. Noor's argument, which is supported by convincing evidence, clearly separates evolutionism - widely accepted at one point - from Darwin's own view of its mechanisms (mainly rejected): strong support for Peter Bowler's well-known concept of the 'non-Darwinian revolution'. What ultimately mattered to the characters in Noor's story was a cosmic world view, not a specific scientific theory.

Noor proceeds as follows: his first chapter, devoted to the 'scientific background', starts from an international perspective and points to Linnean classification as the origin of all discussions leading to nineteenth-century novelties in the theory of natural science. Then he moves to Italy with De Filippi's famous lecture on humans and apes, which directly confronted the most controversial aspect of evolution, the ape-human relationship. Noor is aware of the now large literature that has appeared in the last few years on Italian evolutionism, and is especially inspired by Pancaldi's work on the subject. Various important names (some of them never had much to do with Darwin or his theory, such as Lombroso) now appear in the narrative of the period from Canestrini to Rosa, and Del Pino is somewhat prominent, being the scientific father of the shift that took place in Italian culture towards a vitalistic and finalistic interpretation of evolution very different from Darwin's.

Philosophers also have a place at this stage, with Pietro Siciliani, who preferred to refer to Vico rather than Darwin, and Bertrando Spaventa, a Neapolitan Hegelian, who insisted on agreement between positivistic materialism and his own version of Hegel. A probable weakness in Noor's study is that Mivart, the leading Catholic evolutionist (and one seriously considered by Darwin), is not given the prominent role he may deserve – he appears rather briefly in the theological section and is absent from the scientific one – and Gruber's pioneering work on Mivart is not mentioned.

In a section devoted to theology, Noor shows how strongly some sectors of open-minded Catholic opinion moved steadily towards acceptance of evolution, dividing it from Darwin's view, which did not encounter equal success. This was a long process, which went through the stormy waters of Modernism and was completed only with the Second Vatican Council, a process intimately connected with Jesuit attitudes. The result was an attempt to reconcile science and religion, and, if we follow Gregory's point with respect to Protestant theology, a re-examination of the concept of truth had to be considered. (This aspect is not considered by Noor but would be worth discussing.) Noor shows that what Thomas Junker suspected, namely that Protestants had problems with evolution because of their literal interpretation of the Bible, while Catholics found it easier to accept evolution but rejected natural selection, is certainly true in Italian Catholic circles.

Noor then moves on to three Italian poets, active in the mid- and later-nineteenth century, Aleardo Aleardi, Giovanni Prati and Giacomo Zanella – actually minor and frankly very poor, but representative of the spirit of the times. They wrote of a world of fossils and Genesis, of geological and biblical themes mingled together – Zanella even produced a ludicrous poem 'On a fossil shell', certainly not comparable to the poetic genius of Leopardi or Manzoni, but inspired by a determination to show that the teachings of the Bible and modern science were not irreconcilably opposed but could merge to form a new cosmic vision based on providence and progress. They were, like Manzoni beforehand, liberal Catholics. This new cosmic vision was, however, based on pre-Darwinian themes, and this group disliked Darwin's interpretation of evolution. Vico, Kant and the great chain of being were their main references. The views of such liberal Catholics were well represented by the writer and poet Nicoolòp Tommaseo, the subject of another chapter, who insisted on the uniqueness of man and the great chain of being, and chastised the arrogant attitude of some positivists towards theology. Tommaseo's sources were also pre-Darwinian, including the principle of 'plenitude' in nature, and writers like Bonnet and Robinet.

By far the most interesting representative of Catholic evolutionists in Noor's book is Antonio Fogazzaro, a leading if second-rate novelist in Italian literature. Fogazzaro's views were based on a modernist interpretation of Genesis, and in his lifetime he was ostracized by Roman Catholic authority, and came to feel closer to Augustine. Fogazzaro clearly distinguished between evolutionism, which he liked as a finalist and comprehensive view, and Darwinism, which he disliked since it was neither of those things. Fogazzaro, who admired the often obscure German Catholic Wigand represented a vaguely pantheistic view of nature and religion in which he emphasized the relationship connecting art, religion and science - a kind of upside-down version of the arch anti-Catholic Ernst Haeckel. Like Haeckel's disciple Wilhelm Boesche, he believed in the capital role to be accorded to female beauty, but contrary to Haeckel and Boesche he exalted spiritual over physical love. He tried to give an evolutionary interpretation of Goethe's famous 'das Ewigweibliche zieht uns hinan'. In Noor's opinion Fogazzaro foreshadowed many of Bergson's and especially Teilard de Chardin's views. The threat does not come from science but from its materialistic interpretation, which represents an attack on Church and religion.

It is quite clear that this book represents an essential contribution not only to our knowledge of the spread of evolutionary thought in a cultured part of nineteenth-century Europe but also to the understanding of the historical changes in the relationship between science and religion. As such it is highly recommended to all those interested in the subjects.

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HERMANN VON HELMHOLTZ, Science and Culture: Popular and Philosophical Essays, edited with an introduction by David Cahan. Chicago: University of Chicago Press, 1995. Pp. xviii+418. ISBN 0-226-32658-6, £41.50, \$52.00 (hardback); 0-226-32659-4, £14.25, \$17.95 (paperback).

