Electricity supply for Launceston, c1894.
QUEEN VICTORIA MUSEUM AND ART GALLERY, LAUNCESTON

CHAPTER 54

SCIENCE, PURE AND APPLIED

R. W. HOME

SCIENCE HAS BEEN a significant factor in the Australian experience at least since the time of Lieutenant James Cook's expedition to the South Seas to observe the transit of Venus across the face of the sun in 1769. Joseph Banks and his entourage were travelling with Cook aboard the *Endeavour*. Australia so captured Banks's enthusiasm that he became a leading advocate of its colonisation by British settlers. With settlement achieved, he became a patron of the scientific exploration of the continent, sending out a series of trained botanical observers to collect specimens for study and classification by experts in London. His activities are extensively documented in Warren R. Dawson's magnificent calendar (1958) of the Banks correspondence and McMinn's biography (1970) of Cunningham. The definitive study, however, has still to be written.

Banks's interests were almost exclusively botanical and the other sciences had to find patronage elsewhere. The exploration of the continent continued to be accompanied by the scientific investigation of its unique flora and fauna and of its geological features. With no facilities, however, for providing even the most rudimentary training in science—these came only with the founding of the first universities in Sydney and Melbourne in the 1850s—the Australian colonies remained entirely dependent, scientifically speaking, on imported skills. Furthermore, the number of trained people in the country long remained too small to form self-sustaining institutions or to maintain locally based scientific publication outlets. Serious scientific work thus continued to depend on official patronage, and Australian workers continued to be regarded primarily as collectors rather than recognised authorities on Australian materials. The basis of scientific decision-making and authority remained firmly in Europe, in the hands of men like Richard Owen and William Jackson Hooker, who classified the materials sent to them by their colonial correspondents and published descriptions of them. This pattern is brought out very clearly in Hooker's Van Diemen's Land correspondence (Burns & Skemp, 1961).

A similar relationship of dependency existed even in sciences such as astronomy and geophysics, where Australia's southern location gave it peculiar advantages for certain kinds of observing. Here, too, it was not until after 1850 that sufficient Australian resources could be mustered to sustain a significant program of locally directed scientific work. Until then, Australia served merely as a convenient fixed platform for temporary observatories established under direct British aegis, whether at Sydney Cove in 1788 (McAfee, 1981), at Parramatta in the 1820s (Russell, 1888) or at Hobart in the 1840s (*Annals of science* 39, 1982, 6, 527–64).

The pattern of Australian scientific work changed dramatically during the latter half of the nineteenth century. Though scientific exploring continued to be a major focus of activity, this now tended to be carried out under local rather than European auspices (Spencer, 1932, shows a late example of this). Collectors continued to scour the bush for specimens for the European and American markets (Bischoff, 1931), but as time went by, more and more of the material collected found its way, at least in the first instance, into newly founded Australian museums of natural history. Furthermore, the notion, perhaps first expressed by Leichhardt (1968) in the 1840s, that type specimens and other reference or unique materials ought to remain in Australia, or at least return after description, came to be increasingly widely held.

The second half of the century saw the establishment in the various colonies of a range of other scientific institutions besides museums, all of them now under local control. The founding of universities in Sydney and Melbourne has already been mentioned; Adelaide and Hobart later followed suit, as did Brisbane and Perth shortly after the turn of the century. While all six universities were limited initially to providing a traditional liberal education, the sciences were strongly represented in the curriculum from the outset. In time, separate laboratory-based degree courses in science were introduced and also, in some, science-oriented degrees in medicine and engineering.

Most of the colonies established observatories during this period and appointed government astronomers to run them. They were usually responsible not just for astronomical work (including their colony's time service) but also for routine geomagnetic and meteorological observing and for making the fundamental geodetic determinations for government survey purposes. In Queensland and Tasmania, where observatories were not established, government meteorologists were appointed instead (Day, 1966; Gentilli, 1967; Russell, 1888; Wood, 1958). Other sciences, too, received support from newly independent (or at least semidependent) colonial legislatures. Several colonies appointed government botanists, of whom Ferdinand von Mueller in Victoria is by far the best known (Willis, 1949). With rumours of gold in the air, New South Wales appointed a government geologist in 1850. Victoria set up an excellent geological survey in 1852, and most of the other colonies later followed suit (O'Neill, 1982). Government analysts were appointed to undertake assays and to oversee the quality of water and food supplies.

These developments, along with the growing number of doctors, schoolteachers and other professional people required to service an increasing population, led to a rapid growth, especially in the more populous colonies, in the number of residents with scientific interests and expertise. Viable scientific societies became possible for the first time and were formed one by one in most of the colonies during the middle third of the century. Each colony, sooner or later, came to have a 'Royal Society' patterned after the London model, with its own journal and exchange agreements with scientific societies elsewhere (Maiden, 1918; Marks, 1959; Piesse, 1913; Pescott, 1961). Such societies provided both suitable outlets for local scientific work and a mechanism whereby local workers could keep in touch more satisfactorily with what was being done in other parts of the world. The growth of public reference libraries in the colonial capitals also helped in the latter regard.

