

Book Review Section

Compiled by John Jenkin*

David Miller and Peter Reill (eds), *Visions of Empire: Voyages, Botany, and Representations of Nature*. Cambridge: Cambridge University Press, 1996. xix + 370 pp.; illus., \$95.00.

This collection of sixteen essays, arranged in four parts and jointly edited by an Australian historian of science and technology (Miller, UNSW) and an American historian of the seventeenth and eighteenth centuries (Reill, UCLA), presents the content of a 1991 conference of the same title held at the William Andrews Clark Memorial Library at UCLA. Six years on, it is certainly worth reading, although we could wish such works were published sooner. The focus of the volume is the discovery by European scientists and travellers of the plants and peoples of the Pacific during the eighteenth century. The purpose is to reconceptualize discovery as 'active cultural solutions to problems of representation, rather than mere collection and passive depiction'. The editors argue that these solutions 'reflected and created visions of empire'. While the multi-disciplinary approach certainly succeeds in explicating a 'more sophisticated understanding of how European explorers conceived and represented nature and society', the contributions are uneven. The penultimate two essays that form Part IV, by anthropologists Ingjerd Hoem and Alessandro Duranti, are the weakest of this avowedly revisionist set, offering no new ideas and disappointing expectations with their limited or irrelevant tangential scope.

Otherwise, the volume succeeds in furthering cross-disciplinary analysis of the fascinating subject of Pacific exploration, one aspect of the larger eighteenth-century issue of dealing with the discovery of new worlds revealed by terrestrial and maritime

exploration, the microscope and the telescope, and with the invisible forces made manifest by electrical and magnetic studies. Contributing historians from many fields, including empire, art and science, disagree in defining a united outlook on the issues raised regarding perception, representation and the politics of aesthetics, but all go bravely voyaging to question received scholarship and explore new possibilities and conjunctions. It is a little like Cook's Transit of Venus Expedition, which forms the centrepiece of Part I, 'The Banksian Empire'. Herein six essays teach us yet more about how Banks accrued and exercised his extraordinary power as a metropolitan broker of imperial—indeed global—science. Particular aspects include David Miller's examination of Banks' power in the light of Latour's 'centres of calculation' concept, David MacKay's analysis of Banks' collectors as advance agents of empire, Alan Frost's study of the imperial strategies that framed Britain's natural history commerce with Australia, and Christopher Lawrence's tightly reasoned study of the Royal Navy's policy on fighting scurvy in relation to imperial strategy. John Gascoigne's summary essay emphasises how Banks achieved his influence by operating in the twilight zone between the public and private spheres that defined late-eighteenth-century science, arguing boldly (and accurately) that Banks himself represented a centre of calculation. As Miller's introduction notes, most of these papers rely on visual materials, exemplifying the trend in historical science toward reliance on visual evidence as well as the corresponding shift by art historians toward concern with factual history. Here is a conjunction ripe with possibility that Banks, the friend of Joshua Reynolds and the patron of Sydney Parkinson and Alexander Buchan, would certainly have appreciated.

In Part II, 'The Uses of Botany', Lisbet Koerner examines Linnaeus' mercantilist attempt, through overseas discovery of new commodities and import substitution, to develop scientific solutions to Sweden's negative trade balance with Europe and Asia. She draws a fascinating parallel in Linnaeus' thinking between the discovery of new exploitable products such as tea and the conquest of new territories: ironically, Sweden failed at the former and eventually turned to mercantilist imperialism as an alternative. Janet Browne extends the

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analysis of the social uses of botany into the British aristocracy and gentry, tracing the influence of this most visual of modern sciences in the late-eighteenth-century vogue for libraries of illustrated natural history books, hothouses, landscape gardening and a literature of innuendo based on the Linnaean connection between sex and taxonomy. The emphasis on natural law and sexual freedom carried over into environmental attitudes, Browne argues: the ancient fear of the wilderness dissolved with the borders of nature as wild and exotic species were domesticated and brought into the garden. Browne fails to consider, however, that this new cultural engagement with nature as a benevolent force may well have been fuelled by Europeans' growing realisation that technology had given them unprecedented power to subdue nature as well as native peoples, in all but its most extreme forms on a global scale.

Concluding Part II, Alan Bewell rounds out discussion of the sexual dimensions of botanical discourse by using the example of Banks to examine how the explicit sexuality of Linnaean botany moved into British culture as an erotic, subversive force questioning conventions of gender, class and property. Backed by 'revolutionaries' such as Erasmus Darwin and William Blake, these botanical politics were viewed by many as tinged with Jacobinism; counter-revolutionaries who linked seduction and sedition mounted an assault on a botanical literature that coincidentally lost its sociopolitical edge in the early nineteenth century as the Linnaean system of plant classification gave way to that of Jussieu.

Part III, 'Representations of Living Nature and Their Uses', contains the best of this volume. Art historian Martin Kemp uses Banks' *Florilegium* as a case study to explicate how traditional readings of nature were as embedded in the conventions of botanical illustration as they were in those of general representational art; in fact, the conventions were the same. He argues that enduring human relations with the plant world mean more in all forms of illustration than the immediate historical context of representation: botanical illustrations may encode political aesthetics, but the 'imperial' aspect in this era should be seen as subordinate to the larger history of visual imagery in botany.

Barbara Stafford, too, argues for the conservatism of visual imagery in demonstrating how microscopists imported

metaphors from other spheres of culture to describe the teeming new worlds revealed through their lenses. These equivocal biota were paradoxical, contradictory, intricate, apparently unclassifiable; their incongruity and 'betwixt and between' quality of seeming to be both plant and animal helped break the grip of anthropocentrism and the West's focus on the human body. Stafford explains that these creatures startled observers into new perceptions of reality, dissolving standards of organic coherence. Late in the eighteenth century, however, paralleling the rise of phrenological and physiognomic analysis, this trend toward questioning the borders of biological definition was reversed by a neoclassical emphasis on examination of separate parts, organs and functions. Stafford argues that this imposition of symmetry in microscopic studies forms part of a general mathematization of perception: does it perhaps also represent ambiguity fatigue—the human need, following a period of massive accession of unsettling data about the nature of reality, to classify and subdue the potentially threatening new elements?

Michael Dettelbach's essay on the interplay between science and aesthetics in the global physics of Alexander von Humboldt is the most powerful contribution to this collection. Humboldt measured rather than collected; he let his data speak, not his own subjective reactions to phenomena; he sought to demonstrate the unity of nature by measuring its grand physical laws. As David Miller notes in his Introduction, what mattered to Humboldt 'was the traversal made by his measuring instruments, akin to the deep-space voyages of modern space probes'. For Dettelbach, Humboldt's science disproves Latour's 'centres of calculation' theory, contributing to universal intellectual freedom, order, reconciliation, co-operation and tranquillity rather than aggression and imperialism. Peter Reill argues even more pointedly that Humboldt combined aesthetics with exact measurement in a distinct view, but claims Dettelbach overstates Humboldt's adherence to Laplacian objectification and a neoclassicist tradition. He goes on to attack Kemp and Stafford as well for use of ambiguous terms such as romanticism and neoclassicism that he believes have lost their interpretative power and deserve to be replaced by new explanations that accurately reflect the complexity of Enlightenment science.

Simon Schaffer's summary essay on the historiography of science and empire in the Pacific solidly anchors this volume in the context of our growing awareness of the many-layered perspectives required to interpret and understand European-indigenous encounters, and of the research potential opened up by this growing discourse. While traditional themes like European economic and scientific dominance still require attention, a new focus on indigenous cultures and the nature of the bilateral trade that developed with Europe in regard to cultural elements, technologies and knowledge of the natural world opens up entire new fields of endeavour. Inspiringly, Schaffer concludes that historians of all persuasions who are interested in the cultural role of science have a personal part to play in realising Bernard Smith's vision of a new, less Eurocentric paradigm of Pacific encounters.

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Roy MacLeod & Philip F. Rehbock
(eds), *Darwin's Laboratory: Evolutionary
Theory and Natural History in the Pacific*.
Honolulu: University of Hawaii Press, 1994.
vii + 540 pp., illus., US\$45.00.

Charles Darwin's relationship with the Pacific was and is a varied one. As a young man in England, he was inspired by the accounts of European travellers to the area, and he visited the Pacific himself on the *Beagle* voyage, 1831-6. The focus of this expedition was South America and the charting of its coastline, but in the Pacific landfalls were made at the Galapagos Islands, Tahiti, New Zealand and Australia (with later stops at the Keeling Islands and Mauritius). After his return to England, Darwin maintained a presence in the Pacific through a network of collectors and then later, even more broadly and beyond the reach of his own life-time, through the influence his theories had on other scientists who visited or lived in the Pacific region.

Darwin's *Laboratory* is a collection of sixteen essays which explore the significance of the Darwinian presence in the Pacific in relation to evolutionary theory and the site's natural and political history. The authors were all contributors to a

symposium devoted to Western Science in the Pacific, which was held as part of the International Congress for the History of Science at Hamburg in 1989. The symposium was in part a conscious attempt 'to look away from the specifically cultural and political character of European scientific debates', and except for Janet Browne, the contributors to this volume are all based either in the Pacific (Hawaii) or in Pacific rim countries (Australia, USA, Canada, New Zealand).

MacLeod and Rehbock's introduction ties together what could easily have been a very diverse collection. They assert that Darwin would probably never have strayed from a traditional conception of nature had it not been for his *Beagle* experiences. The Pacific placed him in an alien environment and he was changed by it. The editors also assert that Darwin in turn changed the Pacific environment in an unparalleled way. No doubt others before Darwin were influenced by their Pacific experiences, but Darwin's subsequent impact on European ideas was on a unique scale. By helping to redefine European understanding of nature and human relations to it, Darwinism changed the way Europeans perceived this and all world territories. The implications of Darwinism in the Pacific, therefore, had political and social dimensions as well as scientific ones.

