

# Book Review Section

Compiled by John Jenkin\*

*Australia's Bicentenary (1988) has seen the publication of a number of commemorative volumes of considerable importance to the history of Australian science. This collection begins with reviews of several of these works.*

**R.W. Home (Ed.),** *Australian Science in the Making*. Cambridge: Cambridge University Press in association with the Australian Academy of Science, 1988. xxvii + 413pp., illus., \$75.

With the publication of the Australian Academy of Science's principal contribution to the Bicentenary, a new bench-mark has been established in the writing of Australian science history. This volume was planned with meticulous care. The Academy appointed a Bicentennial History of Science Committee under the chairmanship of J.M. Swan in 1981 to steer the project during its formative years. Two specialist conferences were held at which a wide variety of papers was presented, the intention being to stimulate research and writing in the field generally as well as to encourage submissions for inclusion in the final product. With scholarly awareness raised, the editorial task was allocated to Professor Home, who was able to exercise considerable freedom in selecting and editing.

The central theme of the book is the attempt to understand nature in an Australian environment. 'Australian science' is interpreted broadly to include the political and social context of scientific discourse as well as the specific task of knowledge accumulation. Most chapters relate to the theme in some way, but it provides less unity than the secondary theme — the growth of Australian science from colonial dependence to national independence. The final chapter on contemporary scientific institutions gives some indication that all has not been well with Australian science since the achievement of 'independence' in the 1960s, but the strongly Whiggish flavour remains. The incongruity will not be lost on those who regard 1988 as a year of unprecedented pessimism within the scientific community.

In fifteen chapters the editor has achieved a nice blend of general and specialist contributions, examples of academic as well as of industrial science, of medical as well as of physical science, notable failures as well as spectacular successes. Most contributors are professional historians or science policy experts, although there are several distinguished essays by practising or former scientists. Predictably the approaches differ appreciably, but

most tackle significant historical questions; presentation is of a uniformly high standard.

The book is divided into three parts, each dealing with a major historical phase: pre-1850 aboriginal and white scientific experience, the emergence of scientific consciousness in the second half of the nineteenth century, and the twentieth-century transformation with World War II as the hinge. These phases are illuminated by general essays which can be read consecutively to provide an overview of Australian science over two centuries. Sybil Jack's examination of science and society before 1840 is a masterly and tough-minded appraisal of the lack of a scientific tradition in early Australia. She suggests perceptively that science had little role to play in a society dominated by commerce, pastoralism and agriculture, and that the practical was elevated above the theoretical. What emerged from the early experience was a deep-seated anti-intellectualism, and the 'idea of the practical man as easily the equal of the man of science'. Not much has changed.

Ian Inkster and Jan Todd survey the quickening interest in science after the gold discoveries of the 1850s: the founding of museums and botanical gardens, establishment of the royal societies, and the appointment of a growing number of professors with an interest in experimental science. Agricultural colleges and departments of agriculture were formed with some interest in serious research, and the first meeting of AAAS was held in 1888. The optimistic decade of the 1880s saw Australian science begin to take on an identity of its own, with a growing interest in microbiology and improved methods of mineral extraction by chemical means. Nevertheless, it is easy to exaggerate the economic and cultural significance of these stirrings. The scientific community remained thin and there was little economic dependence on science-based technology.

The most disappointing feature of the book is the absence of a comparable overview chapter for the twentieth century. There are general chapters on the impact of World War II (Home) and on institutional features of science and science policy since World War II (Ron Johnston and Joan Buckley), but these are more narrowly focused. Home correctly identifies the transforming influence of the war because of the vast increase in scale of the scientific enterprise, the influence of scientific expertise on key areas of defence production, and the worldwide enhancement of science's reputation as a means of defence and of economic liberation. But the net might have been cast more widely. The war greatly exaggerated the two-tiered structure of Australian science, with CSIRO allocated responsibility for research and the universities for teaching. The war generated a strong scientific push in favour of untrammelled basic enquiry, and helped to cement the binary division into 'basic' and 'applied' work — an unhelpful distinction that has bedevilled discussion of science policy. Further, the war and immediate postwar concerns bequeathed an allocation of scientific resources that remained sub-

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stantially unaltered for a quarter of a century, so that by the 1970s the structure appeared increasingly inappropriate.

Johnston and Buckley's essay on postwar scientific institutions sits rather uncomfortably in this collection. A brief account is given of institutional growth, but important points are missed. A quantitative overview of the distribution of scientific resources would have been helpful. Most of the essay consists of an account of the protracted birth of ASTEC and, in the authors' view, the ability to steer scientific resources in certain directions. There is a good deal that is assumed in the discussion. The implication, for example, that there was no science policy before ASTEC is wide of the mark. The policy was scientist-led within institutional and political constraints. There were defects in these arrangements, to be sure, but policy of sorts existed. Nor is it clear that ASTEC is the most appropriate steering device when key discussions on funding are made elsewhere. The main antagonists in the science policy debate still talk past each other. Scientists insist quite properly on the need for freedom in the conduct of research yet dodge the problem of scarcity and the need for hard choices to be made; policy advisers overvalue the capacity of their craft and undervalue the need for reasonable scientific autonomy. The chapter would have benefited from a more balanced discussion of the issues in the context of Australia's postwar scientific strengths and weaknesses.

Most of the specialist chapters on the nineteenth century are concerned in one way or another with science in social context. L.R. Hiatt and Rhys Jones present a sensitively written appreciation of the way Aborigines developed a basic taxonomy to describe natural phenomena, and the dualistic ontology of the indigenous religion that turned men's minds to the transcendental. The authors' concluding sentence is worth quoting: 'Although Australians of the future may not remember the indigenous inhabitants for their contributions to science, we can be sure that they will always contemplate with wonder and admiration the unique vision of nature enshrined in their art.'

The French scientific explorers Nicholas Baudin and François Péron come in for some rough handling by Miranda Hughes for their pre-scientific observations of the Tasmanian Aborigines in the first few years of the nineteenth century. To be fair, Hughes is kinder to Baudin, who observed elementary principles of scientific observation; but Péron's account is replete with subjectivism and spurious deductions derived from physiological characteristics. This lucid essay about a little known expedition offers fascinating insights into the cast of mind of early French anthropologists.

Three subsequent essays illustrate the power of scientific networks and the dominant influence of a handful of individuals around the mid-nineteenth century. Robert Stafford explores the influence of Sir Robert Murchison, who theorized erroneously that gold deposits were linked with Silurian strata thrown up during the Permian period. Murchison's

Silurian System, as it was called, dominated geological thought for many years, although it appears not to have impeded the great discoveries that followed hard on publication of his ideas. In a similar vein A.M. Lucas writes on the relentless exercise of patronage by Baron von Mueller and the importance of his links with Sir William Hooker, director of the Royal Botanical Gardens, Kew. Under the title 'gorilla warfare', Barry Butcher offers an account of the fierce debate between George Britton Halford, foundation professor of medicine at the University of Melbourne, and Thomas Henry Huxley on the evolution of man. On the basis of comparative anatomy Halford argued against Huxley that there were discrete differences between man and apes — a dispute that spilled over into the popular press and created a colonial counterpart to the furore over publication of the *Origin of Species*.