Nevertheless, the work done by Australian scientists continued to be quintessentially 'colonial' in character, remaining largely observational and descriptive in style rather than experimental and laboratory-based, and being concerned almost exclusively with local questions rather than with topics of universal import. Furthermore, scientists in the different colonies remained largely isolated from each other. For intellectual support and encouragement they generally looked not to their fellow colonists but to the scientific community 'at home' in Britain, and if they did venture on to topics of more than local concern, it was to the English journals rather than their local Royal Society transactions that they sent their work for publication.

An important change in attitude can be discerned during the 1880s. It was during this decade, for example, that the universities in Sydney and Melbourne dramatically expanded their commitment to science. (The much smaller University of Adelaide followed fifteen to twenty

years later.) Talented new professors and lecturing staff, mostly from Britain, were appointed in a number of fields. New laboratories were constructed. Shortly afterwards, the first research students appeared. Furthermore, most of the new professors were already active researchers and their interests were by no means confined to local questions. Publications by them and their students began to appear with increasing frequency in international journals.

The impact of a number of science-based technological advances also began to be felt during this period. The first telephone services were introduced in the larger cities, as well as the first municipal electrification systems. Chemical and metallurgical industries mushroomed. Major improvements in public health services followed the general acceptance of the germ theory of disease. Soon afterwards, science began to be applied in the countryside as well, through the establishment of scientific services within colonial departments of agriculture.

Australian scientific workers were now somewhat less isolated than they had been. The introduction of fast and reliable steamer services between Europe and Australia via the Suez Canal had halved the time of the journey and made it possible for scientific workers in Australia to keep reasonably up to date with the international journal literature in their field and even to contemplate occasional visits 'home' to establish or renew contacts with fellow scientists there. Within Australia, improvements in transport helped to bring scientists in the different colonies closer together and made possible the formation of the first intercolonial scientific organisation, the Australian Associaton for the Advancement of Science, founded in 1888. The association at first met annually, later at approximately two-year intervals. Its meetings quickly became the highlight of the Australian scientific calendar, offering welcome opportunities to exchange opinions and establish a basis for subsequent correspondence. They remained so until the growth of specialist societies, especially after World War II, challenged the association's hegemony.

The Australian scientific community remained small, however, and the imperial connections continued to be strong. Even in 1939, Australian scientists tended to see themselves and their work very much within the context of a larger British scientific network. Travelling scholarships such as the 1851 Exhibition science research awards (established in 1891) and the Rhodes scholarships (established 1904) strengthened the links by taking many of Australia's best young science graduates to England for further training. A significant percentage, including some of the best of them, never returned.

During World War I, Australian scientists, like their compatriots from other walks of life, flocked to support the allied cause. Scientific work was not a reserved occupation and many scientists simply joined the fighting services. In some cases, however, their special skills were recognised by the authorities. For example, some Australian chemists were transferred to England to help develop the munitions industry there, while Australian geologists, working as miners under the leadership of Edgeworth David, performed remarkable service in the trench warfare of the western front.

For many of the Australians involved, the war brought with it a heightened sense of their Australian-ness. Nevertheless, throughout the 1920s most Australian scientists continued to see themselves within a larger imperial framework. The popular vision of an integrated imperial economy in which Britain possessed the factories while the empire supplied the raw materials and markets for the finished goods implied that Australian science would concentrate on areas such as agriculture and the chemistry associated with mining, whereas sciences such as physics would be concentrated in Britain. The overwhelming emphasis on agricultural research in the early years of the Council for Scientific and Industrial Research (CSIR), formed in 1926, in part reflected this doctrine, though it also reflected the more parochial political and economic circumstances within Australia at the time that had led to the council's creation (Currie & Graham, 1966).

The economic collapse of the early 1930s brought an end to imperialist dreams of this kind. Already, however, local needs had been working against them. CSIR's charter explicitly envisaged the organisation undertaking research that would assist manufacturing as well as the agricultural sector, especially through the establishment of physical and engineering standards.

An early and highly successful involvement in radio research led the way in non-agricultural research (Evans, 1973). During the late 1930s, as war clouds gathered again and Australia began at last to build a manufacturing capability of its own, major CSIR divisions of industrial chemistry and aeronautics were founded, as well as the long-awaited National Standards Laboratory.

World War II had a much more dramatic impact on Australian science than World War I (Evans, 1970; Mellow, 1958). With invasion threatening and traditional British sources of supply cut off, Australia was forced to look to its own resources for essentials that it had previously imported. As the existing science-based industries such as munitions and electronics expanded, they demanded more and more scientifically trained staff. University scientists worked to create new industries where none had existed before in fields such as pharmaceuticals and optical components. Physicists and engineers were recruited in large numbers to work on a new invention of strategic importance, radar.

By war's end, it was clear that Australian science had undergone an irreversible change in line with the general industrialisation of the nation. The number of scientists working in all fields had greatly increased, and new employment opportunities had opened up for them in Defence Department laboratories, in new or newly expanded CSIR divisions and other government agencies, and to a lesser extent in universities and industrial corporations. No longer did Australian science look automatically to England for leadership and research opportunities. For some, the United States had become an enticing alternative, but others looked forward to Australia making an independent contribution to the new scientific age that seemed to have been ushered in with the explosion of the first atomic bombs.