Throughout Europe and the United States, the middle part of the nineteenth century witnessed the emergence of a new kind of scientific figure. This was the public spokesman for science. Typical examples might be Louis Pasteur in France, John Tyndall or Thomas Huxley in Britain, Joseph Henry in the United States and Hermann von Helmholtz or Emil du Bois Raymond in Germany. Public expositions of science were of course nothing new. Natural philosophy had always had a public face. One need only look to Michael Faraday's spectacular demonstrations at the Royal Institution or to the host of eighteenth- and early nineteenth-century public lecturers. These men were different in that they represented, or claimed to represent, a unified, professional and increasingly confident scientific community that wished to define a public place for itself in nineteenth-century culture. Their concern was not only to explain their science to the public, but to explain as well what the public role of science ought to be.

Like William Thomson's in Britain, Helmholtz's career spanned the nineteenth century. His researches also spanned the disciplines. Having been trained in medicine, he served in the Prussian army as a medical officer until 1848 before his patron, the anatomist Johannes Müller, secured his early release and eventually the post of Associate Professor of Physiology at the University of Königsberg in 1849. He had already published in 1848 the classic *Uber die Erhaltung der Kraft*. He was Professor of Physiology at Bonn and at Heidelberg before becoming Professor of Physics at the University of Berlin in 1871. His reputation was not confined to Germany. He was courted by the University of Cambridge for the professorship of physics at the new Cavendish Laboratory. For much of his career, too, he was recognized as one of Germany's foremost public spokesmen for science, speaking on topics ranging from his own specialized though broad-ranging interests to the role of science in the German state.

David Cahan has collected a selection of fifteen of Helmholtz's public performances together in this volume, illustrating their range and significance. Most of the essays are reproduced essentially unchanged from his Popular Lectures on Scientific Subjects. The two exceptions are translated by Cahan from the original German. Proceeding from 'On Goethe's scientific researches', Helmholtz's first popular lecture in 1853, the topics range from 'On the interaction of the natural forces' (1854) to 'On academic freedom in the German universities' (1877). Included also is Helmholtz's 'Autobiographical sketch' of 1891. The selection provides a good flavour of Helmholtz's concerns and interests as well as his efforts to place natural philosophy firmly at the centre of German culture. Usefully, since these essays were originally presented as lectures, Cahan informs us as well where each lecture was originally delivered.

This nicely presented volume will certainly be of interest to historians of science, as a source of teaching material as much as a useful reference tool. It should also interest historians of nineteenth-century German culture in general. It provides a fascinating illustration of a natural philosopher's efforts to carve out a cultural niche for himself, his colleagues and his researches.

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José BRUNNER, Freud and the Politics of Psychoanalysis. Oxford: Blackwell, 1995. Pp. xiv + 238. ISBN 0-631-16404-9. £40.00, \$49.95.

The four parts of this book each deal with one distinct aspect of 'the politics of psychoanalysis'. Part I studies the relationship between Freud's early work and its ideological context. Central to the latter was the 'degeneracy paradigm' with its three central assumptions; first, that nervous

disorders are due to an overburdening of the nervous system; second, that such disorders can be transmitted by heredity; and third, that Jews are particularly prone to develop such mental diseases. By 1894 Freud had rejected all three elements of the degeneracy paradigm; in particular he had reduced heredity to being at best a partial cause of nervous disorders. Increasingly Freud came to emphasize social-historical factors in the aetiology of hysteria: a position of powerlessness, exaggerated moral and social demands, and the early-childhood trauma of being sexually abused by an adult. Brunner rejects the thesis that Freud's abandoning of the degeneracy paradigm was motivated by Jewish self-assertion in the face of anti-Semitism. Such a link is doubtful, Brunner argues, not only because Jewish physicians, too, accepted the concept of degeneracy, but also because Freud maintained a complete silence on ethnic and national matters in his clinical and theoretical works. Freud gave up the degeneracy hypothesis, Brunner suggests, because its use did not bring therapeutic success. Brunner invokes the same explanation for Freud's dropping of the seduction theory at a slightly later date - thus contradicting Masson's famous charge of opportunism.

Part II reconstructs Freud's metapsychology in order to show that both its language and its logic are political. It is of course a well-known fact that social-political metaphors lie at the very heart of Freud's theory of the psyche and its inner workings (that is, metaphors like 'censorship', 'provinces', 'representation', 'occupation', 'repression', 'resistance'). Brunner goes further than earlier accounts, however, by arguing that even Freud's physical metaphors (of 'energy flows') make sense only when seen through the lens of the political. One indication of this is that Freud describes the process through which libido attaches itself to ideas as a military process, an 'occupation' (Besetzung). As Brunner sees it, Freud's depiction of the mind as a conflict-ridden society amounts to a 'decentring' of the subject. In this context, the book also argues that Freud's concept of freedom does not fall easily on either side of Berlin's famous distinction between positive and negative concepts of freedom. Put in a nutshell, 'Freud was

In Part III Brunner turns to the power relation between the psychoanalysts and their patients. He first points out that Freud's therapeutic practice differed from that of most other psychiatrists of his time: Freud did not use physical violence against hysterics; he refused to stigmatize them morally; he was ready to listen to what they had to say; and he encouraged them to express their feelings and desires even when these contradicted prevailing moral and social standards. A similar picture emerges from a comparison of the ways in which mainstream psychiatry and psychoanalysis treated traumatized soldiers during the First World War. Whereas mainstream psychiatry stigmatized and tortured - the idea being that the soldier must fear the therapy more than the front-line psychoanalysts relied on hypnosis, talking and dream-analysis. Freud could occasionally act as a bully towards his patients. Nevertheless - at least according to Freud's programmatic writings - the power of the psychoanalyst over the patient is merely a 'transformative power': that is, a power that seeks to undermine itself.