These three chapters suggest that Australian endeavour merely danced to the tune of Imperial science, a substantial part of but not the whole truth. George Bindon and David Miller provide something of a corrective in their account of the industrial research conducted by the Colonial Sugar Refinery in the second half of the nineteenth century. This may be the first instance of what was to become a familiar Australian story: the application of science to enhance the production of a major primary commodity. CSR employed a number of sugar chemists, notably Gustav Kottmann from the Institut für Zuckerindustrie in Berlin. The intention was to improve sugar yield and generally to achieve greater technical control. Innovation was encouraged by CSR's dominant position in the market, the scale of operations and the patronage of E.W. Knox, a combination of the economic and personal that has a familiar ring.

The specialist chapters on the twentieth century cover medical science (two chapters), astronomy (two chapters) and plant introduction (one chapter). As the editor notes, it would have been extremely difficult to cover adequately Australian science in the twentieth century, but this is a somewhat uneven selection. Astronomy, particularly radio astronomy, and biomedical research are worthy inclusions, but plant introduction is an unusual choice from the vast array of botanical work — particularly the more recent research on plant physiology. Of course, bricks cannot be made without straw.

Of the medical chapters, H. Hamersley describes the establishment of the first radiation laboratories between the wars. Emphasis is given to the failure of the Sydney research programme in 1934 due to incorrect findings about the effects of radiation. F.C. Courtice outlines the emergence of medical research from the foundations laid by Charles Marlin in the late nineteenth century. The emphasis is on the contribution of great individual scientists — Martin, Henry Dale, Charles Kellaway, Macfarlane Burnet, John Eccles and Howard Florey. Great men were obviously crucial, but one wonders whether this is sufficient to explain the excellence of so

much Australian research. Incidentally, Courtice is in error (p. 285) in suggesting that Martin conducted research on myxomatosis while chief of the CSIR division of Animal Nutrition. This work was undertaken after his return to England in 1933.

Perhaps the outstanding contribution in the volume is Woodruff T. Sullivan's account of the early days of radio astronomy. It combines 'external' and 'internal' approaches to the history of science; an expert understanding of radio physics is linked with an astute appreciation of the social dynamics of discovery. The creativity of the Radiophysics Laboratory early in the postwar period is explained by the size of the group and the fact that they remained intact, the abundance of old radar equipment, the leadership of Joe Pawsey, the strength of intellectual linkages with other laboratories, and the recent recruitment of bright young Cambridge-trained physicists. Quite correctly, Sullivan does not give any weight to the group's access to the southern sky, although isolation did have some temporary advantages.

Sullivan's chapter concludes in 1952 at the time of the URSI (International Union of Radio Science) meeting in Sydney, and at a more general level the account is continued by S.C.B. Gascoigne, who discusses both optical and radio astronomy. The focus of attention is on the Parkes telescope, the 74-inch at Mt. Stromlo, the Sydney University interferometers, the Anglo-Australian and, most recently, the Australia telescope. A clear indication is given of the continuing high level of performance, but there is a missing dimension to the account — the intense rivalry between the groups, the controversy over a big single dish versus interferometry, the defections to the United States, the eventual decline of Parkes and search for new directions, and so on. Perhaps it is still too early to tell the full story.

Partly because of the absence of a broad survey chapter, there is a sense in which this volume does not do justice to Australian science in the twentieth century. While acknowledging the excellence of astronomy and biomedical research, the core of Australian science has centred on research relating to crop and animal production — on wheat breeding, the microbiology of plant disease, animal health, mineral deficiency, wool production and processing, tropical agronomy and animal breeding, biological control, and on fundamental physiological and genetic studies. This broad biological research endeavour absorbed the bulk of scientific manpower and, with medical research, contributed most to Australia's welfare. It is no criticism of the chapter by R.L. Burt and W.T. Williams on plant introduction that readers barely obtain a whiff of the magnitude of this endeavour. Ironically, plant introduction, established systematically by CSIR in the 1930s, was somewhat marginal to the main programmes. Most plants of economic value (and many that were not) were introduced before the systematic work began.

Nevertheless, Professor Home, the contributors and the Academy are to be congratulated on pro-

ducing such a fine volume. That there are conspicuous gaps in *Australian Science in the Making* indicates that many rich rewards remain in this emerging field of historical enquiry.

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**Roy MacLeod (Ed.),** *The Commonwealth of Science: ANZAAS and the Scientific Enterprise in Australasia, 1888–1988*, Melbourne: Oxford University Press, 1988. xiv + 417pp., 27 plates, \$35.

This volume is one of a number published recently which have raised to a new level the study of the history and social relations of science and technology in Australia, and placed in our hands a critical mass of material to assist teaching and to help prompt further research in the area. In this regard, the stimulus provided by the bicentennial has been very beneficial, and it has carried us, beyond a history of heroic individuals on the one hand and attempts to deploy the dry and ultimately abstract modelling of scientific development inspired by Basalla on the other hand, into a realm where deep understanding of the development of the Australian scientific enterprise in its historical richness and all its political, economic and social relations is a widely agreed desideratum.

ANZAAS (prior to 1930, the Australasian Association for the Advancement of Science) has been a very important institution in Australian science, its first century coinciding with Australia's second century of European settlement. In 1888, AAAS became the first truly national, or inter-colonial, scientific society — a meeting ground for scientists from the Australian colonies and New Zealand, which also provided a novel public face for science. The Association followed the British model in being peripatetic, having sectional and general sessions at its meetings, and in being relatively non-exclusive. But features of its organization and functioning which were unequivocal advantages in the late nineteenth century have not remained so. As specialization in the sciences spawned a variety of specialist societies and as new institutions were created in bringing science to the service of the state, ANZAAS was increasingly marginalised. The process was gradual, becoming obvious after the Second World War. This has been a global trend in this century, of course, and means, put simply, that it is not possible to view the scientific development of a nation in the twentieth century exclusively or even primarily through the lens provided by scientific societies. This creates a major tension in *The Commonwealth of Science*.

The book is organised in three parts. In the first, Roy MacLeod provides two chapters dealing with the prehistory of the Association, and especially

with Archibald Liversidge's role in its establishment and its first fifty years. This work is striking for its representation of the 'resilient imperial sensibilities' of the AAAS leadership and for its beautifully clear statement of the state of Australian science in the 1920s and 1930s, as the rise of CSIR and the Australian National Research Council, together with the turmoil of the Depression, appeared to demand a change of gear from the Association. This did not happen. MacLeod achieves an impressive depth of historical insight into the activities of the Association, its relations with the rest of the Australasian scientific effort and the political development of Australia, which is not matched elsewhere in the volume. It is left to James Davenport to provide an inevitably breathless survey of 'The Impulse of Science in Public Affairs' from 1945, which is addressed primarily to the issue of why Australia's undoubted scientific excellence has not been more effectively utilized. This issue is seen, in part appropriately, as a political and bureaucratic failure to enunciate and pursue a strategic policy. Revealingly and ironically, this chapter deals only tangentially with ANZAAS, having so much else to say about CSIRO, ANRC and its successor the Australian Academy of Science, the development of higher education in the post-war period, and the saga of ASTEC. Insofar as the work of ANZAAS is discussed here, it is in relation to attempts to use the Association in the 1970s to involve the scientific community in addressing broader social and economic issues. This reached its apotheosis at the Perth Congress in 1973, when the Association was boosted, briefly, into the political firmament.