In some fields, most notably immunology (Burnet, 1971) and radioastronomy, these hopes have been fulfilled superbly well; in almost all, Australian researchers have more than held their own. Yet in comparison with most other countries, scientific effort remains confined to a disturbing degree to government institutions. CSIR, reconstructed in 1949 in the wake of a savage and wholly unjustified political attack (Rivett, 1972) as the Commonwealth Scientific and Industrial Research Organization (CSIRO), no longer confines itself to the applied research of civilian science. University research, too, has expanded considerably, as has the commitment of the universities to postgraduate education. As a result, scientists no longer need to go abroad to complete their training: the local scientific community has at last become self-sustaining.

Unfortunately, Australian industry has failed to keep pace. The longstanding tendency of the nation's manufacturers to purchase the results of foreign industrial research rather than investing in such research themselves and to limit their horizons to import-replacement manufacturing rather than looking to export markets, has left their companies vulnerable and ill-equipped to meet foreign competition in a manufacturing environment increasingly dependent upon the exploitation of new scientific discoveries and techniques. It remains a moot point whether Australia can build a modern science-based industrial economy or whether science will remain on the margins of the nation's economic life.

Notwithstanding the number of works listed below, it is hardly an exaggeration to say that Australia's scientific past has yet to be subjected to systematic historical analysis. Few of the biographies listed, for example, provide more than a wholly uncritical narrative of their subject's life. Deeper psychological insight of the kind that characterises the best works in this genre is almost wholly absent, though Heney's study of Strzelecki (Heney, 1961) is a notable exception. Missing, too, for the most part, is any serious analysis of the actual scientific work that brought the subject of the biography into prominence. Even more rarely is any attempt made to place a person's scientific work in its broader intellectual context. Many of the biographies listed were written by a member of the subject's own family; while such works undoubtedly have their virtues, objectivity is unlikely to be one of them.

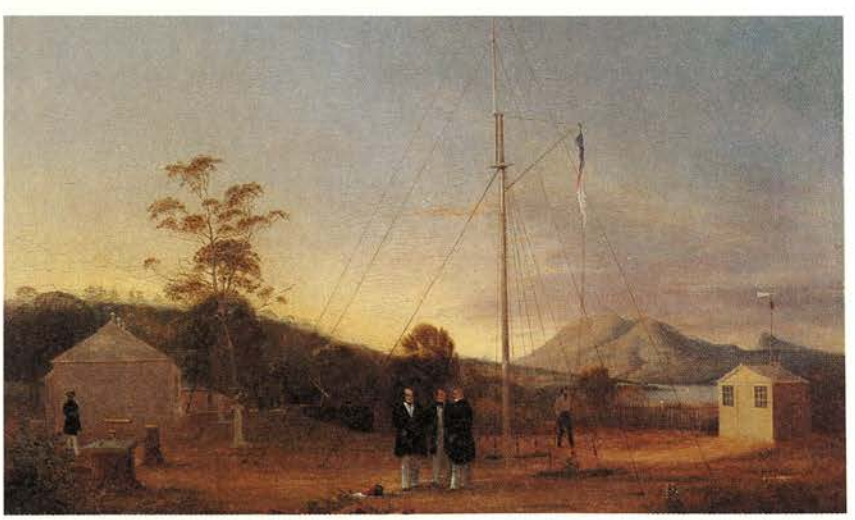
Equally lacking, as yet, are published collections of the letters or papers of influential figures in the history of Australian science. Only four editions of letters are listed below, for Banks (Dawson, 1958), Leichhardt (1968), Baldwin Spencer (1932) and the group of Tasmanians writing to W.J. Hooker (Burns and Skemp, 1961), and these more than suffice to demonstrate

the value of such works. There are other collections of papers which cry out for publication.

The general historical works listed also leave much to be desired. Many of those included are quite short and cannot pretend to provide more than a bare outline of the subject they are addressing. They have had to be included, however, for want of something more substantial on their particular topic. With a few notable exceptions, the institutional histories listed confine themselves to straightforward narrative accounts, lists of office bearers and the like, and make little or no effort either to analyse the conditions that moderated the institution's development or to place the institution in a wider social and intellectual setting. In a number of instances, the work is based almost exclusively on the internal records of the institution under study. In some cases of this type—for example, Evans's history of the Radio Research Board (1973)—the author nevertheless manages to set the institution in a wider historical framework. In others, the attempt is not even made.

Finally, there are few analytical studies of the history of particular sciences, or of the condition of science in general, in the Australian context. Large quantities of relevant archival material, the study of which formerly demanded extended visits to the United Kingdom, are now accessible in Australia through the Australian Joint Copying Project (NLA, 1980). Also, for twentieth century topics in particular, some very extensive bibliographical resources are available. However, such historical monographs as there are tend to offer general surveys rather than detailed discussions.