Whereas Parts I to III work out the emancipatory side of Freud's psychoanalysis, Part IV draws attention to Freud's political authoritarianism and élitism. Even a superficial reading of Totem and Taboo (1912), Group Psychology and Analysis of the Ego (1921) and The Future of an Illusion (1927) shows that Freud had a low opinion of democracy, and that he believed in the need for father-like, autocratic leaders for controlling 'the crowd'. Like Gustave Le Bon, Freud too believed that only common submission under a loved-and-feared father figure could create social cohesion. On Brunner's analysis, Freud ended up supporting authoritarianism because he ultimately construed society as an individual writ large. Just as individual mental health depended on the enlightened monarch's (that is, the ego's) ability to control the anarchy of wishes in the id, so also the survival of the polity presupposed the domination of rational leaders over the crowd.

As Brunner's conclusion indicates, the political reading of psychoanalysis provides a middle way

between those who read Freud exclusively as a natural scientist, concerned with causes, and those who construe Freud primarily as a hermeneutist, concerned with meanings. After all, 'it is in the nature of political discourse to combine references to causal forces over which actors have no control, with references to the selfconceptions and intentions of actors' (p. 182).

This is a clearly written and generally wellargued contribution to Freud scholarship. Although the book does not go very deeply into any of its chosen four political themes, it does throw a fresh light on each of them. On the critical side, perhaps three comments are called for. First, the four themes could have been tied together more strongly. As it stands the links between them remain somewhat vague. Second, more attention could have been given to Freud's development. For instance, it would have been interesting to see how Freud's sociomorphic metapsychology evolved over time. And third, it is strange that a book so intensely concerned with politics, is altogether oblivious to the fact that the success of theories depends in great part on the political abilities of their authors and advocates. Unfortunately, the book never asks whether any of Freud's theoretical and practical moves had anything to do with the expectations and interests of his various audiences.

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EUGENE TAYLOR, William James on Consciousness beyond the Margin. Princeton: Princeton University Press, 1996. Pp. xiii+215. ISBN 0-691-01136-2. £27.95, \$35.

Yet another contribution to the vast body of literature on America's foremost psychologist and philosopher. Do we really need it?, and have the James papers and published works not been plundered and explored to a pedantic extent which is beyond belief? This is the initial criticism which any book on this topic must face. Eugene Taylor convinces the reader from the outset that this work is different and is a valuable contribution to James scholarship. His novel thesis is to contest the claim that James withdrew

from psychology after the publication of his *magnum opus* in 1890: *The Principles of Psychology*. He recasts James's retreat into the philosophy of radical empiricism as a meta-physics which was addressed primarily to psychologists, bringing historical continuity to James's early work on consciousness and later developments in psychoanalysis, personality theory and humanistic psychology, by showing James's involvement in depth-psychology and psychotherapeutics at the turn of the century. Under this appealing interpretation James is no longer to be seen as a disparate figure with two distinct careers, and the preoccupations of his early and later lives can be connected and made coherent.

In the preface Taylor is very explicit about how his method is informed by the University of Chicago tradition of textual analysis in comparative religions, his own interest in Buddhist epistemology and James's radical empiricism. The result is both exegetical, in that 'it is freely applied to contemporary circumstances wherever possible', and soteriological, presuming 'that historical scholarship has applications to the process of personality transformation where questions about the nature of ultimate reality are concerned' (p. xi). Taylor sees his own work in a uniquely Jamesian tradition of psychology as a person-centred science, quite separate from the Wundtian laboratory tradition and Freudian psychoanalysis. He claims that after 1890 James's 'attention was directed toward studying "the rise and fall of the threshold of consciousness" and other phenomena related to abnormal and personality psychology, rather than toward the kind of sterile academic laboratory psychology that was becoming increasingly dominant in the United States at the time' (pp. xi-xii). James abandoned the positivistic stance he took in The Principles in order to widen the scope of psychology beyond the newly emerging German experimentalist tradition he thought to be too narrow. He must be seen as working within 'an international consortium of psychologists, psychiatrists, physicians, psychotherapists and philosophers loosely organised into the French-Swiss-English-and-American psychotherapeutic alliance' (p. xii).

Chapter 1 provides an outline of Taylor's problem to explain how James, despite falling

out with the social Darwinists and the medical profession, remained committed in the last twenty years of his life to a psychology which denied the 'reductionistic positivism' of these approaches because they 'could never lead to an understanding of the whole person' (p. 4). Taylor claims that James scholars have mostly branded him as a philosopher after 1890 and missed the subtlety of his rejection of a psychology based exclusively on normative scientific data, because they have relied on his published works and most accessible letters, have not questioned the extremely selective approach of his first biographer Ralph Barton Perry, and have often interpreted him outside his own eclectic frame of reference as the anticipator of some modern trend, such as behaviourism or phenomenology.