In the second part, six chapters focus upon the development of natural and social science. For me the highlights here were D.J. Mulvaney on Australasian anthropology and ANZAAS, Linden Gillbank's refreshingly nationalistic (Australasian nationalism, I think) account of developments in the life sciences, and Ian Rae's discussion of chemists at ANZAAS, not least because it gives a more concerted picture of the involvement of a particular science with the Association than the other essays. All the contributions to this part provide useful surveys, but their most striking feature is their unanimity about the increasingly marginal status of ANZAAS as a scientific forum in the post-war period, and the current necessity of establishing a new role for the Association. This gives a strained quality to many of the essays; the authors appear torn between wide-ranging accounts of the scientific developments which concern them and the necessity of 'bringing ANZAAS into it somehow'.

The third and final part is devoted to essays on wider themes but all attempting to implicate ANZAAS in 'serving society'. Once again there are some excellent pieces, notably John Powles on sanitary science and hygiene, and Ted Wheelwright and Greg Crough on technology and the Australian economy since World War One. For me, the most significant piece in the collection, from a historio-

graphical point of view, is by J.M. Powell on society and the environment. Apart from his substantive analysis of environmental issues and attitudes in Australia, Powell provides a refreshing perspective from historical geography. For example, in discussing the making of rural Australia, Powell warns against giving too high a profile to applications of science, when legislation, management procedures, tenure arrangements, bank facilities and so on were crucial formative influences. The quite natural preoccupation of historians of science with seeing the world from the vantage point of science and its institutions can be as dangerous for historical understanding as has been the tendency of Australian scientists to do the same with regard to effectively harnessing scientific prowess to the building of the nation. But their and our 'failure' may not be of great moment. As Wheelwright and Crough put it, ANZAAS has 'had no organic connection with an incessantly pecuniary culture that is now dominated by paper entrepreneurs, takeover merchants, tax avoiders, and others of that sort who can make far more money from such activities than by investing in technology...' What would Archibald Liversidge have done about that?

*The Commonwealth of Sciences* covers much more ground than its title might suggest. Some of the essays (notably Rod Home on the physical sciences, Ron Johnston on social responsibility of science, and Sol Encel on technology, employment and post-industrial society) could easily stand alone as erudite but accessible primers on their subject matter. And as the result of a collaboration between scientists, economists, sociologists and professional 'metascientists' the effort is impressive. We have an advantage in Australia. Precisely because of the relatively tardy and only partially professionalized maturation of studies of our scientific enterprise, we might avoid the narrowly specialized kind of analysis typical of much writing on 'national science'. We have an opportunity to meld a variety of skills and perspectives to ground our understanding of Australian science firmly in economic and political realities, past and present. Whilst the current volume does not consistently achieve this, it offers valuable pointers along the way, and as such is compulsory reading for anyone seriously interested in the history or current state of Australian science and technology.

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**Brian Carroll**, *The Engineers: 200 Years at Work for Australia*. Canberra: The Institution of Engineers Australia, 1988. x + 311pp., illus., \$49.95.

In these 300 pages of A4 text, Brian Carroll and his 40 contributors have endeavoured to encompass

200 years of activity in Australian engineering, an occupation of very small numbers in 1850, about 1,000 in 1900, and approaching 80,000 in 1988. It sounds an impossible task, but Carroll, an experienced writer in this area, has managed to construct a coherent work.

Carroll sensibly adopts a chronological structure for the book, and begins with an account of the technical decisions confronting Captain Arthur Phillip, who did not have professional engineering advice available to him. The first engineer, John Busby, arrived in Sydney in 1824. We are given some snippets of early technical developments: roads and bridges, water supplies, steam ships, coal and copper mining; but before 1850 there were very few engineers in Australia to write about.

After gold was discovered in 1851 everything changed. The building of the civic and industrial infrastructure required for the rapidly increasing population, as well as the gold mining itself, created a demand for engineers. At first this was met entirely by immigration, but ultimately Australia had to train her own. The beginnings of engineering education are here traced and the great contributions of Professors Kernot in Melbourne and Warren in Sydney described. It is noted, however, that it was a professor of mathematics, William Wilson, surely an engineer at heart, who began engineering courses at the University of Melbourne in 1861.

Anyone with a trace of engineering blood will be captivated by the accounts of the many and varied contributions of outstanding practitioners. There are Lawrence Hargrave's experiments with flight before the turn of the century, and Lawrence Wackett's incredible achievement in getting the first Boomerang fighter into the air in 1942, only 14 weeks after it was first conceived. There is Charles O'Connor's great water supply system on the Western Australian goldfields, and John Bradfield's grand conception of the Sydney Harbour Bridge. Engineering leadership is also celebrated: in John Butters and the Tasmanian hydro-electric development, William Hudson and the Snowy Mountains Scheme, Laurence Hartnett and General Motors-Holden, Essington Lewis and BHP, and with Hartnett and others, Lewis' founding of the aircraft industry in preparation for World War II.

The feats of the engineers who developed the railways, from the 1850s to the culmination of steam locomotion and the Spirit of Progress in the 1950s, are explored, as are the plans for the future Very Fast Train between Sydney and Melbourne. Charles Todd's epic task in constructing the Overland Telegraph, opened in 1872, is described; although McGowan, who began telegraphy in Victoria in 1854 — a year before Todd's arrival in Adelaide, is omitted. We learn of experiments with radio in 1899, and spanning the 134 years from McGowan's beginnings we are also told of Grahame Gosewinkel's AUSSAT satellite communications system.

Aspects of Australian engineering less well-known also are included: for example, the develop-

ment of refrigeration in Geelong in 1955, and George Julius' important role in the Institution of Engineers, Australia (President in 1925, not 1935 as noted in the book), as well as his invention of the Totalizator and his chairmanship of CSIR.

Australian engineering really spans the years from 1850 rather than 1788, and the book covers this period of 138 years of engineering development very well. The book is aptly named 'The Engineers'. As well as the many examples and excellent photographs of their work, an important feature is the biographical information (and photographs) of a number of significant engineers, including some still active in the 1980s.

Accuracy lapses only occasionally: for example, what is the 'Institution of Engineers (London)' mentioned on p.143? Furthermore, I am happy to report that Professor Charles Moorhouse, listed among the contributors as 'deceased', is alive and well.

In one sense the book tries to do too much, and it could be said that the eighty-one topics are treated too superficially. But depth of treatment was not the intention. The book was not conceived as a definitive historical text, nor as an engineering treatise. Rather, the objective was to provide a wide-ranging, popular overview of engineering achievement through Australia's history of European settlement. In this it has succeeded rather well. It is an excellent and attractive production.

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**Australian Academy of Technological Sciences and Engineering, *Technology in Australia, 1788-1988: A Condensed History of Australian Technological Innovation and Adaptation during the First 200 Years.* Melbourne, 1988. xxix + 1017pp., illus., \$150.**

This is a book that defies easy review — at 1017 pages it is a blockbuster. There are thirteen chapters on specific technologies by sixteen authors, a very good introductory chapter by Jan Kolm, a crisp foreword by R.T. Madigan (the publication's Chairman), and an appreciation of Sir Lindesay Clarke to whom the book is a memorial. Frank Eyre was editor, but he died suddenly in March, 1988 just before publication.

I think he would have been proud of the book. Like any work that is both ambitious and pioneering it has its shortcomings, but the most important thing to say is that the book exists, and we should be grateful to those who brought it into being. The work of doing so was voluntary, demanding and costly. The history of Australia cannot adequately be understood without an understanding of the critical role of technology, yet this significance is inadequately reflected in our general histories, perhaps because our historians have not

had such source material at their disposal before this publication.