The book is in four sections, the first of which is devoted to research in the Pacific. Stoddart opens the section with a comparison of the views of Darwin and Dana on the subject of coral reefs. It was an exchange, in part, between a visitor to the Pacific (Darwin) and a scientist who lived and worked in the area (Dana). In the second contribution, Kay surveys Pacific biogeography and draws attention to the way in which Darwinism sharpened perceptions of Pacific features, such as high rates of endemism, while also giving scientists the means to explain them. In her study of the Wallace line, Camerini links the drawing of the line to the development of Wallace's evolutionary thinking. Amundson's study of Hawaii-born naturalist Gulick shows how Darwin's biogeography could be developed in such a way as not to offend religious or political ideas. Finally, MacLeod charts the careers of early Balfour students at Cambridge to demonstrate how they used the Asia-Pacific area as a laboratory to test Darwinism.

The second section of the book looks at research processes, and Garber takes up this subject in relation to Darwin's Pacific correspondents. These individuals assumed the role of Darwin's laboratory assistants in the sense that they provided him with data for his theories. The paper also emphasizes Darwin's continuing presence in the Pacific after his visit. Benson's study of Seattle's Young Naturalists' Society shows how, by the end of the nineteenth century, Darwin's theories were influencing individuals well outside his own network. This is evident not so much in theoretical speculation but in the Young Naturalists' decision to observe species variation and its relationship to geography. In her paper on Schomburgk, Payne explores the career of a Darwin contemporary, and focuses on communication between the 'centre' and the 'periphery'. Schomburgk, who chose to stay in the Pacific region (in South Australia) developed networks more suited to the utilitarian needs of a colony than to the development of theories.

Browne opens the third section, which is devoted to anthropology, with a paper that shows how Darwin's interest in human culture can be traced to the Beagle voyage. She also asserts that anthropological discussions with Captain FitzRoy were important in helping Darwin to articulate his own position. In the second contribution, Gunson demonstrates the importance of missionaries as contributors to natural history and ethnography, and how their interest in science led them to negotiate ways between evolutionary theory and a literal reading of the Bible. Sohmer's paper shows how strong links between Melanesian missionaries in the 1860s and 1870s and Victorian academic anthropologists can be traced to shared Oxbridge experiences. Finally, Kuklick's study of the Torres Strait expedition points out how the evolutionary theory of anthropological discourse tended to be Lamarckian rather than Darwinian.

The fourth and last section is devoted to an exploration of social Darwinisms. Butcher's contribution to this subject is a reassessment of Darwinism and the Australian colonial attitude towards Aborigines. It points out how Darwinism could be adapted to the comfortably racist conclusions of the colonials. In his paper, Stenhouse traces this phenomenon in New Zealand in relation to an immigration policy that asserted the right of superior races to supplant inferior ones. In a study of Sydney-

educated geographer, Griffith Taylor, Christie explores how one individual developed evolutionary theory in the first part of the twentieth century in opposition to contemporary support for eugenics and racism. Finally, Laurent reflects more broadly on the notion of social Darwinisms in Australia, Japan and Hawaii and how they could be adapted for use in both fascism on the right and collectivism on the left.

The story of Europeans in the Pacific is often seen as one of political subordination and intellectual occupation, but in pursuing the idea of the laboratory, the contributors to *Darwin's Laboratory* draw attention to interactive aspects of European contact with the site. The Pacific was more than just a place where European scientists made observations; it was also a place where they generated new ideas and then tested them. In exploring this process, *Darwin's Laboratory* does manage to move the notion of the 'centre' from Europe to the Pacific in a way not generally acknowledged in studies of Darwin and Darwinism. Thus, reading this book becomes a bit like entering a laboratory—readers leaving with an enlarged understanding of the subject and with inspiration for the direction of future research.

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Tim Bonyhady and Tom Griffiths (eds),
Prehistory to Politics: John Mulvaney, the Humanities and the Public Intellectual.
Melbourne: Melbourne University Press,
1996. xii + 271 pp., illus., \$29.95 pb.

John Mulvaney has been a leading figure in Australian prehistory, history and the humanities generally for forty years or more. He read history at the University of Melbourne immediately after the Second World War before travelling to Cambridge to study archaeology. On his return to Australia in 1953, he taught history at Melbourne and began a program of excavation that introduced to Australia new techniques and attitudes. He continued this research after moving to the ANU in 1965, initially as a Senior Research Fellow in the Research School of Pacific Studies and later as the foundation Professor of Prehistory in the Faculty of Arts. Since his retirement from the Chair in 1985, Mulvaney has

maintained an active research profile and has contributed much through his activities as Secretary of the Australian Academy of the Humanities. He had a major impact in opening up archaeology as an academic area in Australia, although his direct contributions to prehistory and history are not the main focus of this book. It celebrates instead his contribution on a wider stage, especially as a 'public intellectual', as he used his expertise and academic standing to justify and underwrite his forays into public affairs.

The eleven papers in this volume use Mulvaney's career and interests as a springboard for exploring aspects of the history of research and the relationship between the academy and public perceptions and policies. A variety of important issues are exposed, and there is a common concern with the role of the individual in influencing public policy, always seen through critical self-conscious filters and always based on serious scholarship and research.

In their introductory chapter, the two editors trace Mulvaney's academic career and his increasing involvement in public affairs, particularly those to do with the preservation of Australia's cultural heritage: 'While his scholarship was consciously global, his political activism was local. He was prepared to use the academy as a political platform from which to intervene in public debates'. This became most significant after the Whitlam government took advantage of his expertise to appoint him to the Piggot Inquiry on Museums and Galleries and the subsequent planning committees for the proposed Gallery of Aboriginal Australia and National Museum. He has remained a passionate proponent of the original concepts of the National Museum in the face of later changes in government policy. Similarly, participation in the Hope Inquiry into the National Estate was followed by his appointment to the Australian Heritage Commission and as the chief delegate to a UNESCO meeting in Paris responsible for setting out criteria for World Heritage Listing. There he urged the recognition of broad definitions of World Heritage and was involved in the nomination of the Willandra Lakes and Kakadu to the List. He achieved a higher public profile in the 1980s with his stance on the Gordon-below-Franklin Dam. His commitment, together with that of other archaeologists, was

largely responsible for the protection of the Franklin River and its natural and cultural heritage sites. Anne Bickford's contribution gives a closer view of Mulvaney's approach and commitment to heritage preservation in describing his role in the campaign to save the site of First Government House in Sydney. The underlying message is the same: individuals can change public attitudes and policies.

The role of the individual is also one theme in the second chapter, by Ken Inglis, that considers the influence of individual lecturers on Mulvaney, and more importantly, Mulvaney's impact on his students, a theme also addressed by Greg Dening. In blending his personal experience with an account of Mulvaney's career, Inglis provides insights into the nature of university life in Melbourne in the post-war years—a positive view to counterbalance some more jaundiced memories—and later at the ANU.

Inglis is able to build some of his arguments on Mulvaney's early ability to maintain an independent scholarly stance in the context of a conservative Catholic environment. This belief in the independence of scholarship, the universality of knowledge and the importance of archaeological and historical research as the legitimate tools for understanding the past also comes through in Tom Griffiths' chapter. This describes how Mulvaney's stratigraphic excavations were of crucial importance in demonstrating the great antiquity of Aboriginal occupation of the continent, replacing earlier views of a short homogeneous past. While in Melbourne in the 1950s, his approach to research was closely linked to a campaign to persuade artefact collectors of the impact that their hobby had on the archaeological record, and that sites were more important as sources of information than as quarries for artefacts. This finds a parallel in his more recent public stance on reburial of Aboriginal skeletal remains or destruction of archaeological material. There is a common insistence on the necessity for scientific access to information and a rejection of notions of control by individuals or groups. Ancient remains are important for their information content at least as much as for their intrinsic or symbolic value.

In considering the interplay between cultural and historical context, notions of the past and the growth of archaeological

research, Isabel McBryde takes a somewhat different line. She strongly espouses an approach which gives space, or rather primacy, to Aboriginal or community views or interests. Similar concerns underlie Marcia Langton's contribution, which addresses, amongst other things, the relationship between communities and research as seen in the Australian Institute of Aboriginal and Torres Strait Islander Studies. While Mulvaney attempted to raise the level of involvement of Aboriginal people within the Institute, he wanted to maintain its educational and research focus. As McBryde recognises, there are many ambiguities and contradictions in debates on the interaction of researchers and others. As the archaeologist increasingly becomes the servant of the community, addressing their questions, concerns and issues, will there be less recognition of the value of independent research which can create new frameworks of thought or challenges to authority? Humphrey McQueen addresses these issues on a more overtly political and a far broader canvas. He is not concerned so specifically with archaeology, heritage or Aboriginal issues, but with the relationship between individuals, communities, controlling powers and academics—those whom he would class as public intellectuals as 'they are employed to service corporations and governments'.

Three papers in this book are concerned with semantics and a critical appraisal of the significance of words and concepts in forming or encapsulating attitudes and modes of thought. Tim Bonyhady presents a discussion of the origins and development of 'heritage' and 'National Estate'. Bain Atwood uses some of Mulvaney's research to explore the way in which aspects of Australian and Aboriginal history are constructed and ideas implicitly expressed through language. Howard Morphy reflects Mulvaney's longstanding concerns with the history of anthropology in Australia by contributing a substantial exploration of the concept of the Dreamtime. In doing so, he explicitly espouses an approach which promotes the value 'of empirical research, of objectivity, of advances in understanding'. Such an approach, such a belief in knowledge and its intrinsic and instrumental values, characterize Mulvaney's work.

John Mulvaney has made many contributions—as researcher, teacher and public intellectual. As the focal point of the

essays in this book, he makes another indirect contribution and provides an example of the value and importance of individual scholarship, both within and beyond the academy. While it contains much of interest in its own right, this book is especially valuable as a fitting tribute to a significant Australian.

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Macleay Museum, University of Sydney, *'Most Curious and Peculiar': Women Taxidermists in Colonial Sydney*—a review of an exhibition (February 1996 to January 1997).