There has in recent years been a dramatic upsurge of interest in the history of Australian science. However, because this has occurred so recently, some of the best work on the subject as yet remains confined to the periodical literature. Some of the professional scientific journals have long been in the habit of publishing an occasional historically orientated piece. *Search*, the journal of ANZAAS, publishes historical articles rather more regularly, as did the *Records* of the Australian Academy of Science for a number of years. In 1981 the latter journal was given a new title, *Historical records of Australian science*, and converted into a journal concentrating exclusively on our subject. Under its new guise, it has quickly become the most important journal in the field. Some of the general historical journals carry articles on the history of Australian science and so too, occasionally, do the international history of science journals. Useful bibliographies by Ann Moyal (formerly Ann Mozley)—(Mozley, 1962, 1964; Moyal, 1978) provide convenient access to the older periodical literature, while many more recent publications are listed in classified bibliographies published annually in *Historical records of Australian science.*



Thomas Bock, Rossbank Observatory, *c1840. Oil on canvas. Bock's painting commemorates the raising of the flag at Rossbank Observatory, Hobart. Pictured in the foreground are Sir John Franklin, the governor of Van Diemen's Land, and captains Ross and Crozier.*

TASMANIAN MUSEUM AND ART GALLERY

AUSTRALIAN ACADEMY OF SCIENCE. *The first twenty-five years.* Canberra, The Academy, 1980. 286 p, illus.

Compiled for the academy's silver jubilee celebrations. Deals with the foundation and subsequent activities of Australia's premier scientific institution; little historical analysis.

THE AUSTRALIAN Mathematical Society's research register: being a list of the mathematical publications of the members of the Australian Mathematical Society and other mathematicians in Australia up till December 31st, 1962. Canberra, Dept of Statistics, Research School of Social Sciences, Australian National University, 1963. 211 p.

Items are arranged by author with their principal research interests. Lacks subject index. First published in 1958.

AUSTRALIAN NATIONAL UNIVERSITY, Canberra. *Science in Australia: proceedings of a seminar organised by the Australian National University on the occasion of the jubilee of the Commonwealth of Australia, Canberra, July 24–27, 1951.* Melbourne, Cheshire for the Australian National University, 1952. xxxi, 192 p.

A historical perspective of scientific research and study with insights into the condition of science in postwar Australia.

AUSTRALIAN science abstracts. Vols 1–35, Sydney, Australian National Research Council, 1922–56/57. (Vols 17–35, 1938/39–56/57, issued as supplements to *Australian J of science*, vols 1–19.)

A classified index of publications in Australian scientific and technical serials. Includes references to publications by Australians in some overseas journals.

AUSTRALIAN science index. Vols 1–27, Melbourne, CSIRO, 1957–83.

A classified index of articles published in Australian scientific and technical serials. Annual author and subject indexes in the final issue for the year. 1978–83 published in microfiche only.

BISCHOFF, C. *The hard road: the life story of Amalie Dietrich, naturalist, 1821–1891.* London, Hopkinson, 1931. 317 p.

Romantic story of a remarkable woman who collected botanical specimens in Qld, 1863–73, written by her daughter. Letters must be treated with caution.

BLUNT, M.J. AND MORISON, P.N. *Australian anatomy in the 1920s.* Sydney, Anatomical Society of Australia and New Zealand, 1983. 24 p.

A brief survey of a remarkable period in the history of anatomy when Australia could lay claim to a number of the intellectual giants in the field.

BORCHARDT, D.H. ed, *Some sources for the history of Australian science: six papers presented at a workshop on the history of science in Australia organized by the Australian Academy of Science, 24–25 August 1982.* Sydney, History Project Inc, 1984. 81 p. (Historical bibliography monograph, 12.)

The essays discuss problems with and possibilities inherent in various kinds of sources that are available to the historian of Australian science.

BRANAGAN, D.F. *Geology and coal mining in the Hunter Valley, 1791–1861.* Newcastle, NSW, Newcastle Public Library, 1972. 105 p, illus, maps. (Newcastle history monographs, 6.)

An account of the haphazard growth in understanding of the geology of the Newcastle region that accompanied the exploitation of its coal measures.

BRANAGAN, D.F. ed, *Rocks, fossils, profs: geological sciences in the University of Sydney, 1866–1973.* Sydney, Science Press for the Dept of Geology and Geophysics, University of Sydney, 1973. 184 p, illus.

A fact-filled account of teaching and research in geology with appendices listing staff, benefactions, prizes, degrees, students in the subject and publications.

BURNET, F.M. *Walter and Eliza Hall Institute, 1915–1965.* MUP, 1971. 193 p, illus.

A history by the Nobel-prizewinning scientist who directed the institute for over twenty years, followed by an assessment of its principal research activities.

BURNS, T.E. AND SKEMP, J.R. eds, *Van Diemen's Land correspondents: letters from R.C. Gunn, R.W. Lawrence, Jorgen Jorgenson, Sir John Franklin and others to Sir William J. Hooker, 1827–1849.* Launceston, Queen Victoria Museum, 1961. 142 p, illus, map. (*Records of the Queen Victoria Museum*, ns, 14.)

This correspondence documents the close ties that developed between various nineteenth-century Tasmanian botanical collectors, especially Ronald Campbell Gunn (1808–81), and the scientific authorities at Kew Gardens.

CAMERON, H.C. *Sir Joseph Banks*, A & R, 1966. 341 p, illus.

A biography of the great patron of Australian botanical exploration. First published in 1952.