Two of the specific omissions are conceded in the foreword — Aboriginal technology and environmental technology. A decision was taken that these topics 'were better assimilated, where appropriate, into other chapters' — with what success we shall ask later. Other apparent omissions are more apparent than real; for instance, there is no chapter on medical technology, but in fact a wide range of technological advances used in medicine are picked up in various chapters. The Flying Doctor Service, a distinctive adaptation to the conditions imposed by this continent, is discussed under 'Transport', with the conclusion that 'The Royal Flying Doctor Service is an excellent example of a typical Australian innovation which, at its inception, involved the use of two high technology elements — aircraft and radio, in solving a pressing social need' (p.56). At the other end of the scale, the 'Bionic Ear', the 'pacemaker' and other examples of technical wizardry find a place in the chapter on Manufacturing Industry. They are, in fact, very well placed here because they can be set in the context of other high technology products that begin with an innovation and are followed up by successful production and marketing. Nucleus Limited is one such high-technology company, and an admirably succinct account is given of its philosophy and achievements. The whole chapter on Manufacturing Industry is quite outstanding, well exemplifying the adage with which it begins: 'Eloquence amounts to mentioning the gist of the matter and then stopping'. The survey of recent developments in manufacturing technology in Australia is especially interesting, and the note of optimism — a characteristic of most technologists — seems in this case to be well justified.

The medical technologists may not be fully appeased by the examples I have given: there is nothing on immunology, for example, a field in which Australians have excelled, and one in which refined technologies have been necessary research tools. Genetic engineering is discussed only through its applications in agriculture (pp.64–66). My reason for giving these examples is not to criticize, which would be unreasonable, but to confess that I tracked them through the index. I suspect that the index owes much to Frank Eyre, and it is one of the joys of the work, multiplying many times over the accessibility of the mass of information stored in a thousand pages. This book — which should be in every school and public library — will be mined by countless students pursuing a specific theme, and each of them will bless the index.

Australia's dependence on technology is illustrated in countless ways, and the cumulative effect is overwhelming. Many examples were already familiar to me, but many more were not. Most educated Australians have heard of the froth flotation process (described here as Broken Hill's gift to the world's mineral industries, p.747), probably because they have met it through Geoffrey Blainey, one of the few historians who has brought such criti-

cal events into the mainstream of general history in Australia. In the chapter on the Mineral Industries, this process is briefly summarised, subjected to critical appraisal, and then put into contemporary context. It is described as 'a classic case of practice outrunning theory. The physical chemistry behind the process is complicated and the mechanism is still only partly understood, having engaged the attention of many eminent researchers through the world' (p.747). Comments such as this illuminate the nature of technological achievement, although this theme might have been pursued more systematically. Like the English, Australians have been talented in making scientific-technological innovations, but much less successful than the Americans and Japanese in picking them up and running with them. The reasons are complex, including often conservative management, the small size of the domestic market, Australian investment preference for 'safe' areas, and so on. The authors of this book, all Fellows of the Academy and eminent in their field, might have pooled their wisdom to attack this problem, which deserves national attention.

The more sophisticated chapters also give some interesting examples of technological failures. The chapter on the Chemical Industry — one of the best — has several: 'one such example of a significant failure was ICI Australia's work on hydrogen over-voltage in electrolytic cells' (p.685, to which the reader must turn for the details). Failure has many faces. Much of the suspicion of technology that is fairly widespread today — among people who enjoy all the comforts it brings — is based on fears of inappropriate technology, technology that went wrong or was misapplied or had hidden costs. Thalidomide and pesticide residues are global problems. In a book on technology in Australia, one might at least expect some discussion of Maralinga and Wittenoom. Humpty Doo in the Northern Territory and the Ord River Scheme in the Kimberley, two of our more spectacular failures, are discussed briefly, and Basinski and Wood's lucid analysis of the latter is notable. Nevertheless, one would hardly guess from the chapter on agriculture that soil degradation — compaction, reduction in organic content, weed infestation and the erosion of topsoil, with the attendant problems of stream degradation and salinity — are among the most pressing environmental problems in Australia today. Some of them are very nearly beyond our capacity to remedy, the outcome of a hundred years or more of inappropriate farm technology and practice. These topics are addressed briefly in the chapter on Water and Irrigation (p.183 and elsewhere), but there is no specific discussion of the concept of appropriate technology. The answer to the problems created by inappropriate technology is not (for the most part) to reject technology, but to work for better technology. This message is often implicit in the book, but it would be better if it were explicit.

In short, the book would be better for a unifying final chapter, bringing together some of the critical themes and problems, rather than ending abruptly,

as it does, with a chapter on Defence Science and Technology. Nevertheless, we should be grateful for the book we have. Its form follows almost inevitably from the way in which it was written, and it is hard to conceive how it might have been done differently in practice. Jan Kolm's introduction skilfully probes some of the key questions, and I shall let him have the last word with two quotations, one long, one short.

The simplistic linear model of direct flow from science to technology — 'today's science is tomorrow's technology' — no longer holds. This recognition is of a particular relevance to the smaller and middle ranking industrial nations, including Australia. Science progresses in small quanta. Although science quantum jumps differ immensely in merit, each quantum is communicable and comprehensible between individual scientists. The production cost of each quantum is — relatively — low, accessible even to scientists in small countries. Technology, by contrast, involves the combination of masses of quanta from past experience, literature and critical steps. Costs are immense and, as a rule, presuppose vast resources derived from international markets. Without access to such markets the scientific contribution from small nations tends to flow into the international pool from which the technology generating major economies draws. It is for this reason that the contributions to sciences from small countries rarely coalesce into technologies in the country of their origin. More often they contribute to world technology. The respective roles of science and technology are therefore very different in smaller economies. Imaginative and deliberate strategies are needed — differing from those of the technology-leading countries — to bring about effective interaction between technology and science. Unquestionably, in the overall economic development of small economies, the role of technology import predominates over that of their own sciences. The complexity of technological growth has only recently been probed and understood better, particularly in the derivative industrial countries. A clearer vision of the history of technology is a key factor in this understanding (p.xxvi).

Without technology the conquest of the resources of the vast land would have been inconceivable. Australia, the oldest continent, is indeed the product of modern technology. Australia's development was a massive achievement by relatively small groups, some trained and many untrained, isolated from the technological world by thousands of miles (p.xxviii).

If we still have much to learn about how to live in this worn land, surely there are also some substantial achievements to celebrate. *Technology in Australia* sets them before us as they have not been displayed before.

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**Colin Roderick, *Leichhardt, the Dauntless Explorer*. Sydney: Angus & Robertson, 1988. viii + 526pp., illus., \$39.95.**

for the reputation of one of Australia's greatest explorers: the Prussian-born Ludwig Leichhardt. He was at the centre of two interdisciplinary conferences on the German contribution to Australian exploration, science and the arts, which were held at the University of New South Wales in March and at Chossewitz in the German Democratic Republic in October. Papers given at these conferences and the publication of Colin Roderick's massive new monograph remove the last vestiges of the slur that has besmirched Leichhardt's reputation for over a century.