For the 1990s viewer, this was an exhibition 'curious and peculiar', richly informative and coherent, beautifully designed. And melancholy.

We long understood that most white colonial women were convicts and domestic servants, that educated women were wives and companions. More recently, we have learnt that many were property owners, farmers, managers, sketchers and writers, that some were scientists. This exhibition surprised us with the news that a select few were amateur and professional taxidermists who supplied museums, overseas collectors and local homes with wild creatures stilled forever by their specialised art. The first of our women taxidermists (although her name appears nowhere in the exhibition) was probably naturalist Louisa Atkinson (1834-72), who in the 1850s and 1860s extended her zoological work by creating a private collection of stuffed animals, mostly birds.

Curated by Martha Sear of the Department of History, University of Sydney, and Susie Davies of the Macleay Museum, 'Most Curious and Peculiar' was remarkable for the density and range of the information its clear central story (of the working lives of several colonial Sydney women) made possible. The Museum's high-ceilinged room allowed its permanent natural history displays to form an enriching context, while tall vintage display cabinets closed the exhibition in its own central space. Sympathetically backed with Victorian fabrics, mostly in rich dark blues and violets—some shades of William Morris—these glassed cabinets displayed their curious materials for the modern viewer with clarity and progressive thematic

coherence. Here was a sensitive design and staging, whose glowing woods and calculatedly cluttered display echoed its own memory of the well-known window of Tost & Rohu, Naturalists and Furriers, Tanners and Curio Dealers, at 60 William Street, Sydney, a shop-window still alive as late as 1923.

While 'Most Curious and Peculiar' represented the work of a number of women—Helena Scott, Sophie Steffanoni, Mrs Palmer—it centred the story on Jane Tost and her daughter Ada Rohu. Jane (1817-1889), a daughter of London's leading taxidermist family, had brought her singular profession with her, first to Van Diemen's Land and then to Sydney. The business and shop-front—opened by the women in 1872 after a family tragedy—was Tost & Coates Berlin Wool and Taxidermy Studio; later, on Ada's marriage, it became Tost & Rohu.

The exhibition's chief interests were the skilled professional work of colonial women in an unusual field, and the interesting patterned forms of an industry geared to the needs of museums and to the Victorian enthusiasm, inherited from the eighteenth century, for 'curiosities' and natural history. Its dominating but flexible Tost-Rohu story opened windows on a fluid tapestry of colonial stories of family business and business rivalry, all seen in fascinating relationship to the late-nineteenth-century world of colonial and international science, its museums, even its homes. It could digress, for instance, to the embroidered textile work of the Steffanoni family, or to an account of the New South Wales Women's Work Committee for the Chicago World Fair of 1892, and from there to sample items exhibited, and medals won, at the great international exhibitions of the day. Concentrating on the role of women in the taxidermy business, it could easily move to the interdependence of that business with associated industries: fur and wool work, embroidery and millinery, fancy-needle and gold-work for public regalia and drapery.

If 'peculiar', much of the work displayed here demonstrated a polish and delicacy of craftsmanship drawn from decades of family experience, an intimacy with the trade and the material worked. With striking demonstration, it taught much about the work and enthusiasms of some of our grandmothers and great-grandmothers. Further, if the exhibition used its stuffed animals, its elegant plumed hats and

swansdown muffs to emphasise the livelihoods of some women and the fashionable lifestyles of others, it also threw a keen light on one aspect of Victorian colonial science which, perhaps because it is so close in time, we have mostly chosen to forget. That is, while following the positive aspects of particular energies and professions, the display's meticulous historical account avoided neither the 'peculiar' interest of its rare items, then and now, nor their deep pathos to modern eyes.

So it opened frankly with a lion skin rug and a fur rug made of the skins of no fewer than thirteen different creatures, precious mementoes from rare and precious lives, fashioned for the 'dens' of rich gentlemen. It presented the animals of taxidermy, squirrels from America alongside Australian birds under glass domes, all living creatures rendered expertly into 'educational' specimens, stilled forever in postures for our gaze.

And far more poignant than such museum pieces were those creatures taken beyond mere preservation to the uses of decorative or fancy objects. There was, for instance, the kookaburra hand-screen, ornate and heavy beyond use. Attributed by Martha Sear and Joan Kerr to Eliza Catherine Wintle, this screen turned up as one of a pair on the auction market in the 1980s and was fashioned, not of mere feathers, but of a whole bird. Similarly, there was an entire bird-of-paradise stuffed to adorn a hat, an elephant's foot made (with unembarrassed symbolism) into a footstool, a kangaroo paw cigar-lighter, a tiny armadillo shaped into a tiny basket (its little paws placed over its eyes in an almost audible scream). Through such manufacture, the cold 'male' world of natural science was, incredible as it may seem, 'domesticated', absorbed into Victorian patterns of home use and vanity, 'civilized' by becoming art and craft for the lady's parlour as much as trophy and collection for the gentleman's den.

The values and attitudes of such production were, of course, imperial; and the empire's natural world, especially in its colonies, could only be understood as inexhaustible. Even so, as the exhibition also revealed, the firm of Tost & Rohu lived through the time (from the 1890s) of the great struggle to save wild birds from a feather-luxuriating millinery and costume industry. Though anxiety for the natural world had struck a repeated chord in nineteenth-century naturalist writing,

those first public 'plumage' protests and the animal protection movements they inspired through our own century largely account for the sense of disquiet and melancholy we now experience as we contemplate this near (and continuing) history of taxidermy.

Today we know that the greatest threat to natural species is human assault on habitat. In its time, however, the great imperial natural history project was precisely implicated in the loss of species. Only as long ago as the eighteenth century, there lived in its millions on Arctic islands a bird we call the 'great auk', a two foot high 'penguin', delicious to eat, slow-moving, an easy prey for hungry humans and, for this reason, rapidly depleted. From 1830, museum directors were competing in a desperate scramble for stuffed auks. By 1844, just two auks remained alive. These two were forthwith hunted down, killed and stuffed for private collectors, dying with their race for the science that professed interest in them. It is surely one of the saddest of all bird stories, its direct link to the history and values of natural science and museums tragically ironic.

It is today inevitable that we draw a double lesson from any contemplation of brilliant wild creatures frozen by the taxidermist's art, disposed so perfectly for our gaze in museums. In glass cases, they do not melt and vanish into green cover, they do not blur with inconvenient movement, they do not lash out in fear. But they are so tangibly dead, their colours, however cleverly preserved, lacking all living radiance. Our ambivalence before such informative specimens may seem to us 'better' than the nineteenth-century single-mindedness that pursued a kind of defining 'knowledge' with little hesitation or reflection. But we can understand our ambivalence better, not only by remembering what we eat and wear, and the asphalt, lawns and thunderous freeways we lay down where wallabies flee, koalas tremble and birds cease to sing, but by understanding the intricate currents of its history.

This fine and admirably succinct exhibition rediscovered the surprising part played by certain colonial women in a craft that served and was a part of the ambitious naturalist project of their time. Their involvement may seem as 'curious and peculiar' to us now as in their time seemed those wonderful creatures that came under their skilful hands—creatures intimately familiar to indigenous people but so 'curious' to settlers, adventurers, Europeans.

'Familiar', 'curious', 'wonderful': may we learn to cherish their lives so that those words become once again true.

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N. Jardine, J. Secord and E. Spary (eds), *Cultures of Natural History*. Cambridge: Cambridge University Press, 1996. xxi + 501 pp., illus, \$47.95 pb.

This collection of 26 essays—a Cambridge University effort in conceptualization and, to a significant extent, execution—should be read by everyone with an interest in natural history, a cultural construct that has, since the Renaissance, mediated the relationship between nature and society. The book itself is weighty, but individual essays are of an easily digestible length. It is well produced, a pleasure to handle and read, illustrated with relevant and aptly captioned figures, and thematically tight despite tracking the permutations of a notoriously shape-shifting subject across three centuries. The editors have done a remarkable job of weaving together two dozen disparate perspectives covering specific topics ranging from Italian Renaissance gardens through eighteenth-century German mineralogy to anthropology in Victorian Britain.

As the cover notes promise, this is the first systematic general work to integrate the results of detailed recent scholarship in the history of natural history, from the founding of its first institutions in the sixteenth century to its *fin de siècle* transformation by biologists. Designed as a work of first resort, it will equally suit the layperson approaching the subject, the undergraduate seeking a broad introduction and references to more specific reading, and the specialist scholar interested in interconnections, widening horizons and the evolution of the man/nature interface as a crucial component of the *Zeitgeist*. The writing is for the most part clear, direct and refreshingly jargon-free. The focus throughout is on practice not theory—the settings and contexts of natural history and its varied social, political and moral uses. Inevitably (and admittedly) Eurocentric and generalist, the book nevertheless contributes to the 'decentring' of the historical debate by treating developments in and receptions of natural history outside the sphere of élite

savants—for example, by Lancashire working men and ‘anthropologized’ indigenes. It succeeds admirably in its main aim of conveying the richness and variety of former cultures of natural history.

The overall message, not surprisingly, is that there is no ‘natural’ conception of nature. Various frameworks for its study, themselves conditioned by time and place, ‘have structured and informed natural historians’ dealings with nature, [revealing] how the boundaries between the natural and the conventional, artificial and social have been continually contested and relocated’. Science, as in most recent literature in the discipline, is presented as a cultural construct, forged in debate, embodying other cultural preconceptions and, as a form of representation, cutting us off from direct experience of nature. While the editors quite rightly argue that historical studies of natural history such as this can help us regain both the natural and human worlds we are in danger of losing, I suggest, in the spirit of Samuel Johnson’s hitching-post refutation of Berkeley’s theory that material things exist only in being perceived, that direct sensory experience is still as valid as any learned interpretative framework. To know nature, we have only, as a tour guide would put it, to ‘get out into it’ and observe. Scholars we may be, but products of and participants in the natural world we remain.