In chapter 2 Taylor mobilizes evidence from James's early reviews of Huxley and Wallace on evolution and consciousness, his 1867-68 medical school notebook and a description of his early laboratory and experiments to show that Edwin G. Boring's placing of James as failed experimenter in the German tradition is misplaced, and contingent on ideological battlings against personality-social psychologists at interwar Harvard. Instead, a case is made for seeing James as an exponent of the French clinical and experimental tradition, developing a link between 'experimental physiology, psychical research, and experimental psychopathology' (p. 24). Chapter 3 explores what Taylor calls 'the conundrum of The Principles'. He argues that James mediates between two poles over the twelve-year gestation period of his seminal work, and concludes that 'while James's intention had been to launch a positivistic science through a cognitive psychology of consciousness, his text also introduces at least the physiological reality of multiple states of consciousness and suggests several important means of getting them' (p. 39). Taylor proceeds to give a comprehensive survey of James's intellectual development from 1890 to 1896; drawing upon evidence from lesser known published articles and correspondence he shows James's deep involvement with abnormal psychology and psychical research. With masterful knowledge of the archives and fine scholarship he takes the reader on a journey through James's

dabblings with the phenomena of trance mediumship, a statistical inquiry into hallucinations, the work of Freud and Breuer, a defence of mental healers and classical Eastern philosophy. This detailed analysis is then further expanded beyond James's 1896 lectures on exceptional mental states to the publication of the *Varieties of Religious Experience*: a period Taylor describes as James's 'mystical awakening'.

Later Taylor deals with James's opponents, those figures like G. Stanley Hall and E. B. Titchener 'who had much to gain politically by debunking Jamesian psychology as unscientific³ (p. 97). Taylor argues that in fact Jamesian psychology was more representative of the unique character of the natural sciences in the United States, based more upon situational observation and the solution of practical problems than the laboratory-based European counterparts. Next Taylor traces James's rejoinder to his many critics from the birth of his radical empiricism, through his works on The Will to Believe and Pragmatism, to his engagement with the theories of Bergson and Fechner. Finally we are treated to a reconstruction of what Taylor sees to be James's final statement to psychologists: to move away from the stagnant determinism of the laboratory setting. There is also a useful annotated bibliography. Taylor finishes as he began: showing how modern commentators have overlooked the sophistication of James's early work, which anticipated the modern trends of epistemological pluralism and a focus on primacy of immediate experience in psychology after the 1950s. He was 'far from abandoning psychology and ignoring its vast potential as a leading influence in any science of the future. James was, in fact, "the first to burst into that silent sea"' (p. 153).

My, only minor, criticisms are that sometimes the text appears completely focused on Harvard and the reader is left wanting a more sustained filling-out of the European context with which Taylor shows James to be strongly connected. Also, there are times when Taylor appears to be too close to his subject and is uncharitable to other scholars in claiming more authority for his story than the historical evidence allows him. Yet it is difficult to see how this can be avoided in such a fine scholar who is so obviously intimately involved with all aspects of James's work, and sees him as the prophet who should dictate the future of psychology. For those looking for an insightful, interesting and provocative portrait of William James and a partial corrective to the history of American psychology I can heartily recommend this work.

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STEVEN NOLL, Feeble-Minded in our Midst: Institutions for the Mentally Retarded in the South, 1900–1940. Chapel Hill: University of North Carolina Press, 1995. Pp. xiii+254. ISBN 0-8078-2220-5, \$39.95 (hardback); 0-8078-4531-0, \$16.95 (paperback).

Steven Noll presents an impressive array of archive material in this analysis of a topic that, even with recent interest in the history of 'deviances', has received little documentation. This book brings together manuscripts from a wide geographical area including: state asylum reports and correspondence, hospital records, medical and psychological archives, government documents, newspaper articles, court case proceedings and a wide range of articles and secondary source material. Given this extensive research it is unfortunate that *Feeble-Minded in Our Midst* is limited by an uncertain methodological approach, and a restrictive historical approach.

The analysis develops around the confusing and conflicting theories that initiated concern for the feeble-minded, and helped to found and promote the institutional system of the early twentieth century in the southern states of the USA. Central to this are problems caused by a care programme that sought to deliver protection for the feeble-minded from society, while protecting society from the perceived menace that the feeble-minded posed. The overriding theme of the thesis is the failure of the institutional system in the South to overcome these obstacles. Each chapter develops an analysis of the difficulties caused by the lack of accurate definitions of feeble-mindedness, and details a range of factors that related to the institutional picture. This includes: work on the lack of facilities for

the black feeble-minded population; the struggle facing the institutions to care for wide-ranging needs; the divided and confused image presented by the emerging profession of care workers; work on gender issues and sterilization, class issues and the establishment of mental testing.

The thesis is well constructed and informative, but there are certain points that need further discussion. In the introduction it is promised that the thesis will examine the question of why, early in the twentieth century, the southern states suddenly discovered the problem of the feebleminded and tried to alleviate it by introducing an institutional solution. Owing to limited space here I shall cover a selection of points relating to the methods employed to answer this question.

Noll elicits the help of labelling theory as a way of explaining the increasing numbers of feeble-minded people to be identified in the first forty years of this century. He accepts this model to be useful, and thus that an individual's behaviour can be determined by the judgement of others. However, feeble-mindedness, he goes on, presents a problem for this explanation, as: 'for many retarded people...deviance is primary...and mental defects are innate and not caused by societal reaction' (p. 3). Using the work of 1960s sociologist Bernard Farber, a division between social deviance and incom*petence* is established as a framework for understanding the conflicting rationales for care. The higher grades of the feeble-minded population were judged deviant through societal reaction, by virtue of their social abnormalities (criminal, sexual etc.), while the lower grades (idiots) as merely social incompetents (unable to fend for themselves) owing to primary or innate deviance.

This raises problems concerning the status of deviancy, and the nature of the historical object of feeble-mindedness. We are left with a puzzle. Noll mentions that the lower grades were more of a medical than a social problem. This is not surprising as the idiot was deviant by virtue of, amongst others, a medical discourse, but this is not included in the analysis. Given this, surely idiocy is also explainable via labelling theory, as the terms used to delimit the idiot emerged with a medical concern for deviance? Why is it not the case that idiocy was also determined by the judgement of others, in particular, through a medical discourse? This differentiation is again problematic as higher grades in the feebleminded classification were also the subject of medical and psychological discourses, where theories held innate deviance also central to those categorized as social deviants.

