

Book Review Section

Compiled by R. P. Robertson*

G. M. Caroe, *William Henry Bragg 1862-1942: Man and Scientist* (Cambridge Univ. Press, London, 1978), 212 pp. (Price \$39.00).

This affectionate memoir deserves to be brought to the attention of the Australian scientific community, but since it has been reviewed at least six times in the recent historical/scientific literature, another reviewer must ask himself sincerely what more can be added. In this case I believe there are several further important points to be made.

For more than ten years Mrs Caroe, William Henry Bragg's only daughter, urged her brother (William Lawrence Bragg) to write a 'Life' of their father, but she could not persuade him to do it. Later he reluctantly agreed to write something jointly with her, but he died before much progress had been made; in the end she had to do it alone. The result is a warm and chatty story, which emphasises the personal aspects of a creative and lovable man. It is a sensitive, often restrained and charming portrait. Caroe has used family documents, newspaper clippings, the extensive Bragg holdings at the Royal Institution, Bragg's unfinished and unpublished autobiography, and personal memory, but not other archives or recent historical scholarship. In sketching the scientific work of her father and brother she has relied on quotations from the Royal Society obituary memoirs and some guidance from scientific acquaintances, but they have not served her particularly well. 'And yet', as Lawrence Badash has observed (*Isis* 70(3), 474), 'despite this scissors-and-paste approach, there is a charm and unity about the book'. Australian scientists should read it, and will enjoy doing so, even if the Australian price of \$39.00 does not bear comparison with the English (£8.95) or American (\$16.95).

Caroe traces her father's career from his happy childhood, sometimes traumatic youth, and successful early manhood at Cambridge (where he graduated Third Wrangler in the Maths Tripos of 1884), to his professorship of mathematics and physics at Adelaide. Here he learnt his physics, devoted himself to teaching, began research (at age forty-two) and developed his expository skills. He married the third daughter of Charles and Alice Todd and together they raised a family of three children. After front-rank work on the range of α particles and

the nature of X and γ rays, Bragg was awarded an F.R.S. and was appointed to the Chair at Leeds. Here, in collaboration with his son, who was at Cambridge and deduced the Bragg Law ($n\lambda = 2d \sin\theta$) interpretation of von Laue's 'spots', he developed X-ray crystallography, and together they won the 1915 Nobel Prize in physics. He conducted important war work (during both World Wars), spent some time at University College, and finally crowned an illustrious scientific career with memorable years as Director at the Royal Institution. He was gifted, determined, wise, self-contained and self-sacrificing. He wrote and spoke with exceptional lucidity, and was very widely honoured. 'The career that led to these distinctions', Heilbron has suggested (*Science* 202, 740), 'could not be reproduced in our time'.

This book contains many fascinating details of all these periods, but there is much that it does not contain. The first instance I may cite concerns the late start Bragg made on research in Adelaide. Previous reviewers have commented: 'He never thought about doing any research, until after seventeen years ...' (Hodgson, *New Scientist* 80, 622); 'It never occurred to Bragg to do any research until ...' (Perutz, *Nature* 276, 537); and 'He worked it [physics] up leisurely and otherwise relaxed in the comfortable colonial society ...' (Heilbron). In fact Bragg was extremely busy and committed in Adelaide; he had teaching commitments which no modern academic would tolerate, he gave numerous public lectures, he matured socially, courted and married, he helped found the Adelaide University Union, he played lacrosse, tennis and golf regularly, he did a little theoretical research on electromagnetism, and most of all he taught himself physics from the bottom up, so that when he began serious research his first papers were immediately of first-rate importance.

Secondly, Caroe devotes a full chapter to the 'first years at Leeds', and she creates the strong impression that Bragg was unhappy, dispirited and unproductive during this time. The strength of the suggested despondency seems to me uncharacteristic of Bragg, and the tone of the Bragg-Madsen correspondence reproduced and reviewed in the present issue by Professor Home sits uneasily with this account.

It seems possible, thirdly, that the death of his second son (Robert) at Gallipoli may have had a spiritually debilitating effect on Bragg. But it is a characteristic of families who lost loved ones in that appalling conflict (and others) that they are unable or unwilling to re-awaken such memories.

Caroe gives us only eight lines; including the poignant: 'my father unexpectedly passed the window, came in, said to me quickly in a low voice "Bob's gone", and went upstairs to my mother. I heard her cry out.'