As cultural history, this volume charts ‘the production, distribution and reception of knowledge claims’ to demonstrate how both society and the natural world gave rise to their representations and were, in turn, transformed by them. It self-consciously avoids Whiggish ‘presentism’, examining past conceptual frameworks as locally and historically contingent and valid. We learn, for example, that natural history, after a revival from classical antecedents in sixteenth-century Italy, was diffused among Europe’s seventeenth-century élite because it incorporated nature into consumer culture, offering a new way to collect curiosities and display wealth. Daniel Roche, in one of the collection’s more profound offerings, explains how the French academic movement in the seventeenth and eighteenth centuries allowed the world of fashion to enter the sciences and developed important links between the intellectual world and royal and regional bureaucracies. In every era, progress in the practice of science brought social change; for example, Linnaeus’ system of classification went far

to democratize the study of nature. Inescapably, man remained the measure of all things: as Emma Spary notes, ‘Natural history ... depended for its success on its romantic appeal to a public which did not draw boundaries between nature and human experience of it’. By 1800, élite natural historians such as Joseph Banks had created roles for themselves as mediating experts between nature and society. Wielding vast social and political power, such savants were especially important in the context of expanding empires, incorporating new data while advising on colonizing ventures and resource development. They also affected politics in debating the natural, moral and bodily economies—a debate over the proper location of government that was co-opted by French revolutionaries to show regeneration could occur from within the body politic. Also in the eighteenth century, natural history permeated natural theology, helping render God’s creation comprehensible and affirming faith. German *Naturphilosophie*, on the other hand, attacked Enlightenment thought as symptomatic of man’s alienation from nature. Dorinda Outram uses France’s Museum National d’Histoire Naturelle to illustrate how the battle for space between proponents of field- and laboratory-based approaches (display versus dissection) mirrored the larger debate for intellectual authority between backers of physical and psychic distance as the superior form of objectivity. Janet Browne takes us abroad, presenting biogeography as the quintessential imperial science that relied on overseas collections generated by imperial activity, expansionist language and maps. Michael Bravo discusses Britain’s ethnological and anthropological societies, explaining how differing views of what constituted scientific knowledge affected the political status of slave and indigenous peoples within the Empire for over a hundred years. In the process, he draws a neat parallel between the Humboldtian programme of mapping the physical world and phrenology’s contemporary mapping of the human mind.

What was collected was as theory-bound (and therefore culturally determined) as what was done with it. Specimens were not natural objects, but were ‘designed and constructed by naturalists to answer various scientific needs’. One need only visit Frederick McCoy’s anachronistic, anti-Darwinian exhibit of primates in the

Museum of Victoria to appreciate this truth; collections themselves become valuable artefacts. The point of creating collections of accurately identified specimens was reducing the complexity of the natural world, freezing its dynamism so the human mind could overcome its own phenomenological rapture and come to grips with nature's stunning beauty and variety. Today as during the Renaissance, however, the aesthetic appeal of specimens and the adventure of collecting them remain as important motivators of natural historians as the desire to discover nature's order. In this context, David Allen explains how aspects of natural history with particular potential for symbolism within the wider culture of a given period—shells in the eighteenth century, plants in the nineteenth—were incorporated into fashionable decor as design motifs totally abstracted from nature.

The who? as well as the what? of natural history has been contentious. Anne Secord uses nineteenth-century Lancashire working-class botanists to demonstrate that in Britain the terms of participation were drawn early on to privilege middle-class professionals while marginalizing and neutralizing workers, women, clergymen and amateurs. Certainly we may all join in lamenting the demise of the pub as a venue for scientific interchange. The clichés of rural life and exotic landscapes purveyed by the extensive popular literature of natural history also helped create public consensus on issues like rural depopulation and colonization. For better or for worse, ecology has inherited this nineteenth-century tradition. Paradoxically, however, while natural history has surged to new heights of popularity through such media as David Attenborough's *Life on Earth* TV series and Stephen Jay Gould's books, its status and image remain low, its recruitment is falling, and its funding is poor. James Secord's summary essay argues persuasively that if we are to prevent large-scale environmental disaster, we must develop historical perspective to help break down the divide between nature and culture. He contends that the history of natural history should form an integral part of environmental history curricula, explaining both how the current hierarchy of the sciences was created and how science is situated within the wider political culture. Further, such a history must be international to allow us to conceptualize the global scale of the current environmental crisis and the

contributing structural economic inequalities that we have inherited from decolonization. In short, if our problems are products of history, our history must address these problems historically. This balanced, wide-ranging, instructive and eminently readable survey shows the way to ensuring the continuing relevance of both natural history itself and the history of science. It reminds us that, while we have reason to be proud of our achievements, we must be humble enough to remember that we are part of, not separate from, nature.

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Raymond Haynes, Roslynn Haynes, David Malin and Richard McGee, *Explorers of the Southern Sky: A History of Australian Astronomy.* Cambridge: Cambridge University Press, 1996. xiii + 527 pp., illus., \$75.00.

Ragbir Bhathal, *Australian Astronomers: Achievements at the Frontiers of Astronomy.* Canberra: National Library of Australia, 1996. vii + 236 pp., illus., \$24.95 pb.

The history of Australian science has undergone a remarkable growth over the past fifteen years, particularly so in astronomy, the area of science with undoubtedly the highest public profile in Australia. Detailed studies have appeared in recent years on a number of astronomical institutions and telescopes, as well as biographies of astronomers. The two works under review have added to this growing body of work on the history of Australian astronomy.

Oddly, much of this recent work has not come from the growing numbers of professional historians of Australian science. *Explorers of the Southern Sky* is a case in point, where three of the authors are astronomers—two active and one retired—while the fourth is an academic with an interest in the interface between science and the humanities. *Explorers* is by far the most ambitious and comprehensive study of Australian astronomy yet attempted. As the authors state their aim: 'We have tried to write a book that will be accessible to as many interested readers as possible. It is not written primarily for the experts, whether astronomers or historians, though we hope that they, too, will find much to interest them. Nor is it intended to be a complete history of astronomy, though it

certainly includes a great deal of that. Instead, we have tried to focus more or less equally on the science, on the people who did it, and the socio-economic context in which it was carried out.'

The book begins with a somewhat speculative chapter on ancient Aboriginal beliefs about the Sky World—the earliest recorded astronomy anywhere in the world—and then traces the key role played by astronomy in the European discovery and early settlement of Australia. While it is an exaggeration to say that Cook's charting of the east coast of Australia was incidental to his primary aim of observing the transit of Venus in the south Pacific, astronomy was nevertheless woven very early into the story of white Australia.

Observatories were soon founded in each of the new colonies to investigate the rich star fields of the southern skies, beyond the reach of the great European observatories. As the years passed, astronomy often took a back seat at these observatories, pushed aside by the claims of time-keeping, meteorology, tide recording and other pursuits considered of more practical value to the new colonies. An exception to the largely utilitarian role of the colonial observatories was Victoria's bid for fame with the construction of the Great Melbourne Telescope in 1869, the world's largest equatorial telescope. Although it notched up several successes, design flaws crippled the telescope and kept it from fulfilling its original purpose of revealing the true nature of nebulae.

The decision to join the 'Carte du Ciel', an extensive survey sponsored by France that aimed to catalogue all the stars in the northern and southern skies, turned out to be another setback for Australian astronomy. The colonial observatories, limited by their scarce resources, were locked into an ambitious project which would take decades to complete, at a time when many northern observatories were turning away from this type of classical astronomy and were exploring exciting new areas of astrophysics. These chapters on the early history of Australian astronomy bring together for the first time a large body of historical work by others (such as Wayne Orchiston), but also contain much new and original research.

Another fascinating chapter in the history of Australian astronomy is the role played by amateur astronomers, beginning most notably with John Tebbutt last century and continuing through to contemporary figures

such as Robert Evans in New South Wales, the world record holder for the discovery of supernovas, and South Australian William Bradfield, renowned for his discovery of a record sixteen comets. Astronomy is one of relatively few areas of science where amateurs can still make a significant contribution to the subject, part of the reason perhaps for its extraordinary popularity amongst the general public.

As one might expect, the majority of the book is devoted to astronomy this century and, in particular, to developments since the Second World War. There is a detailed account of the efforts to develop optical astronomy on a national basis, first at Mt Stromlo near Canberra and then at the Siding Spring Observatory in northern New South Wales, as well as the emergence of radio astronomy at the CSIRO Division of Radiophysics in Sydney in the late 1940s, when physicists and engineers adapted wartime radar equipment to open up this new radio 'window' on the universe. The story of radio astronomy is treated in particular detail, and rightly so as it has undoubtedly been the jewel in the crown of Australian astronomy.

Although much of this postwar history covers familiar territory, there is a significant fraction that is new material, especially the survey of astronomy at some of the lesser-known research centres of universities around Australia. While optical and radio astronomy are now dominated by national facilities such as Mt Stromlo, the Anglo-Australian Observatory and the Australia Telescope National Facility, all located in New South Wales or the Australian Capital Territory, it has usually been smaller university centres in places such as Hobart, Adelaide and Perth that have pioneered Australia's entry into new fields such as infrared, X-ray, gamma-ray and gravitational astronomy.

Unlike many books with multiple authors, the presentation of material flows quite seamlessly. Some parts suffer from being paraphrases of other published work, attempt to pack too much information on to the page, and are likely to leave many readers feeling somewhat dazed. I was slightly annoyed by the authors' practice of referring to themselves in the main text in the third person; but overall they have achieved their goal of presenting a history which is accessible and appealing, albeit lengthy, to an audience wider than historians and astronomers. There is also a liberal helping of illustrations throughout,

many of which are published for the first time. To round off the book, there are two glossaries and the most detailed bibliography on the history of Australian astronomy compiled to date. The authors are to be congratulated on such a comprehensive and readable history, one which hopefully will encourage others to continue to explore this rich vein in the history of Australian science.