Related to these problems is the question of how to approach feeble-mindedness as a historical object. Does it emerge with the discourses that invented new ways for describing and thinking about social problems (as the labelling theory suggests) or is it the story of the mismanagement of discovery and research of innate signs? This book seems to favour the latter, and takes a critical, rather than descriptive view of history. While documenting the vast problems facing the institutions and the effects upon them from a wider social world, the conclusions focus on the inability of the individuals and professional bodies concerned to overcome obstacles such as those of classification.

The thesis also employs a selective, rather than a reconstructive approach to the marshalling of data. Reworking social control theory Noll emphasizes social context, but reinstates the notion of individual agency in relation to the state. The result is a focus on the class, race and gender assumptions of individuals as underlying factors for the implementation of institutionalization. Although these issues are important, the analysis still places blame with individuals, and fails to construct a wider picture that includes an analysis of the systems of thought and power that were operating during this period.

Following on from this point, the thesis lacks context. Although asylums may have appeared at the beginning of the early twentieth century any comprehensive attempt to ask why this should be the case needs to include an analysis of factors that precede this period and help to make these provisions for care possible. In particular, there is little time given to nineteenth-century developments concerning the relation of the human sciences to the provision of institutional care, or the emergence of new techniques for compiling and comparing races and types.

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HARMKE KAMMINGA and ANDREW CUNNINGHAM (eds.), The Science and Culture of Nutrition, 1840–1940. Clio Medica, 32/Wellcome Institute Series in the History of Medicine. Amsterdam: Rodopi, 1995. Pp. vii+344. ISBN 90-5183-818-2. \$33.00, Dfl. 50.00.

Kamminga and Cunningham's collection of twelve essays offers a useful entry into a potentially vast and tangled subject by linking the rise of nutrition science in the nineteenth century with the rise of laboratory-based science and the union of physiology with chemistry. The chronology of the work is chosen to encompass the lifespan of a particular programme of scientific interpretation of food, a period in which scientific enquiry into nutrition became an academic discipline, and in which the practices, concerns and terminology of twentieth-century nutrition science were invented.

Although the book reflects the absence of similar enquiries covering an earlier period, the value of this collection of well-argued, rich and thought-provoking studies in a singularly neglected topic is not diminished. The principal emphasis of many of the essays lies in the period 1880-1930. The standard of the essays is generally very high, and the volume possesses a cohesive quality often lacking in similar enterprises. Particular individuals, such as the Cambridge biochemist Frederick Gowland Hopkins, and particular projects of nutrition science, such as the invention of vitamins, appear turn by turn in quite different settings, their meaning fashioned through a series of overlapping portrayals of the relations between scientific practitioners, government bodies and consumers. The book thus has a catholic appeal, with particular relevance for historians of biochemistry, medical professionalization and gender, and for all interested in the role of science and the changing uses of scientific knowledge in the late nineteenth and early twentieth centuries.

In spite of the claims of the title, 'nutrition science' itself was not singular: many different sciences of food were possible, reflecting the multiple cultural roles of a science of nutrition and the diverse commitments of practitioners. This is exemplified by Kamminga's case study of Jacob Moleschott's nutrition science, which has been ignored in favour of the work of the inventor of proteins, carbohydrates and lipids, Justus von Liebig. The distinctions between these individuals are shown to have operated at every level from nationality, religious commitment and scientific training to relations with publicity and claims about the nature and operation of foodstuffs within the body.

The body was the subject of a range of different sciences, including physiology, chemistry, biochemistry and physics. Many models of bodily function were invoked by contemporaries to explain the operations of food. Milles and Teich portray the body as engine, as the object of politicians' scrutiny, subordinated into the social order constructed by middle-class reformers and reflecting a spectrum of concerns about the decadence of the West. Horrocks's and Barnett's contributions display the eater's body as empowered, the locus of health through the informed selection of dietary habits. The multiple identities which food debates could confer upon the body are revealed in Smith and Nicolson's discussion of portrayals of the poor as ignorant slaves to their desires, or as trapped by the circumstances of poverty into inadequate (from a scientific perspective) diet. Given that such different models of bodily function evidently underlay the different accounts of food in the period, some comparison of competing accounts of the operation of appetites and other manifestations of the body's relation with its foodstuffs would have been of value. What alternative accounts of the body might have supplanted, pre-empted or shaped scientific accounts? Schlich's essay on the role of scientific claims in reforming the Jewish dietary laws in late nineteenth-century Germany is one example of such an enquiry, opening the way for other studies along the same lines.

The contributions of Apple and Salmon point up the gendered nature of histories of nutrition science. Apple considers the entry of nutrition science into US universities as an example of the problem of fashioning gender boundaries within institutions, a theme picked up in Salmon's essay, where, however, the setting is a Spanish hospital. Nutrition science prior to the Second World War was a scientific anomaly, an arena which allowed women with university qualifications to carry out scientific research. In consequence the history of the discipline during

this period has been neglected, with attention paid primarily to male practitioners such as Hopkins, now portrayed as the 'father of biochemistry'. Barnett and Weatherall explore a no less neglected aspect of the history of science, namely the shifting power relations between scientific practitioners and the consuming public. Where there was no overarching voice of authority on health matters, the public was not obliged to prefer one set of nutritional claims over another. Weatherall reveals how 1910s nutritional reform programmes were driven by the media and by the claims to expertise of consumers, not physicians or government administrators, and Barnett's title, 'Every man his own physician', tells a similar story. Scientists today who, concerned with the 'public understanding of science', fulminate over eaters who waver between the health principles proposed by government experts and those of 'alternative' food reformers, might be depressed to learn that the brown bread and fresh fruit 'fads' of the 1910s are the government recommendations of the 1990s.