From a scholarly and scientific point of view this is long overdue, for Leichhardt has been poorly served by Australian historical traditions. In his lifetime he was a man of great popularity and considerable achievement: his expedition from Moreton Bay to Port Essington ranks as one of the longest in Australia's exploration history, and he was given numerous international awards for his services to botany, zoology, geology and medicine. Posthumously, however, he was maligned for reasons which had little to do with his personality and work. Initially these attacks were the result of an unfortunate mistake. The Director of the Melbourne Botanic Gardens, Ferdinand von Mueller, translated extracts of some of Leichhardt's letters, in one of which Leichhardt tried to explain the failure of his second expedition (his first attempt to cross the Australian continent from east to west). He suggested that part of the reason lay in the fact that some members of his party, 'used to the soft, comfortable life of the city', could not cope with the rugged bushlife. Leichhardt used the term *weichlich* (soft), which von Mueller translated as effeminate (perhaps misreading it for the German *weiblich*). Whatever the reason, one member of the party, John Mann, felt deeply insulted, and in his own book, *Eight Months with Dr. Leichhardt*, heaped many insults upon the explorer.

The German imperialist drive and the traumatic experiences of the First and Second World Wars left the Australian people with a sense of resentment towards anything German, and Leichhardt became a victim of it. For many years, works ridiculing and belittling the explorer appeared, and too often accuracy and scholarship were sacrificed. The intense physical and psychological stress of expedition life, the perpetual fight with the elements and the constant threat of death all led to tremendous strain and emotional exhaustion. Quarrels and confrontations were inevitable. In much exploration literature such factors are assumed and are barely mentioned. Not so with Leichhardt. An occasional diary entry by an expedition member that the night's food rations were not fairly distributed turns Leichhardt into a glutton who gobbles his food while other expedition members do without; a miscalculation of the precise latitude makes him 'a hit or miss explorer'; a letter reference that he had to escape from an irate bull is evidence of poor bushmanship; the fact that he had to rely on the support of sponsors and benefactors — which explorer did not? — is used to depict him as a

The bicentenary year was also an outstanding year



sponger. He is called a liar because he allegedly presented himself as a doctor, but Leichhardt never claimed to be a doctor; others called him so. Attacks on this German-born explorer who was proud to be Australian reached their low point with Alec Chisholm's *Strange New World*, which was published during the Second World War and which demanded that Leichhardt be struck off the list of explorers. Even as late as 1979, Russel Ward reiterated all the familiar accusations in a foreword to *Travels with Dr. Leichhardt* by Daniel Bunce, a member of the second expedition.

It is a merit of Professor Roderick's book that it puts the final nail in the coffin of the anti-German, anti-Leichhardt tradition. Marcel Aurousseau in his publication of Ludwig Leichhardt's letters, and Elsie May Webster's *Whirlwinds in the Plain*, had already exposed the shallowness of many of the allegations referred to above, but *Leichhardt, the Dauntless Explorer* removes the last doubts. It is a massive study which provides a great deal of hitherto unknown information about the explorer's life in Europe as well as new insights into his more familiar Australian years. Most of the new material comes from Leichhardt's diaries, which are held in the Mitchell Library and of which so far little use has been made. Roderick traces the explorer's life from his early youth and provides meticulous detail of the young man's studies at Berlin, Göttingen and Paris. Listed and described are all the courses the student enrolled in, the background of his lecturers and professors, and, as far as this is possible, the results he obtained. These early chapters, which also cover his extensive tours through parts of southern and western Europe, show Leichhardt's almost insatiable thirst for scientific knowledge, both in the *Geisteswissenschaften* (humanities) and in the *Naturwissenschaften* (natural sciences).

Leichhardt's diaries also provide much new detail about the explorer's last years in Australia. We now have a more comprehensive picture of his expeditions, and the *Dauntless Explorer* also sheds new light on his character and personality. Among other things, we learn that Leichhardt fell in love several times with young ladies; traditional accounts also claim, or imply, that he was a homosexual. His last love was Emmeline Macarthur, daughter of Hannibal Hawkins Macarthur, whom he hoped to marry after the completion of his east-west crossing. In a concluding chapter, Professor Roderick also speculates about the disappearance of this last expedition: he believes the most likely explanation to be the massacre of the party by Aborigines as part of guerilla warfare between squatters and tribes.

A substantial appendix lists the principal places named by Leichhardt, the tribal areas traversed, and the pastoral properties, townships and reserves that followed in the footsteps of Leichhardt's explorations. These show that, of all explorers, Leichhardt discovered the most extensive areas of potential grazing land.

Some of Professor Roderick's assertions will no doubt stimulate discussion. Anthropologists will

question whether Leichhardt was really as tactful and considerate in his dealings with the Aborigines as, for example, were Grey and Eyre. His account of John Gilbert's death is also likely to be challenged. Roderick claims that the expedition party camped on the site of sacred Aboriginal ceremonial grounds. This contradicts the recent claim by Brian Dalton that Gilbert was the victim of a punishment party, formed as a result of the collection of a water-lily held sacred by the Aborigines. Another interesting argument about this incident has been advanced by Professor Rose of Leipzig University, who lived for several years among the Aborigines. Rose claims that the attack occurred close to the landing spot where Dutch sailors at the beginning of the previous century attempted to abduct, and killed, several tribesmen. According to Rose, this encounter with the whites became part of Aboriginal folk-memory and the attack on Leichhardt and his team must be seen as an act of revenge. On a minor point: this definitive work on the great German explorer should have a full and not just a selected bibliography.

These comments notwithstanding, Professor Roderick is to be congratulated on a most stimulating and scholarly contribution.

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**David Evans, *Under Capricorn: A History of Southern Hemisphere Astronomy*. Bristol: Adam Hilger, 1988. x + 376pp., illus., £29.50.**

This is an intriguing title and prompts the immediate question: what is it that distinguishes southern hemisphere astronomy from astronomy as a whole? Is it the particular objects found only in the southern sky, the people who observe them, or the conditions under which their institutions function? The southern hemisphere, or more precisely the third of the sky invisible from the north, has always been a magnet for astronomers, initially because of the fascination of the unknown and the unexplored, more recently because it has been found to contain a disproportionate number of objects of major astronomical significance: the two obvious examples are the Magellanic Clouds and the galactic centre. On the other hand, southern astronomers have always been few in numbers — even in 1950, no more than a twentieth of the total astronomical population — and being effectively confined to South Africa, Australia and South America, are separated by wide stretches of ocean and can hardly be said to form an astronomical community.

Nevertheless, they share a common thread. The first systematic observations were made by expeditions, usually sent south by colonial powers with an eye to expansion. The first observatories



were established in colonised territory, primarily to provide accurate time against which mariners could check their chronometers. The functions of most of them then expanded to include geodetic surveying, meteorology and the supply of general scientific advice to local governments. Thereafter, their various paths diverged; some prospered, some did not. More recently, numerous other observatories have been established on something of an out-station basis, staffed from their home countries, with the bulk of the observations being made by streams of short- or long-term visitors. The whole forms a rich and well-documented source of material for historians interested in 'imperial science' and in models of colonial scientific development.

This is not, however, the course Professor Evans has taken. He puts his emphasis on personalities and the progress of institutions rather than on science, and what he gives us is an informative and entertaining account of the astronomers who have worked in all parts of the southern hemisphere, beginning from the times of the earliest European contacts. Evans is well equipped for the task. British by birth and training, he was for 22 years a senior staff member of the Royal Observatory at the Cape before taking up his present appointment at the University of Texas. He has written widely on the history of South African astronomy, and he brings to this account of it a completeness and an intimate first-hand flavour which between them make it the best section of the book.