Fourthly, there is the fascinating father-son relationship. By the time he returned to Leeds, WHB was very well known, so that WLB's discovery of the Bragg Law was often attributed to the father. A coolness and tension grew in their relationship which the award of a joint Nobel Prize did not erase and which seems to have been a cross that WLB carried with filial piety to his grave. It was something that a gesture and a few words from WHB may have overcome, but he seemed unaware of its depth, perhaps because they had other things in common which preserved the contact between them. Caroe gives some attention to the conflict, always with affection and sympathy for both men, but one feels that there is more to be said. For example, how did their relationship develop when WLB was young? It can be suggested that, although WHB's physics was characteristically English (Cambridge-like in particular), he was in other ways 'Australian', fond of sport and the outdoors, straightforward and open; while WLB, although born and raised in Australia, was 'English' in many ways, less sporting, reserved and more introverted. This relationship, including the details of the early collaboration in X-ray crystallography, offers much to the student of the history and social aspects of science.

Badash has suggested that Bragg 'remained a shy, insecure, diffident ... person'. In part Caroe's book supports these adjectives, but I feel they are inaccurate, and other parts of her work also suggest otherwise. True 'he had the humility of a great man,' and he had an easy line on the non-accountability of science and scientists; but, for example, only a confident, secure, experienced and penetrating mind could produce the superb words on research and research students which Bragg delivered at the Sir John Cass Technical Institute in 1924 and which Caroe reproduces on pages 130-2. If only we could persuade Australian politicians to read and ponder these elegant and powerful sentences!

In summary, we can thank Mrs Caroe for reminding us so pleasantly that, to use Perutz's words, 'success in science can be combined with devotion to human values, and that occasionally the great can also be good and true.'

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D. R. Oldroyd, *Darwinian Impacts. An Introduction to the Darwinian Revolution* (New South Wales Univ. Press, Kensington, 1980), 399 pp. (Price \$9.95).

David Oldroyd, with *Darwinian Impacts*, joins a distinguished company of Australian contributors to the international scene in the area of the history and philosophy of science.

Oldroyd sets out to provide, in a single book, an account of 'the Darwinian theory of evolution, the way in which it fitted into Western thought, its subsequent influences, and the general consensus among contemporary scholars as to the status of the theory, and the role it plays in biology'; and in this ambitious and seemingly all-inclusive scheme he succeeds admirably. Also, Oldroyd modestly claims that his book provides a general elementary synthesis of the insights of recent scholarship. The synthesis may be elementary in the sense that it is written in a style intended for the beginning student and the interested general reader, but the book is by no means a mere compilation of the research of others. It is also suffused by the findings of Oldroyd's own extensive research, as any glance at the footnotes will show. Oldroyd also states that his book offers 'certain personal reflections on the subject', and indeed this is charmingly so, on occasion to the extent that the reader might wonder whether a new word, 'Oldroydian' might well be coined.

The great problem in writing a book on *Darwinian Impacts* is knowing where to begin. Just to start with Darwin is far too abrupt, as many recent studies in the social history of science rightly stress. The historian R. M. Young has described how Darwin's theory and its reception were part of a much wider debate on the question of man's place in nature; this debate started in the 1790's with Darwin's grandfather, Erasmus Darwin and in the century following nearly every leading intellectual in England and Scotland became involved. Oldroyd avoids the two extremes of excluding everyone or including everything by concentrating in the first five chapters for the most part on the immediate scientific predecessors of Darwin, which, together with a chapter on the theologian Paley and the social theorist Malthus, are sufficient to

indicate to the reader the rich and varied antecedents of a biological theory. An omission I find disappointing here is the failure to give any reference, either in the footnotes or in the suggestions for further reading at the back, to the very intense discussion of the social origins of Darwin's ideas which historians such as R. M. Young are debating. Indeed the suggestions for further reading seem restricted to books only. Yet recent articles are possibly more accessible to the student than the nineteenth century texts referred to in the footnotes.

One pleasing feature of the introductory section is the inclusion of illustrations of various charts of taxonomic systems, from Pophry, Aristotle (after Bonnet's version), Lamarck and Linnaeus. Lamarck's table is provided with the author's useful translation of the technical terms; I have often wondered why Lamarck points his ladder of creation down, rather than up.