CAROE, G.M. *William Henry Bragg, 1862–1942: man and scientist.* CUP, 1978. 212 p, illus.

Memoir of the Nobel prizewinner who was professor of mathematics and physics at the University of Adelaide, 1886–1909, by his daughter.

CARR, D.J. AND CARR, S.G.M. eds, *People and plants in Australia.* Sydney, Academic Press, 1981. 416 p, illus, maps.

CARR, D.J. AND CARR, S.G.M. eds, *Plants and man in Australia.* Sydney, Academic Press, 1981. 313 p, illus, maps.

Two volumes containing 31 essays on the history of Australian botany, including plant introduction and utilisation.

COCKBURN, S. AND ELLYARD, D. *Oliphant: the life and times of Sir Mark Oliphant.* Adelaide, Axiom Books, 1981. 369 p, illus.

Important for his wartime work on radar and the atomic bomb project, Oliphant became a professor at the Australian National University, founding president of the Australian Academy of Science and eventually governor of SA.

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION. *Abstracts of published papers and list of translations*, vols 1–22, Melbourne, CSIRO, 1952–74. Title varies. Succeeded by *CSIRO index*, 1975– .

A classified listing of publications by CSIRO staff. Author and subject indexes. From 1979 issued in microfiche only.

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION. *Annual report*, Canberra, 1–22, 1927–48; 1, 1949– .

Provides details about the work of the organisation that has dominated Australian scientific research since its establishment in 1926.

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION. *Australian scientific societies and professional associations* (2nd edn). Melbourne, CSIRO, 1978. 226 p.

A detailed alphabetical list of societies and associations. First published in 1971.

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION. Central Library and Information Services. *CSIRO published papers: subject index 1916–1968.* Melbourne, CSIRO Central Library, 1970–76. 16 vols.

A comprehensive alphabetical index of subjects treated in publications by staff of CSIRO and its predecessor organisations during the period stated.

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION. *Historical directory of Council for Scientific and Industrial Research and Commonwealth Scientific and Industrial Research Organization, 1926 to 1976.* Melbourne, CSIRO, 1978. 101 p.

A compilation of senior personnel associated with CSIR and CSIRO during the organisation's first half-century.

CURRIE, G.A. AND GRAHAM, J. *The origins of CSIRO: science and the commonwealth government, 1901–1926.* Melbourne, CSIRO, 1966. 203 p, illus.

A political and administrative history showing how the federal government acquired responsibility for scientific research.

DAVEY, L.J. *CSIRO water research bibliography, 1923–1963.* Melbourne, CSIRO, 1964. 98 p.

An index on water research, arranged alphabetically by subject, then chronologically. Author index.

DAVID, M.E. *Professor David: the life of Sir Edgeworth David.* London, Edward Arnold, 1937. 320 p, illus, maps.

A detailed but uncritical biography of the famous geologist.

DAWSON, W.R. ed, *The Banks letters: a calendar of the manuscript correspondence of Sir Joseph Banks, preserved in the British Museum, the British Museum (Natural History) and other collections in Great Britain.* London, British Museum (Natural History), 1958. 964 p.

Lists and indexes more than 7000 letters held in Great Britain to and from Sir Joseph Banks. There is a wealth of material relating to botany in Australia. *Supplementary letters* published in 1962 and 1965.

DAY, A.A. 'The development of geophysics in Australia', *Journal and proceedings of the Royal Society of New South Wales* 100, 2, 1966, 33–60.

Surveys Australian work in the observation branches of geophysics and in geophysical prospecting, from the earliest shipboard determinations to about 1950. Bibliography.

EVANS, W.F. *History of the Radiophysics Advisory Board, 1939–1945.* Melbourne, CSIRO, 1970. 238 p, 64 annexes in 8 microfiches.

EVANS, W.F. *History of the Radio Research Board, 1926–1945.* Melbourne, CSIRO, 1973. 395, (148) p.

The two histories deal with the history of radio research in Australia and its application in wartime. Also important for the growth of physics as a profession in Australia.

FLETCHER, J.J. ed, *The Macleay memorial volume.* Sydney, Linnean Society of NSW, 1893. li, 308 p, illus.

Includes an account of the life and scientific work of William John Macleay (1820–91) and papers on natural history by leading Australian scientists.

GANI, J. *The condition of science in Australian universities: a statistical survey, 1939–1960.* Oxford, Pergamon, 1963. 131 p.

Includes valuable information with historical perspective and suggestions for future action.

GENTILLI, J. 'A history of meteorological and climatological studies in Australia', *University studies in history* 5, 1, 1967, 54–88.

A survey of meteorological observing in Australia to the early 1960s. Extensive bibliography.

GIBBS, W.J. *The origins of Australian meteorology.* AGPS, 1975. 32 p, illus, maps. (Bureau of Meteorology historical note, 1.)

Brief notes and thorough overview of Australian botany in the nineteenth century.

GRAINGER, E. *The remarkable Reverend Clarke: the life and times of the father of Australian geology.* OUP, 1982. 292 p, illus, maps.

A biography of the Anglican clergyman who became a leading figure of nineteenth-century Australian science.