Vast projects of urban hygiene and nutritional education demarcated the scientific permeation of Western society at the end of the nineteenth century. Daily life was arguably more affected by the patterns of manufacturing, advertising, buying and selling characteristic of the new commercial society. The advertising of foods must have transformed the meaning of individual food items and their appreciation of consumers. Food choices, as Weatherall points out, are a relatively new possibility; prior to the twentieth century most were confined to the consumption of necessities and especially bread. Industrial society offered new possibilities of feeding Western populations even while it created the conditions for mass poverty and malnutrition: artificial fertilizers (invented by Liebig), mechanized agriculture, factory food production. Industrial nutrition scientists, in claiming to have unlocked the secrets of food, could promise improved diet for all. But the possibility of changing diet was viewed by many contemporaries as putting public health at risk and as encouraging moral degeneracy among the poor, as Smith and Nicolson indicate. Horrocks reveals how industrial food scientists were attacked as 'sophisticating' foods by academic nutritionists while

they portrayed their own activities as 'improving' upon nature. Perhaps for the first time, even middle-class consumers began to perceive government interventions in the food supply as putting public health at risk. Nutrition science was thus a distinctly industrial science. In a remarkable study of the fate of scientific claims attached to a commercial factory-produced food item, Liebig's meat extract, Finlay shows how the business of pinning down the scientific meaning of a food had now become the task of the manufacturer rather than the scientific practitioner, a tale borne out by Horrocks. Somehow, then, the identity and authority of nutrition scientists and the aims of commercial entrepreneurs were continually being interwoven in the period. We know that this was also a period when laboratory scientists were fiercely defending their claims to independence from political and commercial concerns, and the volume would have benefited from the inclusion of a study of the peculiar position of nutrition scientists in that regard.

'Western society has become', the editors claim, 'a nutrition culture'. What becomes abundantly clear in this volume is that, during the period covered, many cultures of nutrition emerged in the West, exemplifying concerns about the decadence of Western societies, about shifting gender relations, about the transformation in eating habits resulting from the development of commercial structures and media forms which we now take to be characteristic of our society. This book demonstrates the historical groundedness of many debates about food which are still of burning significance today, and which, a century on, are often expressed in terms first invoked before the First World War.

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LEO CORRY, Modern Algebra and the Rise of Mathematical Structures. Basel: Birkhäuser, 1996. Pp. 460. ISBN 3-7643-5311-2. DM 178.00.

It is a widely shared opinion that the general development of modern mathematics is a continuous and straight evolution towards increasing levels of abstraction. The idea is that interest has gradually shifted from concrete mathematical objects, say, for example, the natural numbers, to the study of abstract 'structures', say the system of the natural numbers. Thus, the modern mathematician does not investigate merely the properties of the natural numbers, but the very general features of the system of rules by which they can be defined. The influence of the modern, 'structural' approach has been strong, and it has interested even some nonmathematical disciplines. Nevertheless, the historian of science should always be very careful when coming across such 'teleological' reconstructions, typically characterized by the scarcity of historical material and the vagueness of the conceptual tools.

In this work, Corry tries to make clear the origins of the pervading concept of 'mathematical structure', and the historical reasons for its growing importance. To this end, he employs a basic methodological distinction between two domains of discourse: the 'body of knowledge' and the 'image of knowledge'. The first 'includes statements that are answers to questions related to the subject matter of the given discipline', and the second 'includes claims which express knowledge about the discipline qua discipline' (p. 3). The 'images' determine the answers to meta-questions such as what are the more interesting problems, the more relevant arguments, the borders of the discipline, the legitimate methodologies, the appropriate university curriculum, and so forth. Then, given a certain image, it will determine a particular selection of interesting problems and methods in the body of knowledge. But, as Corry properly emphasizes, this schematic separation is not a rigid one. In fact, it is subject to continuous shifts, and a main task for the historian should be to define the limits of the two regions at a given period, and then to study their interactions and their transformations. In the case of mathematics, the interactions between images and bodies are particularly interesting, because of the 'reflexive character of mathematics', that is to say, the 'possibility of formulating metastatements [...] from within the body of mathematical knowledge' (p. 4).

Taking this as a starting point, Corry finds it useful to consider the *structural approach* itself as a particular image of knowledge, that 'evolved

from a particular historical process' (p. 8). In the first part of the book, Corry follows the development of algebra (a discipline that has been particularly transformed by the structural approach) between 1860 and 1930, and the interactions between its growing body of knowledge and the images that guided the research of the principal mathematicians. Through the analysis of the algebraic works of Dedekind, Hilbert, Emmy Noether and others, including some lesser-known textbooks of algebra, Corry reconstructs the complex shift from the classical image of algebra to the structural one. The classical image assumes systems of numbers to be the basic mathematical entities, whose properties underlie the algebraic research (so that the *fields* are the proper subject of the theory of algebraic numbers, whereas other non-numerical entities such as groups and rings are considered only as useful tools). According to the structural image, algebra is the discipline studying abstract constructions, number systems being defined as particular cases of them (the hierarchical order is then completely reversed). Corry places van der Waerden's textbook Modern Algebra, published in 1930, at the end of the development of this shift. Obviously this should be considered mainly as a symbolic indication, given that the adoption of the structural image of algebra cannot 'be associated to a single idea, nor to a single publication, nor even to the work of an individual mathematician' (p. 221).