In contrast to this grand synthesis by Haynes et al., the book *Australian Astronomers: Achievements at the Frontiers of Astronomy* is a collection of transcripts of interviews that Ragbir Bhathal recorded for the Australian Astronomers Oral History Project, sponsored by the National Library of Australia. Eighteen astronomers are featured, including three whose entries are based on interviews conducted by others, years ago, before each passed away. As Bhathal states, the purpose of publishing these edited texts of the interviews is to bring to the attention of the general public some aspects of the scientific achievements of eighteen astronomers who have made, or continue to make, significant contributions to the moving frontiers of research in international astronomy.

It is difficult to find fault with Bhathal's choice of the eighteen elite Australian astronomers of the past few decades. His two criteria were that each had to be either a Fellow of the Australian Academy of Science or at one time the head of a major astronomical institution. Radio astronomers outnumber their optical counterparts (but only just) and, as one might expect, the major institutions are well represented: CSIRO (7), the Mt Stromlo & Siding Spring Observatories (5), other Australian universities (5), and the Anglo-Australian Observatory (one). Interestingly, eight of the eighteen were born overseas but all established their scientific careers in Australia. Unfortunately, as Bhathal points out, no women are included, though if the list were to be expanded (and different criteria used) it would certainly feature Ruby Payne-Scott, one of the founders of Australian radio astronomy, who took part in the early radio studies of the Sun in the late 1940s.

Bhathal introduces each astronomer with a short biographical piece and then each transcript follows in question-and-answer form. The questions are brief and to the point, and designed to encourage the subject to narrate his life's work. One gets the feeling that these astronomers have been

more open and direct in conversation than if they had been asked to commit their thoughts to paper. The result is a fresh and honest description of the events, often controversial, that have shaped Australian astronomy today. The book concludes with a novel list of 'Milestones of Australian Astronomy', together with a useful glossary and bibliography.

Despite the success of the interviews themselves, the book is seriously flawed by the Introduction, a 22-page history of recent Australian astronomy that aims to set the scene for the interviews that follow. Unfortunately, this is poorly written and contains numerous errors. In parts, one is left wondering whether the author has fully understood what he is writing about. Some sections appear to have been hastily cobbled together, while others are thinly disguised passages from other published work, often without proper credit to the original source. The Introduction improves towards the end, where Bhathal is more at home describing contemporary events in Australian astronomy, but for me the damage had already been done.

Some of these problems could have been overcome with more careful editing. For example, there is a 'side-bar' item on p. 12 dealing with the Hertzsprung-Russell diagram, which bears no apparent relationship to the main text. A disturbing oversight occurs later in the book when Bhathal fails twice to mention the name of his co-author, Graeme White, when referring to their earlier book, *Under the Southern Cross*.

Aside from these shortcomings in Bhathal's historical writing, the interviews shine through and give a fascinating insight into those who have shaped the course of Australian astronomy. The interviews themselves will be a valuable resource for future historians of science.

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James Ryan, Keith Sutton and Malcolm Baigent, *Australasian Radiology: A History*. Sydney: McGraw-Hill, 1996. xvii + 524 pp., illus., \$139.00.

Medical radiology has a long and venerable tradition of celebrating its own past, its martyrs and its heroes. Notable contributions to this tradition include Percy Brown's classic account of the early practitioners of medical radiology who

unwittingly sacrificed health and life in the practice of their craft, and E.N.R. Grigg's massive *The Trail of Invisible Light*, a lively and anecdotal account of personalities and technology of both the 'gas tube' era and of the succeeding era when the advent of the Coolidge X-ray tube and of innovative systems of radium dosimetry brought medical imaging and radiotherapy to their first period of technical maturity. But these classics of the genre reflect their American origins in content and emphasis. For the beginnings of medical radiology in Australia, J.P. Trainor's *Salute to the X-ray Pioneers of Australia* has long been an invaluable and much consulted source. The histories of some of the major hospitals that have been published provide some of the later story, and for the history of radiology in Victoria to 1940 there is M.M. McKeown's University of Melbourne MD thesis. There have also been occasional contributions to the history of the subject in Australia in the journals of the Royal Australasian College of Radiologists (RACR) and the Australian Institute of Radiography. Some of these are scholarly and well-documented explorations of the early history, valuably supplementing and deepening Trainor's account. More typically, however, contributions to the later history have been cast less in the modes of formal history than in the modes of the anecdotal memoir. In these the authors celebrate former colleagues and mentors, and recollect in tranquillity the joys and frustrations of working with the equipment and technologies of earlier days.

Until now there has been no comprehensive account of the history of radiology in Australasia. But the centenary of Röntgen's discovery of X-rays and of their first production and exploitation in medicine in Australia and New Zealand has now been marked by the publication of this book, which aims to provide the comprehensive account that has so long been needed. The authors are well-qualified for undertaking this difficult project: James Ryan is a radiologist and former editor of *Australasian Radiology*, the journal of the Royal Australasian College of Radiologists, Keith Sutton is a professional writer and editor, and Malcolm Baigent is a New Zealand-based radiologist.

A problem facing anyone undertaking a project such as this is the availability of sources. Although the RACR has, under the guidance of Dr Morris Owen, built up over the years an archive of documents and

memorabilia relating to the history of radiology in Australia, far more primary source material exists, of course, in government and major hospital archives. But constraints of time, the fact that the records are held, if they are still held at all, by many different institutions and organizations around the country, and the need to use the good offices of colleagues on the spot to search and extract information from available records, has limited the use which has been made here of primary source material. Granted, however, that there were these obstacles to making fuller use of the archives, it is surprising that no use appears to have been made of the reports of the sub-committees of the National Health and Medical Research Council concerned with radiology from the 1940s to the early 1960s. In compensation for the limited use they have been able to make of archival records, the authors have been well situated to gather a rich harvest of personal communications from senior figures of Australasian radiology, giving the key facts about their professional careers and the radiological departments with which they were affiliated.

This material, supplemented with information on the pioneering generation of radiologists drawn with due acknowledgement from the available secondary sources, forms the core of the book. In this way, virtually every significant figure over the last century in the relatively small professional community of Australasian medical radiology, and every major institution possessing a radiology department, have been given at least passing notice. This does put the book at risk of seeming a mere compilation of biographies of radiologists and local histories of radiology at various centres and institutions across the country, but introductory sections to most chapters sketch general developments in the period concerned, to provide a context for the material that follows. The concluding chapters shift the focus from the radiologists and the departments in which they worked to the local firms and technical people who manufactured and serviced equipment, the evolution of the technology, the development of concepts and standards of radiation protection, radiology in the services, and the history of the local radiological societies. There is a bibliography but no endnotes or

footnotes.

This book, therefore, is a history as insiders see it of a professional community defined by its control and use of a medical technology—a kind of collective autobiography of the Australasian radiological community. As such, it has both the strengths and the limitations of its genre. It is 'internalist' history in the strongest sense, closely focused on practitioners and the context of autonomous technical progress and innovation in which they worked. Little is said, on the other hand, about the social and professional contexts in which the diagnostic and therapeutic branches of radiology emerged—not without resistance from some medical conservatives—as fields of specialist medical practice in Australia. Similarly, the impact in the 1920s of new methods of radium and deep X-ray therapy, which seemed to promise breakthroughs in the clinical management of cancer, is treated only superficially. Some of the major initiatives that ensued—the successful fund-raising 'cancer campaigns' in some states, the Commonwealth government's purchase of radium—are briefly noted, but little context is given to explain why these initiatives were taken. An interesting story could have been told here about the way societal expectations and perceptions can influence the adoption and implementation of new medical technologies. This theme, however, is briefly noticed in the interesting and valuable chapter on the development of mass screening mammographic services.

In any work of this scope, there will be some statements and judgements that may be questioned. I would question, for example, the statement of p.11, made with reference to Campbell Swinton's method of exciting his X-ray tube by high-frequency currents from a Tesla coil, that 'the high frequency approach to generating high currents was accepted as standard' by the medical profession in Britain and the Commonwealth, when in fact most of the profession stayed loyal to Röntgen's ordinary induction coil in the gas-tube era. The 'George de Hevesy', mentioned on p.482 as a pioneer of radiotracer techniques, is George von Hevesy, winner of the Nobel Prize for Chemistry in 1944. The suggestion made here that he resided in the United Kingdom is misleading; his residence there was brief, while he was a research student under Rutherford at Manchester before the First World War.

When all reservations and caveats have been made, however, this book will be for many years to come an indispensable resource for anyone interested in the subject, and the authors and the many collaborators around the country they enlisted to obtain information should take pride in what together they have produced.

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Geoff Raby, *Making Rural Australia: An Economic History of Technical and Institutional Creativity, 1788–1860*. Melbourne: Oxford University Press, 1996. xiii + 217pp., illus., \$29.95.

The encouragement and promotion of 'economic champions' is part of the current argot of economic rationalist governments. The period covered by this book provides rich veins of the changing interaction between bureaucratically-governed colonies and the relatively unfettered opportunism of individual enterprise. Geoff Raby, an economic historian and latterly Government trade negotiator, contends that 'many factors come together, interact and reinforce each other, to produce economic champions in the pursuit of technical and economic growth'. In *Making Rural Australia* he makes a well-argued case that Australia's early innovativeness was essentially market-driven, with relatively few judicious and strategic government interventions. Raby's analysis provides, perhaps unintentionally, a template to put some flesh on the often cliché-ridden current debate on the role of government in encouraging economic growth. The language includes the vernacular of modern economic debate, with chapter titles such as 'No free lunches', 'Adding value on the station', and 'Supplying public goods'.

The focus of this book is the source of technical change in agriculture and the adaptation of technology in the era of European history of Australia preceding the period of more rapid, and better recorded, technical change after 1860. The Introduction sets the scene with an incisive consideration of the antecedents and nature of technical change. Five of the seven chapters in the book are concerned with technical creativity. The final two chapters consider institutional creativity and adaptation. The period provides a particular challenge for historical research on the

identification of technical change because of the absence of time series data and the need to use various secondary sources of information.