South African astronomy provides an interesting case history, in that from the 1820s until after the Second World War it was dominated by the Cape Observatory in Cape Town. This observatory was set up as the southern arm of the Greenwich Observatory, and was essentially a government institution, operating under the aegis of the British Admiralty. It had a degree of independence, but its funding and senior staff came from Britain, and its observing programmes had to satisfy Admiralty requirements, more or less. Hampered by inadequate resources, it made an uncertain start, but with the appointment of the extremely gifted David Gill (later Sir David) in 1879 as H.M. Astronomer at the Cape, it rapidly assumed a prominent position among the world's observatories, and until the 1950s was undoubtedly the leading observatory in the south. In 1949, a 74-inch telescope came into operation at the Radcliffe Observatory, Pretoria, and following a major shift in astronomical priorities, Radcliffe took over the running. In 1971, the two observatories were amalgamated and passed into South African control as the South African Astronomical Observatory; South Africa, with its long astronomical history, at last had its own substantial astronomical establishment.

Australian astronomy followed a different course, passing through several well-defined phases. An early step was the establishment of the Parramatta Observatory by Governor Brisbane in 1822; it was the first 'regular' observatory in the south, preceding that at the Cape by a few years. It was relatively short-lived; but the mariners' needs for accurate

time could not be denied and led to the setting up of state observatories in Melbourne in 1853, Sydney in 1856, Adelaide in 1874 and Perth in 1896. Their functions soon expanded to the point where they were the principal governmental scientific agencies of their day. However, around the end of the century their fortunes took a sharp downturn, the reasons for which were partly economic, partly political and partly scientific; Perth is the only survivor. By the outbreak of the Second World War, and with the exception of work on the sun, astronomy had virtually disappeared from the Australian scene, which makes its renaissance after the war all the more striking. The story thereafter is well known, and on the radio side already constitutes something of a classic of scientific history.<sup>1</sup>

When he comes to write about Australian astronomy, however, Evans' touch is less assured. There is plenty of information but the emphasis can be misplaced, and there are too many errors and omissions. Thus on p.241, it was not the 74-inch mirror but that of the Great Melbourne Telescope which was damaged by its protective coating; the 74-inch mirror was sent back because it was astigmatic. And the results of the rebuilding of the 50-inch at Mt Stromlo did *not* leave a good deal to be desired (p.239); on the contrary, the telescope was in steady demand for the next twenty years, as I can well testify. On p.253, the firm of Grubb Parsons was *not* excluded from tendering for the Anglo-Australian Telescope: it was awarded the tenders for the optics, the cells and the tube, about a third of the total mounting contract (it chose not to tender for the main mounting). More emphasis could have been given to Woolley's decisions to direct Mount Stromlo from solar into stellar astronomy and to have it transferred from the Public Service to the National University; both steps were critical to the development of optical astronomy in Australia. Perth Observatory receives some appreciative remarks, but no mention is made of its most important contribution, the *Perth 70 Catalogue*, a landmark in its particular field. On p.255, Don Morton is not American but Canadian, a difference a Welshman should appreciate. And while pp.214–216 are devoted to the well-known Pretoria work on occultations at optical wavelengths, perhaps the most famous occultation of them all, that observed with the Parkes Telescope of the radio source 3C 273, does not receive a mention. Nor is any reference made to that essential source of Australian astronomical history, the *Australian Dictionary of Biography*, or to the present journal, *Historical Records of Australian Science*.

Evans does better with South America, where Argentina and Chile emerge as the most successful countries astronomically, for quite different reasons. Given the stimuli of a far-sighted President (Sarmiento) and a strong US connection, the first Argentinian observatories were established at Cordoba in the 1860s and La Plata in the 1880s, and, despite the political and economic vicissitudes of their country, both have flourished and have produced a succession of well-known astronomers. The

post-war decades brought a renewed appreciation of the great richness of the southern sky and of its relevance to current astronomy, and this led to plans in Europe and the USA to set up new observatories in the south. The three largest of them went to Chile, to the southern part of the Atacama Desert, some 500 km north of Santiago. Two are southern offshoots of the Kitt Peak and Mt Wilson Observatories in the USA, while the third is ESO, the European Southern Observatory. But while Chile is the immediate beneficiary of these plans, most of the observing is done by short-term visitors from the north, and Chile has been unable to establish an indigenous branch of astronomy, not to the extent that Argentina has. Incidentally, had its political climate been more acceptable, some at least of these powerful institutions might have gone to South Africa.

Besides his coverage of the three continents, Evans produces a surprising amount of information about astronomers on various islands, from Java to Kerguelen. The variety might have been confusing, but this and the other material is ordered well, and the general organisation of the book is one of its strong points. There are over 30 pages of pictures, many of them people, and a 22-page bibliography, fine except that it is unfortunately low in Australiana, and relies too heavily on the IBSH, the Information Bulletin of the Southern Hemisphere. This was a semi-official publication which ran from 1960 to 1975 and of which I suspect more sets have survived in Texas than in Australia. The printing raises questions, with only 25 lines to the page as opposed to 40 in the introduction, where the same font has been set differently. It reads oddly, and reinforces the impression that the density of solid information is not as high as some people — readers of this journal among them — might have preferred. But notwithstanding these reservations, I have no doubt that the book will have much success and be widely read, not only by astronomers and not only by those in the southern hemisphere.

## Reference

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S.C.B. Gascoigne,  
Pearce, A.C.T.

**D.J. Mabberley**, *Jupiter Botanicus: Robert Brown of the British Museum*. Braunschweig: J. Cramer (with British Museum — Natural History), 1985. 500pp., illus. + 24 colour plates, DM 150.

Robert Brown (1773–1858) was one of Britain's most distinguished nineteenth-century botanists.

Educated in Aberdeen and Edinburgh, he became an enthusiastic student of natural history and, while serving in Ireland as a surgeon's mate with the Fifeshire Fencibles, was brought to the notice of Sir Joseph Banks, who obtained his release from the Fencibles to join Matthew Flinders's *Investigator* expedition to Australia as naturalist. Brown's work in Australia resulted in the publication of his *Prodromus Florae Novae Hollandiae et Insulae Van-Diemen...* (1810), and an essay, 'General remarks, geographical and systematical on the Botany of Terra Australis' in Flinders's *Voyage to Terra Australis* (1814). These together with his support for Jussieu's 'natural system' of classification, as opposed to the Linnaean system, established his reputation as a botanist and a pioneer in plant geography.

In December 1805, soon after his return from Australia, Brown was appointed clerk and librarian to the Linnean Society, and in 1810 became librarian to Banks, a position that gave him oversight of Banks' library and herbarium, resources that enabled him to enhance his international reputation and a base from which he worked until, and after, Banks' death. Banks' will provided him with an annuity and a lease of the house containing Banks' collections in which he was given a life interest. On Brown's death the collections were to pass to the British Museum, but in 1827 Brown came to an agreement with the Trustees by which the collections became a new department in the Museum under his personal direction. Declining offers of university chairs, because of his obligation to Banks and lack of interest in teaching, Brown's interests were concentrated on his research in the Museum and his work with the Linnean Society, interrupted by relatively few visits to scientific meetings in Europe.

Apart from his work on Australian botany, his principal contributions to science were his championing of the 'natural system' of taxonomy, his observation of molecular agitation in fluids, now called 'Brownian movement', and his recognition of the presence of nuclei in plant cells and of the nucleated cell as the unit of structure in plants. His standing among his contemporaries is perhaps best summed up in von Humboldt's description of him: 'Botanicorum facile princeps'.