The second part of the book is devoted to the 'reflexive' attempts to study the non-formal concept of 'mathematical structure' in the body of knowledge. Corry presents three main attempts to develop a formal theory of structures, namely those of Oysten Ore, of Bourbaki, and category theory. They are attempts to transform what was an image into a body of mathematical knowledge. Of particular interest is the chapter on Bourbaki's formalization of structures. Corry makes evident the 'ideological' necessity for Bourbaki to work at this formalization, but, at the same time, the superfluity of the structural apparatus (structures, motherstructures, their hierarchical order) with respect to the body of knowledge presented in Bourbaki's Eléments. Such apparatus does not play any important operational role in the Eléments, and its use is mainly an *ad hoc* one. Significantly,

the structure-related concepts played (and continue to play) a much more important role in the popular articles and in the philosophical debates. Here it is 'as if they [the structures] in fact provide a solid, reflexive foundation of Bourbaki's images of mathematics' (p. 342). A more positive judgement is given by the author about the category theory's results, even if 'the mathematical reality is much more varied than even a good generalizing theory like category theory can exhaust' (p. 372).

Corry, then, through the use of a few clear metamathematical tools, offers the reader a convincing and well-documented historical reconstruction of the rise of the structural image of algebra, and of the idea that mathematics as a whole should be the science of 'structures' (a very ambiguous term indeed). Moreover, this reconstruction makes evident that at any point of the evolution of algebra, the body of knowledge could have been organized in very different ways, depending on the different images of knowledge held by the mathematicians involved in the research (and in the publication of textbooks). That is to say, any mathematicians wishing to reorganize a certain body of knowledge always have to face a basic *choice* between different images that they could assume as leading principles in their work. And on this choice will depend the legitimate aims and methods of the discipline. In fact, considering the example of algebra, Corry notes that the body of knowledge 'did not in itself determine the change of images of knowledge that implied the adoption of a structural approach' (p. 402).

Corry's book, by reason of its historical approach, could be associated with the so-called 'new historiography of mathematics'. But, unlike some of these works, it is a very good example of the fine balance between historical data and philosophical interpretation.

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ANTONI MALET, Ferran Sunyer i Balaguer. Barcelona: Societat Catalana de Matematiques and Societat Catalana d'Historia de la Ciència i de la Tecnica, 1995. Pp. 306. ISBN 84-7283-286-4.

In presenting the life and the works of the

Catalan mathematician Ferran Sunver i Balaguer (1912-67), the author faces the scarcely studied problem of the relations between the Spanish scientific community and Franco's regime. Sunyer was certainly an atypical figure in the Spanish academic panorama. An autodidact, suffering a serious physical handicap, a fierce supporter of Catalan culture and language, he was never integrated into Spanish academia. This was in spite of his being an internationally recognized mathematician (his speciality being theory of functions), and a referee for the most important international journals. In fact, in postwar Spain the few mathematicians who were internationally recognized were marginalized by the national scientific community. In the case of Sunver, marginalization manifested itself as resistance to an autodidact, with no academic degree. In the cases of Ernest Corominas (1913-92) and Ricardo San Juan (1908-69), the only real colleagues of Sunyer, the process of marginalization was more subtle, but equally effective.

On the basis of a rich documentation, the author dissects Sunyer's relations with Corominas, San Juan, the other Spanish mathematicians and his colleagues from abroad. In doing this, he also describes the general working of the Spanish research institutions. A whole chapter is devoted to the ideology and the structure of the Consejo Superior de Investigacion Científicas (CSIC), which was the principal institution for scientific research during Franco's regime. This allows the author to challenge a standard opinion, according to which, during the regime, scientific research was damaged by the lack of economic resources. The author maintains, on the contrary, that the scarce productivity of Spanish academics cannot be explained as a mere consequence of financial limitations: it depended on certain deeper, cultural reasons. This lessening of the role of economic factors, 'gives a new importance to the cultural, political and moral factors which conditioned the working of the scientific community' (p. 101). In a similar way, we are shown that the isolation of the Spanish mathematical community did not derive merely from physical restrictions. It was 'much more a spiritual than a material phenomenon' (p. 243). The isolation consisted, in fact, in the lack of conformity of the Spanish community to the values, standards and methodologies of the international community. This permits the author to declare, paradoxically, that 'Sunyer, even if travelling little abroad, was by full right a member of the international mathematical community. Others, who travelled more, were not' (p. 130).

We are shown the peculiar aims and values of this 'ill-functioning' mathematical community. The opposition to the values of the international community is evident, for example, in the negation of productivity as a value in itself, and in the view of teaching as superior to original research. These mathematicians controlled the universities and the research institutes, and they were able to maintain their practices unchanged even in the 1960s, when the regime itself promoted substantial reforms to modernize scientific research (that is to say, to make it more productive). Interestingly enough, these reforms, introducing new duties for professors and new teaching programmes, were utilized by the institutions to marginalize the 'international' mathematicians even further. San Juan, for example, was attacked and isolated for not devoting enough time to teaching and for being critical towards the advance of the 'new mathematics', the 'modern', structural conception of mathematics which became dominant during the 1960s. This was, in fact, an interesting case of the instrumental usage of 'modern' arguments to maintain the status quo in the academic system. 'The normal mechanisms of power' concludes the author, 'even those of an authoritarian state, can be insufficient to change the internal dynamics of an academic community' (p. 267).