The chapter on *Darwin and Literature* shows some of the problems of the 'impacts' approach. There is a considerable historiographical problem in writing about influences, a problem which has recently been illuminated for Darwin studies by Manier in *The Young Darwin and His Cultural Circle* (Reidel, Dordrecht, 1978). Influence can range from complete acceptance to complete rejection of another's ideas, and all the varieties of partial acceptance and partial rejection in between. The problem with writing about the influence of Darwin on literature, for example, can, on occasion, be the problem of writing about what is not there, i.e. the writer who rejects evolution to the extent that he writes nothing about it. This is not so obviously silly as it sounds, for that too, is impact, even if in a totally negative sense, and it is a problem which becomes acute if we want to write about science and literature in the twentieth century. Today the fragmentation of the common context of intellectual debate has become so much more acute, for the educated person can no longer attempt to keep himself well informed in all the arts and the sciences. Modern literature may proceed as if the scientific discoveries of our age have not happened, yet the context of our times is one of the brain scanners and the bomb. Perhaps the persistence of the evolutionary model into the twentieth century, and the exploitation of the evolutionary idea in so many directions helped maintain the illusion that one person could embrace all knowledge, at a time when this was fast becoming an impossibility.

I must confess to disappointment with the chapter on Social Darwinism (Darwin's ideas applied to society), and a glance at Oldroyd's suggestions for further reading on the topic tells me why. Oldroyd mentions the same old tired group of American millionaires that everyone else does—Carnegie, Rockefeller, Sumner and this is fair enough, because they were Social Darwinists. But they are very tedious, these American millionaires, whose espousal of *laissez-faire* business economics under the guise of Darwinism was in their own best interests and no-one else's. Oldroyd has missed a golden opportunity here, for feminist historians are busy rewriting this section of intellectual history, and not before time, too. Why always include the same men, when two of the liveliest women of that generation, Olive Schreiner in England, and Charlotte Perkins Gilman in America, are omitted? I'm sure it can't be for any anti-feminist reason but simply because it is sometimes hard for historians to see what is there, but in another area of study. Gilman's *Women and Economics* (1898) and Schreiner's *Woman and Labour* (1911) were both best sellers, and reached a far wider audience than, say, Carnegie's *Gospel of Wealth*. Gilman and Schreiner's Social Darwinism was certainly not the free-for-all competition of the millionaires, but rather an exploitation of the evolutionary model in a direction applicable to 'the woman question', the demand for a wider participation by women in public life. Their work was far more influential than Carnegie's, for women eventually got the vote, while the millionaires got income tax.

One pleasing aspect of the book is Oldroyd's frequent references to Australian material. For example he gives a good coverage of the Australian reception of Social Darwinism. There is no need for an apology for this (though one is tentatively offered in the introduction) as we have heard so much about American millionaires that it's time to read about similar advice given to Australians.

I don't know how elastic the term 'Darwinian Impacts' can be made to be, but one Swinburne Institute student presented an inspired off-the-cuff interpretation of the evolution of reggae from rock music, after reading the chapter on 'Darwin and music' (a totally original 'Oldroydian' interpretation). This might be something for the author to ponder, as such an analysis would certainly rivet the student imagination.

Oldroyd sees the Darwin story as providing the general reader with an illustration of the great interest and satisfaction to be gained from intellectual history. Perhaps it gives us more: the excellent example of *Darwinian Impacts* will go a little way towards glueing up some of the cracks in our present-day fragmentation of knowledge.

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Joan Radford, *The Chemistry Department of the University of Melbourne. Its Contribution to Australian Science 1854-1959* (The Hawthorn Press, Melbourne, 1978) 314 pp. (Price \$16.95).

This book is much more than a history of a Chemistry Department. It is a story of the men and women who participated in the work of that Department in the period 1854-1959. It defines the influence of 'the Department' on the profession of Chemistry, upon the development of science in Australia, and describes the consequent effect of that development upon Australian Society.

My background must be taken into consideration when reading this review. I was first an undergraduate then a graduate student at Melbourne during the late 50's and early 60's, and I am currently a teacher, researcher and administrator at another institution. I find myself not only reviewing Joan Radford's book but also reviewing the influence of the Melbourne Chemistry Department on its students and upon science in Australia.