After 1860 technical innovation became more intensive, with world industrialization and Australia's rapid growth as a consequence of gold mining. Raby chose the period prior to 1860 because it has been perceived as a time of little technical change. In this period it has often been assumed that Australia was technically backward, even though real gross domestic product was increasing at an annual average rate of ten per cent between 1820 and 1850. While the genetic improvement of the Australian merino and the invention of Ridley's wheat stripper are well known, the less obvious and slower accumulation of other technical knowledge has tended to be ignored. Raby contends that the development of technical innovation in this period was a significant and essential springboard to later technical change and consequent economic growth.

In the first years of colonial settlement, Arthur Phillip's attempts at achieving food self-sufficiency failed. The inexperienced military directed unwilling convicts to farm an unknown and apparently inhospitable environment with generally inappropriate husbandry techniques. This soon changed. Raby shows that in the early years of settlement the land was anything but inhospitable and that conditions soon allowed human adaptation to make its mark. He also suggests convict intellectual capital, related to farming skills, may have been higher than previously acknowledged. Adaptation was easier with each set of new arrivals, as they could learn about seasons and soils from those already present and without the costs and risks of experimenting. In the first three chapters, Raby carefully categorizes and documents these technical adaptations that enhanced rural productivity.

In a chapter concerned with change in farm tools and equipment used in arable farming, Raby shows that there was no lack of creativity in response to commercial possibilities of technical change. He makes the important point that, for the period preceding 1821, the non-pastoral sector was considerably larger (in terms of value of output) than the pastoral sector. The absolute value of production was still small and was determined by the size of the domestic market. After 1800 public support for technical change was no longer so

pervasive, as the food supply had been secured and private sector interest in transfer of livestock increased. However, it should be remembered, when analysing the technical change as a response to markets in this period, that the growth in the demand for cereals was driven by a publicly-subsidized market based on British convict transportation.

The idea of factor endowments of frontier colonial societies being different to that of 'metropolitan' colonizers is well known—the former are land extensive and the latter land intensive. Two particular corollaries are explored by Raby. The first is the contrary efficiencies of labour and land use in these different circumstances. In a chapter titled 'Wasting the Land', he describes the Cumberland rotation. The two-course rotation was the first major technical innovation in arable farming made by European farmers in Australia. It reflected the low price of land and it employed a bush fallow—without the need for manuring or planting nitrogen-fixing plants—as a form of shifting agriculture within a single holding. When soil fertility was depleted, another plot would be cultivated and regenerating *Acacia* species would slowly replenish the depleted land. While the practice was at odds with English crop husbandry practices, for prevailing Australian conditions the rotation maximized farm output and, by growing two crops—wheat and maize—minimized production and market risks. A piece of land was cropped continuously for between three and six years. Raby speculates that, with three years' cultivation, a typical farm with multiple crops may have completed its rotation in eleven years. The system only became unsustainable when population increase, capital accumulation and rising land prices encouraged greater intensification of land use in arable farming. Today, environmentalists with a counter-intuitive focus on the short-term rather than the long-term would object to the short-term 'resource depletion'.

The different factor endowments also pointed to the folly of slavishly following international (English) best practice, encouraged by English-orientated agricultural 'improvers' who visited Australia and wrote about colonial affairs. The difference between technical and economic efficiency frequently still confuses technically-orientated scientists and is likely to ensure that the current fashion for 'best practice techniques' is unlikely to be an

enduring one. Raby, in cautiously citing the association of population density per unit of land with the technical evolution of agricultural systems, also appears to have fallen for the folly of assuming that technical ratios in one country necessarily apply in another.

Institutional innovations and adaptations are considered in chapters on (private) collective action and on the supply of public goods. The purpose of government in the eighteenth century was simply to govern, which meant keeping order and maintaining security and stability in domestic and foreign arenas. In the case of the early Colonial government of New South Wales, this meant ensuring food security, including the first, often later-repeated, floor-price scheme for wheat. In the nineteenth century, prior to 1858, public expenditure on botanic gardens was the main means of public support for technical change in agriculture. This activity provided a pathway to more extensive government-supported activity. Subsequently government experimental stations and other forms of public activity became more common. Non-government institutional activity was most commonly undertaken by collective agricultural 'scientific' societies or associations. Their activities included plant exchanges, the sharing of seeds obtained from overseas and the dissemination of information. Today, governments in many parts of the world are reassessing the efficacy of current public-agency programmes to encourage technical change in agriculture. The examples considered here, including public subsidy of private collective action as an alternative to public agency activity (in today's parlance, 'strategic alliances'), provide some insights into alternative forms of collective action.

Government intervention is most commonly justified when market failure occurs. Market failure means the private market mechanism alone cannot perform all economic functions for appropriate resource allocation, such as when property or ownership rights are difficult to enforce. The desirable balance of government and private activity in an economy is always contentious and contestable. The balance reflects evolutionary structural change, social or political fashion change, or political opportunism. Historical antecedents are also important in determining the culture for public or private economic activity.

Raby's analysis rectifies the lack of

documentation of a critical period of technical change in Australia's early economic development. It is a valuable contribution. The period is apposite because after 1861 the colonies of New South Wales, Victoria, Queensland and South Australia introduced land selection Acts, often with unfortunate economic and technical consequences. The consequential government response was much greater intervention to attempt to 'engineer' technical change. Raby's book allows a consideration of the circumstances before this expansion of government intervention. The book is drawn from the author's PhD and Master's theses. The writing is clear, well-organized and extensively footnoted. Its thesis origins intrude only to the extent that its style of detail and rigour may deter a more popular readership.

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Trevor Ophel and John Jenkin, *'Fire in the Belly': The First Fifty Years of the Pioneer School at the ANU*. Canberra: Research School of Physical Sciences & Engineering, ANU, 1996. 157 pp., illustrated.

When the Second World War ended in 1945, the Chifley government took two steps that marked a new relation between universities and government. At the time these decisions appeared to be wholly beneficial, but now they show a darker side.

The first decision was to create the Commonwealth Reconstruction Training Scheme (CRTS), to provide support for returning servicemen and women to take up their education where they had left it off to enlist. As one of the recipients, I was able to get married as well as pick up the mathematics and physics course which I had left four years before. Others, who had never even contemplated a university course, were able to start, and among those are many who have become highly distinguished. When the supply of returnees began to dwindle, the CRTS was turned into the Commonwealth Scholarship Scheme, which later evolved first into the Whitlam TEAS program and eventually into HECS. In this way the federal government enabled the number of students to grow from an immediate postwar number of 20,000 to the

present mammoth 600,000.

The second decision was to create the Australian National University, an institution devoted solely to research, initially within four Research Schools. Out of this first direct but quite specific interest of the Federal Government in tertiary education grew its present complete involvement, and all that has meant to the development of academic life in this country.

One of the Research Schools was the Research School of Physical Sciences (RSPS), the history of which is described in this book. The authors, Trevor Ophel and John Jenkin, are very well qualified to do this as they have both been associated with the School, and Ophel still is. John Jenkin now lectures on the history and philosophy of science at LaTrobe University and has written extensively on historical aspects of Australian science. The account which they give of what has been a very colourful episode is, in my view, an honest one, but the historical writing proper forms only part of the book. The remainder, which covers the many components of the School that were created in the past fifty years, reads more like a condensed series of annual reports and is not very exciting. It was in the nature of the School, or more correctly of its Directors, that it should be continually seeking to widen the range of activities covered. So from an initial concept of a particle physics laboratory with collateral interests in nuclear physics, the School has, over the years, included Applied Mathematics, Astronomy, Atomic and Molecular Physics, Electronic Materials Engineering, Geophysics, Laser Physics, Mathematics, Plasma Physics, Solid State Physics, Systems Engineering, and Theoretical Physics. Some of these, such as Geophysics, have become separate schools, whilst others like Solid State Physics have ceased to exist. The book attempts to give some account of all of these in the form of brief summaries each written by a member of the corresponding department, and it is not surprising that this is not particularly successful.

The first steps in the creation of the ANU have been reviewed in many places. It is well known that of the initial distinguished members of the Academic Advisory Committee—Florey, Hancock, Oliphant and Firth—only Mark Oliphant decided to make a go of it, and there were no half measures about his vision. He wished to bring Australia right up to the forefront of the most advanced part of science, high energy

physics. At the time of his acceptance of the Directorship in October 1948, design studies were in progress elsewhere for a 'big' machine, a particle accelerator reaching energies above 1Gev. Indeed, a machine of this size was already under construction in Birmingham, under Oliphant's leadership. However, for the RSPS Oliphant had higher aims, and if he had succeeded there is no doubt, in my mind at least, that the standing of physics in Australia, both in the international scientific world and in the eyes of the general community, would now be very much higher than it is. But he did not succeed, and the first part of the book sets out clearly why it was never really a possibility.

First of all, Canberra was then a small town, population about 30,000, with no experience in heavy engineering let alone the highly sophisticated techniques that would be required here. Second, the design of the accelerator was entirely novel, and many problems were encountered for which there were no precedents. Third, although the money available (£500,000) was enormous compared with what Australian physics departments had been used to, it was still small in comparison with American spending. Given unlimited money, perhaps all the problems would have been solved, even when the whole design was radically changed in 1953. Certainly the team around Oliphant worked with great dedication to achieve some remarkable engineering, in the face of the growing realisation that the overall scheme would never eventuate. Although the homopolar generator was finally fully operational in 1963, and is still the largest homopolar generator ever built, there was no longer any question of proceeding with the construction of the accelerator, and Oliphant resigned as Director in 1963.

Ophel and Jenkin have done a good job in presenting this rather tragic story with sympathy and show very clearly how the technical problems proved too much. In the meantime, the Americans had gone ahead with much more money and much less originality to build two big machines, and Europe and the Soviet Union followed soon after. Australia was put very firmly in its place.

Also in the meantime, Ernest Titterton was proceeding with a programme to construct a nuclear physics laboratory of world standing. Initially he and his group intended to use the big machine when it was

ready, but the authors suggest that Titterton soon realised that there would be a very long wait, and so moved to purchase an independent machine with £600,000 from the federal government. With this came the parting of the ways between Oliphant and Titterton, as that sum was as much as had been spent up to that time on the big machine. Although nuclear physics is not the forefront science that it once was, the RSPS nuclear physics department has been able to maintain its position by judicious input of new equipment.