HALE, H.M. 'The first hundred years of the museum: 1856–1956', *Records of the South Australian Museum* 12, 1956, 1–225.

Tells of the development of South Australia's natural history museum in the face of inadequate accommodation and funding.

HENEY, H.M.E. *In a dark glass: the story of Paul Edmond Strzelecki.* A & R, 1961. 255 p, illus.

A good biography of the Polish adventurer and explorer who made important geological observations in southeastern Australia in the early 1840s.

KIDSON, I.M. comp, *Edward Kidson, O.B.E. (Mil.), M.A., D.Sc., F.Inst. P., F.R.S.N.Z., late director of meteorological services in New Zealand.* Christchurch, Whitcombe & Tombs, 1941. 144 p, illus, maps.

Comprises extracts from Kidson's journals and material concerning his travels—across western and central Australia—and his career as a meteorologist in Australia and elsewhere.

KRUTA, V. *et al, Dr John Lhotsky: the turbulent Australian writer, naturalist and explorer.* Melbourne, Australia Felix Literary Club, 1977. 176 p, illus, maps.

Essays on the life and scientific work of the bohemian naturalist and explorer who spent six years in Australia, 1832–38. Lists his many publications.

LEICHHARDT, F.W.L. *The letters of F.W. Ludwig Leichhardt.* Ed and trans by M. Aurousseau. London, CUP for the Hakluyt Society, 1968. 3 vols, illus, maps. (Hakluyt Society, series 2, nos 135–7.)

Text in English of all Leichhardt's known letters revealing that his later treatment by historians was undeserved. His Australian letters reflect the state of science in Australia in the 1840s.

LUCAS, A.H.S. *A.H.S. Lucas, scientist: his own story.* A & R, 1937. xxi, 198 p, illus.

An autobiography of the schoolmaster who was also a naturalist in late-nineteenth-century Vic and early-twentieth-century NSW.

McAFEE, R.J. *Dawes's meteorological journal.* AGPS, 1981. vi, 29 p, illus, maps and microfiches. (Bureau of Meteorology historical note, 2.)

Brief notes about Lieutenant William Dawes and the observatory he operated at Sydney Cove from 1788 to 1791, together with a copy, on microfiche, of his meteorological journal kept during that period.

MACFARLANE, R.G. *Howard Florey: the making of a great scientist.* Oxford, OUP, 1979. 396 p, illus.

The early career (1898–1942) of the Australian-born pioneer of penicillin, his upbringing and his undergraduate education at the University of Adelaide.

McMINN, W.G. *Allan Cunningham: botanist and explorer.* MUP, 1970. 147 p, illus, maps.

This biography concentrates on Cunningham's explorations and discusses superficially his botanical work.

MAIDEN, J.H. 'A contribution to a history of the Royal Society of New South Wales, with information in regard to other New South Wales societies', *Journal and proceedings of the Royal Society of NSW* 52, 1918, 215–361.

Consists chiefly of abstracts of the previously unpublished

minutes of the society's meetings, 1856–75, with details of publications, membership and a considerable amount of documentary material on the activities of earlier groups.

MAIDEN, J.H. 'Records of Australian botanists: (a) general, (b) New South Wales', *Journal and proceedings of the Royal Society of NSW* 42, 1908, 60–132; 55, 1921, 150–69. *Report of the Meeting of the Australasian Association for the Advancement of Science* 13, 1911, 224–43.

Brief biographical notices of a large number of botanical collectors, horticulturalists and botanists who have described Australian plants. Maiden also published records of the numerous state botanists in state-based journals.

MARKS, E.N. 'A history of the Queensland Philosophical Society and the Royal Society of Queensland from 1859 to 1911', *Proceedings of the Royal Society of Qld* 71, 1959, 17–42.

Biographical sketches of leading members of the society with an outline history based on the society's minute books.

MARSHALL, A.J. *Darwin and Huxley in Australia.* Sydney, Hodder & Stoughton, 1970. 142 p, illus.

A narrative of the experiences of Darwin and Huxley in Australia, based on their travel journals and other published materials.

MELLOR, D.P. *The role of science and industry.* Canberra, Australian War Memorial, 1958. 738 p, illus. (*Australia in the war of 1939–1945.* Series 4, vol 5.)

A study of the achievements of Australian science and secondary industry during World War II. The period is portrayed as a turning point in the industrialisation of the Australian economy.

MOYAL, A.M. *Science, technology and society in Australia: a bibliography.* Brisbane, Science Policy Research Centre, Griffith University, 1978. xii, 74 p. (Science Policy Research Centre, occasional papers, 2.)

A compilation of limited scope restricted to works published since the early 1960s, but omits several highly relevant works.

MOYAL, A.M. ed, *Scientists in nineteenth century Australia: a documentary history.* Melbourne, Cassell, 1975 280 p.

Source materials with linking commentary. Bibliography.

MOZLEY, A. 'A check list of publications on the history of Australian science [with supplement]', *Australian journal of science* 25, 5, 1962, 206–14; 27, 1, 1964, 8–15.

A listing of the older publications on the history of Australian science.

MOZLEY, A. *A guide to the manuscript records of Australian science.* Canberra, Australian Academy of Science in association with ANUP, 1966. xxiv, 127 p.