The book is well documented, and covers an under-researched area in the history of scientific institutions. It certainly provides new and interesting materials for the study of the working of scientific communities, and of their interactions with political power. In particular, for those who have read with interest the works by H. Mehrtens on the German mathematical community under the Third Reich, it is natural, and fruitful, to make a comparison between the two cases.

It is important to note that the book is written in Catalan. This is entirely appropriate, since Sunyer employed it in his mathematical writings, and so helped to restore the dignity of Catalan during the regime, though it may prove inconvenient for anglophone readers. But those who can read one of the major romance languages, Italian in particular, will probably be surprised by the accessibility of the Catalan idiom.

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MITCHELL G. ASH and ALFONS SÖLLNER (eds.), Forced Migration and Scientific Change: Emigré German-Speaking Scientists and Scholars after 1933. Cambridge: Cambridge University Press, 1996. Pp. xviii+301. ISBN 0-521-49741-8. £35.00, \$59.95.

Although the secondary literature on the emigration of German-speaking intellectuals after 1933 is very large, it has not so far been of much general interest to historians of science. For one thing it has focused largely upon emigrés from the worlds of the arts and politics; ten years ago, for example, the number of books on literary emigrés alone was estimated at around one hundred. But even where the literature has dealt with academics, it has been mainly biographical in perspective, recording the accomplishments (and suffering) of individual emigrés. While historians' desire to pay tribute to these figures is hardly surprising, one consequence of this orientation is that until recently the literature has tended to be rather anecdotal and unanalytical in character.

The collection of essays reviewed here, however, is part of a new approach to the emigration which promises to be of far more general interest. In an excellent introductory essay, Mitchell Ash and Alfons Söllner survey the existing literature on the emigration and outline their own research programme. Much of the literature so far, they argue, has tended to assess the intellectual consequences of the emigration in terms of Germany's loss and the host country's gain, treating the emigration as a transfer of intellectual nuggets (largely unchanged) from donor to host. What Ash and Söllner call for instead is a study of the dynamics of cognitive change. In part this entails looking at how disciplines were not merely impoverished in the donor countries or enriched in the hosts but

qualitatively transformed. Moreover they want us to analyse in detail the ways in which the *emigrés*' experiences – of emigration itself but also of a foreign host culture – prompted intellectual transformations, often of an innovative kind. The focus in this volume, therefore, is on disciplines rather than on individuals, on the research process rather than its output, and on the relationships between culture and science.

The essays gathered here address the work of German and Austrian emigrés working in theoretical physics, psychology, psychoanalysis, education, economics, sociology, political science and theology. In almost all cases the host country was the United States, but one essay examines the impact of medical scientist-emigrés on Britain through a case study of Oxford. One of the general themes which emerges is that since emigrés were often concentrated in particular fields within a given discipline, their migration often led to a reconfiguration of the discipline in donor and/or host country. In his study of German economists, for example, Claus-Dieter Krohn shows that while the discipline was dominated by the long-standing historical school, more modern approaches could be found in a small number of institutions on the periphery. 'Post-classical' economists of a quasi-Keynesian persuasion were concentrated at Frankfurt, Kiel, Heidelberg and a few non-university institutions, while neo-classicals (for example F. A. Hayek) were to be found mainly at Vienna. Because these places also employed a high proportion of Jews and leftists, they were especially hard hit by the Nazi takeover, but the small number of such institutions meant that the overall effect of the emigration upon the disciplinary landscape in Germany was slight. (The impact in Austria was far greater, as Christian Fleck shows, since 70 per cent of the economists there were forced to emigrate.) Both of the German groups' settlement in the United States were eased by the fact that they had already enjoyed especially generous funding from the Rockefeller philanthropies before 1933. The post-classical group was welcomed by the New School for Social Research, which soon became the major brains trust for the New Deal. And as

Alfons Söllner shows in his essay on political science, in the United States, too, *emigrés* were concentrated in specialities such as international relations or comparative government, where they could exploit their knowledge of European matters, or in political philosophy where figures like Hannah Arendt, Leo Strauss and Eric Voegelin could achieve visibility and impact precisely because they were at odds with the mainstream positivist tradition.

Several of the essays examine the research process at close enough range to illuminate the dynamics of acculturation. In his discussion of three groups of psychologists, Mitchell Ash shows why it is misleading to think of the emigrés as simply 'assimilating' or 'adapting to' a new culture. Instead they drew upon the diverse resources available to them in order to construct new standpoints which remained distinct from the disciplinary mainstream. Some emigré Gestalt psychologists, for example, began to adopt more sophisticated instruments in an attempt to persuade their American colleagues of the nature of perception, but they also continued to criticize the American tendency to treat perceptual, cognitive and motivational variables as separable rather than part of an integrated process. Karen Greenberg's essay focuses more narrowly upon a particular individual, tracing the ways in which the theologian Paul Tillich's relationship to German and American intellectual traditions changed over time. In the early years following emigration, his work was largely historical and philosophical, oriented primarily toward German issues, and especially critical of the empiricism which he encountered in American scholarship. Somewhat later Tillich began to search for common ground between German and American traditions, and by the 1950s his earlier socialist critique of bourgeois society had been replaced by a concern with the individual and the particular. Though Greenberg's argument does not entirely convince, her fine-grained analysis of the research process over time is impressive and comes closest to realizing Ash and Söllner's programme.

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