Given the important place that Brown occupied in British botany for half a century, it is surprising that Mabberley's *Jupiter Botanicus* is the first substantial book on Brown to be published: there have been many journal articles describing aspects of his work, entries in most of the important biographical dictionaries, but, until now, no book. The reason is partly revealed in Mabberley's work: the quantity of papers, notebooks and correspondence that have survived, and the great variety of Brown's interests, may well have daunted those lacking Mabberley's wide expertise as a botanist and his energy and determination as a researcher.

At the end of his introductory Author's Note, Mabberley has put a short 'Notice to the Reader':

This book is essentially a source-book on Robert

Brown. For those to whom he is an unfamiliar figure as yet, it is strongly recommended that the Epilogue be read first.

As a 'source-book' the work quotes extensively from the documents which have to a large extent determined the structure of the book. Thus, for instance, Brown's notebooks chronicle in detail his activities with the army in Northern Ireland, and in the corresponding section of *Jupiter Botanicus* one learns of plants collected, books bought and bottles of wine consumed (a great deal of detail about a relatively unimportant part of Brown's life). In comparison, the chapters dealing with the *Investigator* voyage are less detailed because Brown's notebooks consist largely of lists of plants seen or collected and tell little about the progress of the voyage or about shipboard life: here the narrative has had to come from others. In compiling a 'source-book', Mabberley has often allowed the availability of sources rather than the importance of events to determine the amount of space given to the various phases of Brown's life, but he is at his best when it becomes necessary to leave the bare recounting of events to interpret Brown's opinions and work. The sections on the natural system of taxonomy and the nucleus are, to a non-botanist, comprehensible and illuminating. Here Mabberley's scholarship shines and one can only regret that he has been content to produce a 'source-book' rather than a finely-honed biography.

The book is long and detailed, and consequently not 'a good read'. The advice to read the Epilogue first is of little help, for it is, as an epilogue should be, a summing-up and an ending. It includes so many allusions to events and opinions that it is rather incomprehensible until one has read the text. It seems strange that, while recognising that the text could be hard going for those ignorant of Brown's life and work, Mabberley has not provided a prologue as well as an epilogue. Those unfamiliar with Brown would do well to read Nancy Burbridge's article in the *Australian Dictionary of Biography* before tackling *Jupiter Botanicus*. And it is well worth tackling, despite the effort required to cope with the sometimes almost overwhelming detail.

Some of the text figures have not reproduced well, but the twenty-four previously unpublished coloured plates of Australian plants and animals by Ferdinand Bauer, 'natural history painter' with Flinders and Brown on *Investigator*, are both incredibly detailed and incredibly beautiful.

All in all this is a difficult, but important, contribution to the history of science: important both because of the significance of Brown's work in the development of botany and taxonomy, and because of Mabberley's interpretation of that work. This interpretation makes it worthwhile to persevere with the dull parts of the book for the sections in which Mabberley abandons the chronicle to explain and interpret the work of a great botanist.

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**Fred Jacka and Eleanor Jacka (Eds.),**  
*Mawson's Antarctic Diaries*. Sydney: Allen & Unwin/Haynes, 1988. 1 + 414 pp., 88 photographs, \$49.95.

It is a sad commentary on our inflationary times that the image of Australia's most revered Antarctic explorer, Sir Douglas Mawson, should be so familiar to his present day countrymen from its presence on our \$100 note. (I must be getting old when I can still recall the exquisite rarity of the note when it first appeared; now it seems to be the smallest denomination of currency peeled off fat wads by overseas tourists!) But to those of us who have an interest in that last of lands — Antarctica — the image of his balaclava-covered head has been a constant reminder of Australia's major contribution to the heroic era of Antarctic exploration through Mawson's four classic journeys into the region from 1907 to 1931.

The Diaries as published are based on a heterogeneous collection of notebooks and papers written by him during Shackleton's British Antarctic Expedition (BAE — December 1907 to February 1909), and Mawson's own leadership of the Australasian Antarctic Expedition (AAE — December 1911 to February 1914) and the British, Australian and New Zealand Antarctic Research Expeditions (BANZARE — First Voyage: October 1929 to January 1930 and Second Voyage: November 1930 to March 1931). They add little or nothing to the scientific results of these expeditions published elsewhere, but they make fascinating reading for anyone interested in the human interactions behind heroic deeds done in the white wilderness of Antarctica at a time when only the most primitive technological support was available. It is a most humbling experience to read the descriptions in these diaries of the conditions under which Mawson and his men carried out their scientific work during extended field traverses on dog-hauled and man-hauled sleds, while we present-day Antarctic scientists depend so much on jet-powered helicopters and heated tractor caravans.

But it is the people — the players in this real-life scientific adventure drama — who most claim our attention. I find it particularly fascinating because I knew a number of the main characters — Professor Leo Cotton (from the BAE), Dr. Frank Stillwell and Frank Laseon (from the AAE), Frank Hurley (from the AAE and BANZARE) and Harold Fletcher (from the BANZARE) — while I remember Sir Douglas himself delivering a lecture I attended as a young student geologist at Sydney University. I had been brought up to revere the geological research and exploratory deeds of Professor Sir T.W. Edgeworth David, himself a giant among the scientific elite of Australia, if not the world. It came, then, as something of a shock to read Mawson's some late evidence in Mawson's account of that expedition to suggest an earlier manifestation of what now appears as a total breakdown in co-operation between the two. There are indi-

tetchy descriptions of David's irritating mannerisms as Leader of the assault on the South Magnetic Pole: 'He generally comes into the tent after we are both in bed and spends 1/2 hour on top of bag arranging and changing things. He sits on our legs and faces alternately. Finally, when we have got the chill off the bag, he struggles in all cold and bedaubed with snow. Of course he has the warm middle berth and occupies certainly more than 1/2 the bag as he wears innumerable clothes.' Oh, how we can relate to this irritation at the fussy foibles of a 50-year-old as seen by his 26-year-old junior colleague who even then saw himself as a natural leader of men; a view apparently shared by Shackleton, who left instructions that should his own expedition to the South Pole not return in time, then Mawson, not David, was to be the leader of the search party.

It is inevitable that most interest will centre on Mawson's daily commentary as the tragic traverse by Mawson, Mertz and Ninnis reached its horrible climax during the Australasian Antarctic Expedition, with the loss of Ninnis and most of the provisions down a crevasse and the rapid decline and death of Mertz just 25 days later. Mawson's own subsequent privations and near death after falling into a crevasse are part of every Australian's heroic heritage, but they can still move us to a surge of compassion and to wonderment at the indomitable spirit of this man pitted against horrendous odds. The final blow was to return to the Commonwealth Bay hut just hours after the *Aurora* left to pick up the Western Base party and continue on to Australia, leaving Mawson and seven others in Antarctica for another winter. His account of that second year is coloured by the apparently unbalanced behaviour of the wireless operator, Sydney Jeffryes. Bizarre behaviour by Jeffryes is chronicled day by day, and Mawson's frustration with the man is clearly an all consuming passion; but as soon as the relief ship arrives, absolutely nothing more is heard of Jeffryes, and we can only wonder what this means, both for Jeffryes and for Mawson.

I was also disappointed to find virtually no comment about relations between Mawson and C.T. Madigan during their long association at Commonwealth Bay. There have long been rumours of major differences between the two, which were said to have surfaced during the second year at Commonwealth Bay. I wonder if we will ever know the truth of these rumours, for there is certainly no hint of any such differences in these diaries.