A pioneering survey listing in broad terms collections of the major Australian repositories. Arranged alphabetically by originating author or scientific institution.

MUSGRAVE, A. ed, *Bibliography of Australian entomology, 1775–1930: with biographical notes on authors and collectors.* Sydney, Royal Zoological Society of NSW, 1932. 380 p.

Arranged alphabetically by author then chronologically, includes biographical details for authors wherever possible. Subject index.

NATIONAL LIBRARY OF AUSTRALIA. *Australian Joint Copying Project handbook.* Part 8. *Miscellaneous* (M series). Canberra, NLA and State Library of NSW, 1980. 90 p.

A guide to microfilm copies of Australian-related manuscript materials in various British repositories. The Miscellaneous (M) series includes much science-related material. A resource for any study of Australian science in the nineteenth century.

OSBORNE, W.A. *William Sutherland: a biography.* Melbourne, Lothian, 1920. 102 p, illus.

A charming account of the self-effacing molecular theorist and leader-writer for the Melbourne *Age* who, though he never held an established scientific post, was a great scientist.

PERRY, W. *The Science Museum of Victoria: a history of its first hundred years.* Melbourne, Science Museum of Vic, 1972. 203 p, illus.

A well-documented history of Australia's oldest museum of applied science.

PESCOTT, R.T.M. *Collections of a century: the history of the first hundred years of the National Museum of Victoria.* Melbourne, National Museum of Vic, 1954. 186 p, illus.

A narrative of administrative issues of details of the collections.

PESCOTT, R.T.M. 'The Royal Society of Victoria from then, 1854 to now, 1959', *Proceedings of the Royal Society of Vic* ns, 73, 1961, 1–40.

An account of the leading events in the society's history devoted mostly to its earliest years.

PIESSE, E.L. 'The foundation and early work of the society: with some account of earlier institutions and societies in Tasmania', *Papers and proceedings of the Royal Society of Tas* 1913, 117–66.

Details about learned societies in Tas prior to the formation of the Royal Society in 1843, emphasising the first twenty years of its existence.

PRESS, M. *Julian Tenison Woods.* Sydney, Catholic Theological Faculty, 1979. 242 p, illus.

A biography, chiefly on Woods' remarkable career as a Catholic priest, including discussion of his investigations in natural history and geology.

RADFORD, J.T. *The Chemistry Department of the University of Melbourne: its contribution to Australian science, 1854–1959.* Melbourne, Hawthorn, 1978. 314 p, illus.

A well-documented history. Appendices indicate changing courses, textbooks and examination papers and lists members of staff and scholarship winners.

RADOK, R. AND RADOK, S. eds, *A profile of Horace Lamb.* Townsville, Qld, Mathematics Dept, James Cook University of North Qld, 1980. 102 p, illus. (Mathematics Department report, 2.)

Lamb's reputation rests chiefly on his treatise on hydrodynamics. This 'profile' comprises summaries of his many publications and includes the obituary notice from *Nature* and memoir published by the Royal Society of London.

'REVIEW of progress in agricultural science in Australia (1901–1951)', *J of the Australian Institute of Agricultural Science* 17, 2, 1951, 41–110.

A special issue marking the jubilee of the Australian commonwealth, with contributions by a number of authors. Includes a history of the Australian Institute of Agricultural Science itself.

RICHARDSON, J.F. *The Australian Radiation Laboratory: a concise history, 1929–1979.* AGPS, 1981. xii, 87 p, illus.

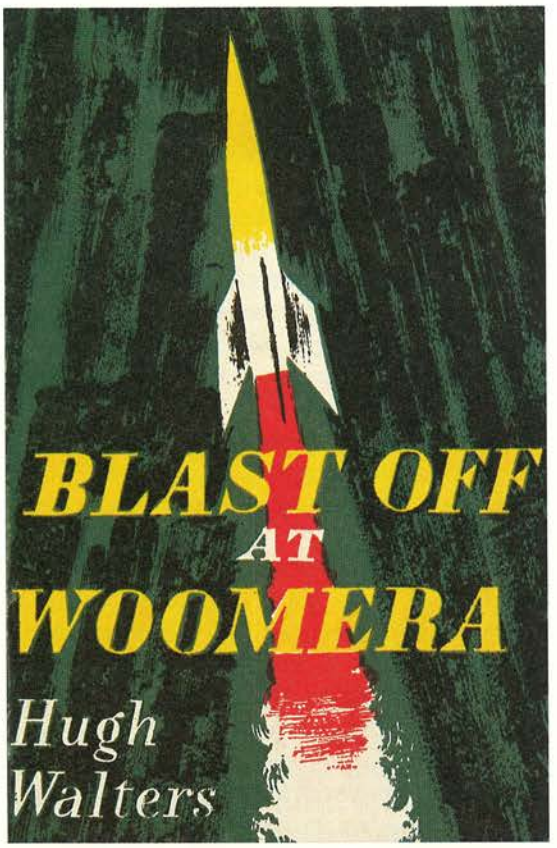
A survey of the laboratory which now performs many functions in relation to the medical applications of radiation physics.