After the drama of the failure of the big project, the RSPS has had a more conventional existence under a succession of directors and a succession of reviews. There have been major departures from the School over the years, including Geophysics (now called Earth Sciences), Mathematics, Information Science and Engineering, and the Computer Centre. One department, Astronomy, which was incorporated very early into the School, has pursued a very successful existence after separating in 1986 to become the Mount Stromlo and Siding Springs Observatories. The story of astronomy in Australia is one in which big science has managed to maintain its standing, helped in the first instance by the valuable fact that northern observatories cannot see the southern skies, skilful lobbying of the federal government, and undoubted scientific excellence. Very large pieces of equipment such as the Anglo-Australian Telescope and the 2.3m telescope became available to the astronomers, and the radio astronomers were not far behind.

The final chapter, provocatively entitled 'A Rogues Gallery', gives a set of thumbnail portraits of the six Directors and of Ken Le Couteur, who quietly but effectively assumed the position of Acting Director during two interludes. The past Directors—Oliphant, Jaeger, Titterton, Street and Carver—were all powerful personalities, and they were certainly not universally liked. Ophel and Jenkin are frank about their successes and failures.

One notable omission is an account of the relation between the RSPS and the physics departments in the State universities. Mention is made at the beginning of Laby's initial warm support for the idea, followed by some cooling off when he realised the difference between the support promised to Oliphant compared with the total amount of £30,000 for all universities in all faculties. Relations between ANU and the

State universities over the following years have ranged from warm co-operation to sharp jealousy, depending to some degree on the attitude of the incumbent Director towards the State departments.

The authors begin the Introduction by saying modestly that 'It is somewhat pretentious to call the present work a history', and to a certain extent I must agree. But that must not hide the real contribution they have made in presenting a story which contains so many lessons for the future of Australian science. Their presentation of the necessarily complex technical matters is authoritative and balanced, and their analysis of the personal and political factors that played so large a part in the early history is perceptive and fair. The first half is therefore no tedious litany of self-congratulation, and it is to be hoped that when a more definitive version is produced, the latter part of the book will be similarly appraised.

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Ed Muirhead, *A Man Ahead Of His Times: T. H. Laby's Contributions to Australian Science*. Melbourne: University of Melbourne School of Physics, 1996. xiv + 120pp., illus., \$23.95.

This book is indeed a welcome addition to the steadily growing information about the development of indigenous science, particularly physics.

Research and research training in physics began at the University of Sydney under Richard Threlfall from his appointment in 1886. The opening of Australia's first Physical Laboratory there in 1888 made a profound impression on the young William Bragg and became a model for the rest of the country. Physics came of age at the University of Melbourne under Thomas Ranken Lyle. Thomas Howell Laby, the subject of this sensitive memoir by a former Chairman of Melbourne's School of Physics, Ed Muirhead, was Lyle's immediate successor in the chair from 1915, a post he enriched for the next 27 years. Muirhead deserves the thanks of the physics profession for his worthy tribute, commemorating the fiftieth anniversary of Laby's death. Although we can read elsewhere the scope of Laby's achievement, the fully

documented evidence that Muirhead assembles enables one to savour the greatness of the achievement.

There is more to Laby than *Tables of Physical and Chemical Constants* (with Kaye), some mathematical functions and a string electrometer. Muirhead unfolds the career of the first born-and-reared Australian to hold an Australian chair of physics in a seamless text. Dispensing with the interruption of chapters, the narrative flows chronologically, with headings announcing the turn of events or subject. Under the heading 'The Early Years', we make our acquaintance with an 'Aussie Battler': broken education, unmatriculated but still a junior demonstrator in Liversidge's Chemistry Department at the University of Sydney from age 20 to 24.

The conditions found in Sydney stimulated his talent for research. He teamed up with Douglas Mawson, who found Laby single-minded in his pursuit of research and without leisure activities. This may be an early signal of later personal inflexibility. A balancing fact at this time (though Muirhead does not mention it) is that Laby also helped in setting up the Science Society. His involvement in affairs beyond the laboratory first comes to notice here.

Laby next moved to the Cavendish Laboratory under J.J. Thomson for five years. The same environment that formed Sydney physics was to mature Laby and later consolidate Melbourne physics. It is by reflecting on the evidence from this period that we can appreciate the range and versatility of Laby's capacity and the significance already achieved by his work. He reached the first rank in research and a chair seemed likely. But as good as Laby was, the chair vacated by Liversidge at Sydney was not to be his. Instead he went to a new chair at Victoria College, Wellington. With a few deft strokes, Muirhead brushes in Laby's New Zealand activities: setting up the department, continuation of his Cavendish research programme, membership of the University Reform Association and the Round Table Movement (fostering Empire affairs). Appropriately, the chronological sequence is interrupted here to consider Laby's relationship with Rutherford.

The story resumes with Laby succeeding Lyle in the Chair of Natural Philosophy at Melbourne a few weeks before the Anzac tradition was to be born at Gallipoli. The year 1915 marks the point where the

subsequent development of the departments of physics at Sydney and Melbourne diverge significantly. At Sydney, three out of the four full-time members of staff went to the war, while at Melbourne it appears that none of the full-time staff went. At war's end, multiple chairs in physics were proposed at Sydney to manage the diversity of the subject, as had already happened in chemistry, but to no avail. Laby too had proposed a second chair to relieve the heavy teaching load brought on by the post-war flood of students, though this hardly is an example of his being ahead of his time as Muirhead suggests. However, Laby was successful in increasing the number of his staff, even if not to the desired level, whereas Sydney's decreased by one.

In reflecting further on the effect of the Great War on the development of the two departments and the fact that Australia was all too soon to be plunged into a second World War (the physicists' war), it was well that Melbourne's development was uninterrupted. Similarly, we are told that Laby, Secretary of the Melbourne Round Table Group, was chagrined at the possibility of a 'no' vote to the 1917 referendum on conscription. We are told that Laby considered the teaching of Physics Part I 'properly' his single most important task, but he was held to be a 'terrible' lecturer. We are told that Laby had a profound knowledge of social philosophy and politics, yet later we learn that he would storm out of meetings or resign in protest. On this last point, Muirhead is right to point out the effect of failing health on his behaviour. Nevertheless, the character that will make Melbourne physics great is the same character that on the stage beyond the department believes itself to be indispensable.

Muirhead pauses to give an overview of Laby's eighty-one published works before plunging into the excitement of the Melbourne years. By working usually with collaborators, Laby orchestrated a virtuoso performance of experimental physics enhanced with experimental best practice, that ranged from the classical (determination of the mechanical equivalent of heat and thermal conductivity), to the modern (the study of X-rays and their application, and nuclear physics), and on to extra-mural collaborations (in cancer research, the setting up of the Commonwealth X-ray and Radium Laboratory, the Imperial Geophysical Experimental Survey, radio

broadcasting problems leading to the Radio Research Board, and the wartime Optical Munitions Panel). Remarkably, towards the end of his career comes a piece of pure research that harks back to J.J. Thomson and the Cavendish: a measurement of the value of the electronic charge.

Muirhead devotes considerable space to the determination of the mechanical equivalent of heat and to the Radio Research Board. The former is a tour-de-force, a bench-marking standard, while the latter collaboration trained many first-class research workers, some of whom were vital to the wartime development of radar and the emergence of CSIR radiophysics.

After acquainting us with the range of Laby's achievements, Muirhead evaluates them under a series of headings involving research, the Melbourne years and his extramural contributions such as involvement in public policy formation, the setting up of the Australian branch of the Institute of Physics and proposals for a Commonwealth university, which eventuated as the ANU. The difficulties of Laby's final years and resignation are squarely faced, and a summary of his life and influence, flavoured by a number of testimonials, draw the text to a conclusion. There are many useful appendices that not only quantify Laby's achievements but also give the research output of the Department of Natural Philosophy during his tenure. Having gone that far, the Melbourne saga is completed with a short reference to the story surrounding the Grayson diffraction-grating ruling engine (which did not involve Laby). Particularly impressive is the list of Melbourne postgraduates who went on to the Cavendish, mainly on 1851 Exhibition scholarships. It reads like a Who's Who of Australian physics.

I have some difficulty with the title of the book. Whose time is Laby ahead of? If it is the University of Melbourne's, I have no problem, but the subtitle suggests it is of Australian physics. To make this claim one has to know what the rest of Australian physics was doing, and that evidence lies elsewhere. Sir Harrie Massey's appraisal, quoted by Muirhead, seems fair: 'being in advance of his time in appreciating the vital role which applied physics should play in national life'. A second piece of evidence provided by Muirhead is that Laby first suggested approaching the Commonwealth Government to support university research financially, but this was under the stimulus of establishing the Radio Research Board,

something that others besides Laby had a good deal to do with. The third piece of evidence regarding multiple chairs has been discussed above. Being first does not necessarily mean being ahead of the times.

Nevertheless, the above reservation is minor when compared with the comprehensive account of Laby's achievement given by Muirhead. The centrepiece of that achievement is surely the pre-eminence of the Melbourne Nat. Phil. Department in the Australian universities of Laby's time. That alone is sufficient to justify the care invested by Muirhead and the Melbourne School of Physics in its recalling in this memoir.

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Arthur J. Birch, *To See the Obvious*. Washington, DC: American Chemical Society, 1995. xxviii + 269 pp., illus., US\$34.95.

This is the autobiography of an Australian boy who made good: awarded an MSc in chemistry by the University of Sydney (for a 25-page thesis!), supported by an 1851 Exhibition scholarship to complete a doctorate at Oxford, wartime work on steroids which laid the chemical foundation of the contraceptive pill, appointment to the Sydney chair in 1952 at age 37, subsequent chairs in England, and the foundation Deanship of the Research School of Chemistry at the ANU. Birch was a leader in the laboratory as well as in the politics of Australian science. In the 1970s, he chaired the first in what was to become a succession of major reviews of the government research organisation, CSIRO.