Mawson's account of the first of the BANZARE exploratory voyages on the *Discovery*, complete with the Gypsy Moth seaplane used so effectively for sea ice and land reconnaissance, shows a growing obsession with the increasing antagonism between Captain John King Davis and himself. Davis had been the captain on the *Aurora* during the Australasian Antarctic Expedition, and there is cations that Davis resented the honours and acclaim that were showered on Mawson following his return to Australia after the fateful traverse with Ninnis and Mertz. Another factor was the relative

unsuitability of the *Discovery* for extended voyages into the Antarctic sea ice zone, since it was primarily a sailing ship without adequate coal storage for its inadequately powered engine. Then there was the continued insistence by Davis that the voyage was not a scientific expedition, but primarily aimed at claiming as much land as possible in the MacRobertson Land and Enderby Land regions in an attempt to forestall the rival claims that the Norwegians were feared to be poised to make. One is left with the distinct impression that Mawson was more than hypersensitive to this criticism, probably because it was very close to the truth! Similar antagonisms soon surfaced with the new captain on the second voyage, Captain K.N. MacKenzie, and I cannot help but feel that in the BANZARE voyages Mawson was beginning to feel the strain of his new role as territory claimant rather than scientific explorer. The reality is that the record of his scientific achievements in Antarctica and in the Southern Ocean, along with his pioneering use of wireless communications, were largely unchallenged in the international scene until the upsurge in scientific research in Antarctica following World War II.

The book is illustrated with many hauntingly beautiful and evocative photographs of Antarctica by Frank Hurley, the one man of whom Mawson had nothing but good to say during the AAE and BANZARE voyages. Each one is a gem and a masterpiece of photographic art, which attests to the unique genius of Hurley. May they be preserved forever in the collection of the Mawson Institute for Antarctic Research.

At the end of it all, the natural question is: what do these diaries tell us about Australia's greatest Antarctic hero? The answer in part is given in the editors' introduction, when they say that they give 'the impression of a man of action, whose interests were almost entirely in the manifestations of the physical world and man's interaction with it, highly knowledgeable, supremely practical, not reflective, and certainly not given to introspection. Touches of sentimentality can be observed, but little humour and no whimsy'. Another part of the answer is his belief in his own destiny as a leader of men into feats of scientific exploration, coupled with a mystical 'reliance in the great Providence, which has pulled me through so far'. He was indeed a giant amongst men, but the comment about 'little humour and no whimsy' makes me glad I was not one of the men who had to spend the two years with him at the hut on Commonwealth Bay.

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**Roy MacLeod (Ed.),** *University and Community in Nineteenth Century Sydney: Professor John Smith, 1821–1885.* Sydney: University of Sydney, 1988. viii + 103pp., illus., \$16.

John Smith, M.A. and M.D., of Marischal College, Aberdeen, 'much devoted to the science of chemistry', arrived in Sydney in 1852 as Professor of Chemistry and Experimental Physics, one of the first three professors of the University of Sydney. He had been to Australia before as a ship's surgeon, but since 1847 he had been an assistant to the Professor of Chemistry at Aberdeen. The uncertain status of his discipline rather than any personal deficiencies meant that he was less equal than the others. His salary was to be three hundred pounds per annum. Pell, the Professor of Mathematics and Natural Philosophy, was to receive five hundred pounds, Woolley, the Professor of Classics and Logic, with the title of Principal, six hundred. Before anything else, the university was to produce the needed numbers of men educated in a literary, humanist tradition, and so, it was hoped, able to assure civilized ways for a colony about to become self-governing. Young W.C. Windeyer, self confessed aspiring colonial Pericles and under the spell of John Woolley, wrote as an undergraduate in 1853, 'I have just returned from our Chemistry examination. I shall not be first though I do not think I have disgraced myself, every muff can do this work so I do not care much about it'.

Smith represented the Scots university tradition, which was not so much utilitarian as broadly 'philosophical', rationalist and systematic, with an Arts course that fostered studies in Physics and Chemistry as naturally as Mental and Moral Philosophy or Philology. But the model for Sydney was reformed Oxbridge, tutorial and collegiate, with a curriculum of Classics, expanding into Ancient History and Philosophy, and Mathematics. Always fearful of what he saw as religious divisiveness, he began a discreet and deferential association with the young radical Henry Parkes, editor of *The Empire*, to persuade him to the view that the new university be a State institution with a monopoly of teaching for its degrees rather than a mere examining authority for candidates from affiliated colleges, and to assure him that his editorial dismay at the 'aristocratical predilections' of the founders of the University of Sydney would disappear when he saw how liberal the professors were. Woolley indeed was later accused 'that in his lectures on Aristotle he instils into the minds of his young hearers those politico-philosophical notions which ripen into vulgar and rampant radicalism'.

The response of the colonists to such a university was not encouraging, and Smith never had much to do at the university which was only graduating four or five students a year in the 1870s. In the University of Melbourne, a Medical School, founded in 1862 and providing the majority of the university's

students, gave utility to courses in Chemistry, but Smith, whose relations with the medical profession in New South Wales were not good, joined his colleagues in opposing the foundation of professional faculties until the Arts course looked safely established. At Melbourne, professors were given equal salary and status.

But Smith was far from inactive. He gave public service and sought public distinction. This monograph represents a very good idea worthily realized by its seven contributors. All is written with a sure touch and unpretentious scholarship by authors who can see Smith in his time and place. Kenneth Cable helps us to understand how remarkably unclear the idea of a University of Sydney was that confronted Smith at the beginning, his part in shaping it, and his work on boards and councils of education as a champion of beliefs that were to give us eventually a State secular school system. Catherine Snowden follows 'the strayfaring professor's' learned leisure as pioneer photographer, as early as the 1850s, and as wandering naturalist and geologist. Some of the remarkable photographs of both topographical and domestic scenes from the John Smith Collection, University of Sydney Archives, are reproduced. She speculates whether we can speak of a new professional or intellectual social class to which Smith belonged, and see him as a type of 'expert' in colonial public life.

Graham Holland makes clear what Smith actually taught at Sydney. Pell, a Cambridge Senior Wrangler, and Smith were to have responsibility for what were assumed to be two different sorts of Physics, the former teaching Newtonian Physics, Optics and Astronomy, while Smith was to concern himself with 'Heat, Electricity, Galvanism and Magnetism'. Smith would have had to begin teaching at a very elementary level. The subjects for the Matriculation examination were 'The Greek and Latin Languages, Arithmetic, Algebra and simple equations inclusive, Geometry, first book of Euclid,' which was disheartening for the few schoolmasters hoping to encourage the study of natural sciences in their schools. It was not until 1882 that Elementary Physics and Elementary Chemistry were included in the Matriculation examination as options.

Deborah Campbell shows us Smith at the Royal Society of New South Wales, the Australian Museum, the Australian Mutual Provident Society, in the Legislative Council and on education boards as a very public man; Milton Lewis tells the rather unhappy story of Smith and the medical profession; Peter Sheldon relates his long public service in the cause of a pure water supply for Sydney; and Jill Roe tells the curious tale of Smith as Free Church Presbyterian and ardent Theosophist. Smith died in Sydney in 1885.

Smith is worth commemoration. Samuel Johnson warns us that 'in lapidary inscriptions a man is not upon oath': there is no need here. The 'Smith workshop' has produced just the right inscription. This book is a contribution to our cultural history. Smith

was a professional, an academic, a public man and lots besides.

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