RIVETT, R.D. *David Rivett: fighter for Australian science.* Melbourne, The Author, 1972. 225 p, illus.

Account of the long-serving chief executive officer and later chairman of CSIR, written by his son.

ROYAL SOCIETY OF NEW SOUTH WALES. *A century of scientific progress: the centenary volume of the Royal Society of New South Wales.* Sydney, The Society, 1968. 478 p, illus.

A volume celebrating in descriptive rather than analytical terms the progress of science and applied science in Australia, with special reference to NSW.



Hugh Walters, Blast off at Woomera, *Faber, London 1965. Cover design by Leslie Wood. Like a number of novels of the 1950s and 1960s,* Blast off at Woomera, *first published in 1957, used the site of Woomera for a highly romanticised adventure tale. Science doubled as fiction; reference to Woomera was always in terms of a rocket range for space exploration, a frontier of scientific endeavour. In fact it was the site of atomic testing between 1952 and 1957 and, as part of the Woomera–Maralinga–Monte Bello Range, was involved primarily in weapons testing.*
CLARK COLLECTION

RUSSEL, A. *William James Farrer: a biography.* Melbourne, Cheshire, 1949. 226 p, illus.
Biography of the man who revolutionised wheat growing in Australia by breeding new, disease-resistant strains.

RUSSELL, H.C. 'Astronomical and meteorological workers in New South Wales, 1778 to 1860', *Report of the Meeting of the Australasian Association for the Advancement of Science* 1, 1888, 45–94.
A history of Governor Brisbane's observatory at Parramatta with notes on the new Sydney observatory established in 1858.

SAUER, G.C. *John Gould, the bird man: a chronology and bibliography.* Melbourne, Lansdowne Editions, 1982. 416 p, illus, maps.
Comprises a genealogy, a bibliography and a chronology of Gould, his wife and family.

SKEATS, E.W. *Some founders of Australian geology.* Sydney, Australian National Research Council, 1934. 24 p. (Australian National Research Council. David lecture no 1, 1933.)
On early explorers, scientific visitors and scientifically minded settlers, and the work of the early geological surveyors.

SPENCER, W.B. *Spencer's scientific correspondence with Sir J.G. Frazer and others.* Ed by R.R. Marett and T.K. Penniman. Oxford, Clarendon Press, 1932. 174 p, illus.
Letters, 1897–1913, concerning Spencer's three great expeditions to central and northern Australia.

STANBURY, P.J. ed, *100 Years of Australian scientific exploration.* Sydney, Holt, Rinehart and Winston, 1975. 124 p, illus, maps.
Describes the work of Australia's scientifically minded explorers.

STRAHAN, R. *et al, Rare and curious specimens: an illustrated history of the Australian Museum, 1827–1979.* Sydney, Australian Museum, 1979. 173 p, illus.
An illustrated history of Australia's oldest natural history museum; concentrates on questions of personnel and administration.

WALKER, M.H. *Come wind, come weather: a biography of Alfred Howitt.* MUP, 1971. 348 p, illus.
A biography of the noted explorer, geologist and pioneering anthropologist, assessing his work.

WALKOM, A.B. *The Linnean Society of New South Wales: historical notes of its first fifty years.* Sydney, Australasian Medical Publishing Co, 1925. 46 p, illus.
'Official' account listing office bearers, details of the society's various homes and its publications.

WATERS, B.H.J. *A reference history of the Astronomical Society of South Australia Inc.* Adelaide, The Author, 1980– .
Volumes of archival materials each covering a ten-year period in the society's history.

WEBSTER, E.M. *Whirlwinds in the plain: Ludwig Leichhardt—friends, foes and history.* MUP, 1980. 462 p, illus, maps.
A study that successfully restores Leichhardt's reputation as scientist and explorer.

WEBSTER, H.C. *A history of the Physics Department of the University of Queensland.* Brisbane, Dept of Physics, University of Qld, 1977. 47, ix p, illus.
Chronological account, devoid of historical analysis.

WHITLEY, G.P. *Early history of Australian zoology.* Sydney, Royal Zoological Society of NSW, 1970. 75 p, illus, map.

WHITLEY, G.P. *More early history of Australian zoology.* Sydney, Royal Zoological Society of NSW, 1975. 92 p.
Two volumes providing a chronology of observations of Australia's animals by Europeans to the 1830s.

WHITTELL, H.M. *The literature of Australian birds: a history and a bibliography of Australian ornithology.* Perth, Paterson Brokensha, 1954. 116, 788 p, illus.
Arranged by author and including in many cases a brief biographical outline of the person in question.

WILLIS, M. *By their fruits: a life of Ferdinand von Mueller, botanist and explorer.* A & R, 1949. 187 p, illus, maps.
Biography of the man who, as Victoria's government botanist, 1852–96, dominated Australian botany. Includes brief discussion of Mueller's scientific work.

WOOD, H.W. *Sydney Observatory, 1858 to 1958.* Sydney, Government Printer, 1958. 32 p, illus. (Sydney Observatory papers, 31.)
An official history to mark the institution's centenary. A sequel by the same author has since been published, *Sydney Observatory, 1958 to 1981* (Sydney, The Observatory, 1982).