Arthur Birch, who died late in 1995, was arguably the best chemist Australia has ever produced. His specialty was natural products (that is, chemicals found in higher plants and micro-organisms), and his contributions ranged over structure determination, laboratory syntheses and biosyntheses, which he explored through isotopic labelling. His use of dissolving metals in liquid ammonia to effect novel changes in aromatic ring structures was named the Birch Reduction, and there is hardly an organic chemist who would not have made use of it at some time or other. Birch's work was marked by an apparent simplicity that led one admirer to remark

'you are the best person I know for seeing the obvious', and it was this idiosyncratic approach to chemical problems that made him widely sought as a consultant.

Birch's autobiography is the last in a series of twenty-two commissioned by editor Jeffrey Seeman on behalf of the American Chemical Society and published during the first half of the 1990s. Seeman was never content to accept what his authors first produced for him and, as a result, Arthur Birch worked on his manuscript for ten years before Seeman was happy with it. They were just in time, because Birch died a few months after the book's publication. Seeman's badgering of the author is clearly evident in the chapter that Birch entitled 'Random Conversations with the Editor', but reading other volumes in the collection enables one to identify other editorial influences such as the authors' pithy and insightful comments about their contemporaries and the personal photographs scattered through the text. Neophytes always chuckled when Birch introduced into chemical conversations such clichés as 'pious hope' and 'the eye of faith'. Here he expatiates on Robert Woodward—a good poker player, prepared to lose but seldom did; Gilbert Stork—by his own estimation the world's second-worst car driver; and the great Robert Robinson, Birch's supervisor at Oxford, who 'often wasted ... his great intuition'.

Although this book is about Arthur Birch and his chemistry, the thoughtful reader will find in it much to ponder: the role of scholarships in making possible undergraduate study in Australia followed by a higher degree in Britain; the impact of air travel in facilitating face-to-face contact for members of the invisible college; science politics and the growth of the Australian National University; and the nationalism that brings successful Australians back from overseas. Those unfamiliar with the structural formulae and the logic of organic chemistry will find, I think, that it is possible to skip the chemistry and still get a lot out of this splendid autobiography.

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G. and J. M. Scurfield, *The Hoddle Years: Surveying in Victoria, 1836-1853*. Canberra: The Institute of Surveyors Australia, 1995. 144 pp., illus., \$29.95 pb.

While historians and cultural geographers

have in more recent times explored the carving up of the continent in terms of spatial symbolism, practical studies of land survey itself have been conspicuously absent. Where Paul Carter, for example, has boldly tackled spatial history from the viewpoint of the geographical imagination, the Scurfields' book is a much-needed chronicle of the historical geography of land use in Victoria over the first two decades of settlement, from 1836 to 1853. Where other works, too, have long since recorded moments in surveying achievement (for example, Volume 5 of *Historical Records of Victoria*), *The Hoddle Years* takes us over not only those initial town-building years of the late 1830s, but also through an important era of colonial land legislation up to Hoddle's somewhat inglorious retirement in 1853.

This is a book of three distinct parts, amply illustrated throughout with many cartographical surveys. The first part deals with Robert Hoddle's training and early career, his appointment as Officer-in-Charge of the Survey Department in 1837 and then first Surveyor-General of Victoria until 1853, and the evolution and work of the Survey Department more generally. Details of Hoddle's background are sketchy. At the age of 15 he was a cadet in the Corps of Military Surveyors and Draftsmen, completing by 1812 a three-year course including instruction in mathematics, astronomy and topographical drawing. After a trying six-month stint of surveying in South Africa, Hoddle reached Australia with a letter of introduction from the Governor of Cape Town to Sir Thomas Brisbane, Governor of New South Wales.

Hoddle's first appointment was as temporary assistant surveyor in 1823, and he rose to the rank of senior surveyor in 1828 after a brief interlude as Acting Deputy Surveyor General. In February 1837, Hoddle was instructed to accompany Sir Richard Bourke, Governor of New South Wales, to the newly established settlement at Port Phillip. Though the history of the Melbourne Survey has been rehearsed elsewhere, the chronology of the enterprise and detail of the incompetence of the assistant surveyors are worth revisiting. Hoddle eventually assumed responsibility for the Melbourne survey, despite allegations of misconduct over his forage allowance, and it is here we get the minutiae of departmental affairs, the introduction of contract surveying, and the general functioning of

the Survey Department as a whole.

While Hoddle's profession was one that he claimed to be his 'chief delight', illness dogged his career through the 1830s and 1840s. Hoddle's term was marked by his constant requests for leave or retirement on gratuity, leading for a time between 1840 and 1841 to his standing down from duties. Despite financial strictures, from 1845 to 1850 the Survey Department continued its work of parish survey, subdivision and land sale, with an increase of staff from three to 31 surveyors and draftsmen. Hoddle seemed periodically discontented with his remuneration, particularly after the discovery of gold saw the salaries of more junior staff increased against his own. An 1853 request for two years leave in England gave La Trobe the opportunity to reconsider Hoddle's role and force an unwilling retirement.

The second part of *The Hoddle Years* concentrates on colonial land legislation, and forms perhaps the most useful part of the volume. There were at least seventy Home and Colonial Acts affecting Crown Lands between 1831 and 1847, and this section includes detail and implications of successive legislation to regulate the subdivision, occupation, lease and sale of colonial land. Rules had been established by the mid-1820s for the systematic survey and subdivision of land in New South Wales into counties, hundreds, parishes, sections and allotments, with provision for square-mile township and half-square-mile village reservations, together with reserves for roads and other public purposes. The 1830s saw successive legislation regulating modes of acquiring land, with land to be obtained by purchase at public auction rather than by direct grant. Following the voiding of Batman's treaty with the Port Phillip Aborigines in 1835, the Squatting Act opened up the Port Phillip District for settlement in September 1836, and by the end of the decade Port Phillip had become the southernmost of the nine squatting districts.

The third section details the nature and extent of work carried out by the Victorian Government surveyors between 1836 and 1853, the results of which culminated in Arrowsmith's *Map of the Province of Victoria*, published in London in 1853. The authors suggest that the claim of this map as being principally derived from Hoddle's surveys is an exaggerated one, and that while Hoddle clearly played a significant role in the laying out of Melbourne, his subsequent work (the scope of which was

reflected in Kearney's 1855 map of *Melbourne and Suburbs*) was more of piecemeal accretion than visionary planning. The work of earlier surveyors, explorers and overlanders—Bass, Flinders, Murray, Grimes, Hume and Hovell, Henty, Wedge, Batman, Sturt and others—had prior to 1836 laid the foundation for coastal and inland survey. The progress of land survey from 1836 to 1853 is elaborated in terms of settlements (notably at Melbourne, Williamstown, Geelong and Portland), thoroughfares, sales and licensed occupation of Crown land, coastal survey, and boundaries of counties, squatting runs and the Port Phillip District itself.

The Scurfields' intimate departmental history—its chronology, bureaucracy, legislative framework and geographical scope—adds a much needed chapter to the history of surveying more generally, and clears the way for further reflections, more particularly on the science and symbolism of the profession. In cultural terms, the elevation of Hoddle to the status of founding visionary is premised on his role in choosing the site of Melbourne as well as executing the grid plan with its celebrated wide streets. It was clearly Governor Bourke's intention to instruct Hoddle personally in the survey at Port Phillip. On 4 March, Bourke rode over the ground with Hoddle and 'traced the general outline of a township', concurring with the spot chosen by the initial settlers. On 7 March, Bourke 'Directed the town to be laid out', and on 9 March chose 'Melbourne' (after the British Prime Minister of the day) as the name of the new settlement on the northern bank of the Yarra River. On 22 March, Bourke 'Inspected the progress of Mr Hoddle in laying out the Town of Melbourne', and on 25 March 'Made a second inspection of the Town for the purpose of fixing the levels of the streets and arranging the conditions for sale of building allotments'. Hoddle's field book states that the line of the streets was pointed out by the Governor. The final say over the choice of Melbourne's site was Bourke's, but it is clear that just as Lonsdale had found it convenient to locate his administration at the place where settlers had already congregated, so too Bourke fell in with the general consensus, directing a town to be laid out on the site 'selected for a settlement by Mr Batman', a spot 'appearing to be well chosen'.

Just as there has traditionally been keen debate over who chose the site for Melbourne, the circumstances of the execution

of the town plan itself are shrouded in controversy, the design being attributed variously to Bourke, Russell, Hoddle, Lonsdale, even La Trobe. Analogous to the search for a foundillg 'father' has been an apparent desire, as in other cities, to pay homage to a single architect of the city's streets. Hoddle informed Bourke of the progress of Russell's survey party, noting that a 'small plan of the settlement was produced by Russell, on which I have shown the Town of Melbourne'. Hoddle reported to Perry that Bourke instructed him 'to lay down the Towns of Melbourne and Williamstown', and that from Russell he 'could only obtain a plan of the settlement executed by himself and Mr D'Arcy, on which I drew a plan of the Town of Melbourne'. Perry notified Bourke that he was transmitting Hoddle's plan of the Town of Melbourne, which he had recently received, for official approval, and by the end of April, Hoddle's plan of Melbourne had been placed in the Survey Office 'for public inspection and reference'.

It is Robert Hoddle who has been most widely recognised as the planner of Melbourne; Russell, in some eyes the originator of the plan, himself claimed 'I was with him [Hoddle]; I did not help him to survey'. Russell saw Hoddle as a fairly slapdash surveyor, not necessarily particular in his technique, but 'a good chainman for the Government, inasmuch as he chained the land very quickly, and got it into the market quickly, and that was what the Government wanted'. Russell claimed to have accompanied Hoddle when he chained the streets of Melbourne, being consulted frequently about his original plan of the settlement.

Apart from the use of his name in the form of the city he planned and in one of its main roads, Robert Hoddle is a man rarely memorialized. The Scurfields' account of his years in the Survey Department gives long overdue substance to a surveyor, in the words of Manning Clarke, 'with geometry in his soul'.

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