Joan Radford must be complimented on this splendid work; it took eight years to research, it is equally of interest to a historian or a chemistry graduate, it is highly readable yet carefully referenced, it is a history yet a series of interwoven stories, it describes the many positive contributions of the Department yet it is sometimes critical of certain policies and individuals. The book must be read at least twice, the first time to grasp the general theme, the second to appreciate the fine detail and the many subtleties contained therein.

Part I of the book is particularly enjoyable. It describes the founding of the University, and the era of the first Professor of Chemistry, J. D. Kirkland. Kirkland was an anti-establishment figure who had little rapport with the ultra-

conservative University Council. He was suspended by the Council for suspected alcoholism, yet his death soon afterwards was probably caused by prolonged exposure to noxious chemicals in badly ventilated laboratories.

Part II deals with the 'Massonian era' (1886-1939). It is fascinating to learn that the two people short-listed to succeed Kirkland were D. O. Masson and W. H. Perkin Jr. It is clear in retrospect that the selection panel chose the less able chemist. But if Perkin had been appointed, how long would he have stayed? We will never know.

Masson had an enormous influence on the development of both the Chemistry Department at Melbourne and science in Australia. He started the research school, he was influential in chemical education, he was an adviser to Government, he was involved in the formation of the Institute of Science and Industry (now CSIRO) and with professional societies including the (Royal) Australian Chemical Institute, and he was even indirectly involved in Antarctic exploration. When he retired in 1923 it was his former students Rivett, then Hartung who succeeded him. Thus began the inbreeding in the Melbourne School, a situation which, apart from the appointment (in 1924) of the organic chemist W. Davies, was to continue for another two decades.

The third part of the book deals with the period 1940-59; the Hartung, Anderson, Davies era. The 1950's was a time of unprecedented staff development, which inevitably led to a decline in professorial influence within the Department. Although the research groups of Anderson and Davies were large and productive at this time, it was staff of the calibre of R. D. Brown, R. A. Craig, R. G. Cooke and K. H. Pausacker who were stimulating the undergraduates. Special mention must be made of Pausacker, who was by far the best and most popular lecturer in the Department. His death, a matter not mentioned by the author, was to leave a lasting sadness with all staff and students who knew him.

If I have any criticism of this book, it is that some of the main characters do not 'come alive' because we are not told enough of their personalities. We can all relate to the unfortunate Kirkland, to Masson who was witty, kindly, courteous but certainly not a man to be crossed, and we know that Anderson was reserved, adored by his research students but generally

unapproachable. But what of Rivett, Hartung, Davies and the many lesser characters? Davies I remember well; what is said of him in the book is true as far as it goes. He *was* a poor lecturer, but his lecture demonstrations were memorable and often dangerous. No student would ever sit in the front row in his lecture class. On one occasion I recall him receding behind a giant wall of flame! Davies was a kindly man, a man always ready to help a student who had a problem. That was an attribute not shared by many of the Melbourne staff of that period.

The University of Melbourne should, in 1960, have had the premier chemistry department in Australia, but that was not the case. That is my judgment, not the author's. In the period 1920-40 the Melbourne School of Chemistry produced some of the most influential graduates Australia has known. Was there a decline in standards in the 1950's and if so what caused it? Was it the nepotism which stretched beyond the Masson era; was it a consequence of World War II, the calibre of the staff, the staff structure, the unsuitability of the 'new' chemistry building, lack of innovation in teaching, the structure of the practical courses; or was it due to a decline in chemistry teaching in secondary schools? If you read the book carefully you will find the answers.

I thoroughly enjoyed this book and shall certainly read it again, and also use it as a reference text. I would like to conclude with a quote from the book which may be of interest to present-day academics: 'The evidence given before the Royal Commission (of 1903) had revealed to the public the heavy teaching and administrative load carried by all the science Professors. The Professor of Chemistry (Masson) spent almost the whole day on lectures and practical duties, reserving a few hours each afternoon for research, and up to seven hours each night on reading and preparation. Masson publicly stated that (his) teaching duties should take precedence over research and consulting'.

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K. T. H. Farrer, *A Settlement Amply Supplied: Food Technology in Nineteenth Century Australia* (Melbourne Univ. Press, 1980), 332 pp. (Price \$26.00).

Although parts of the story of the growth of food preservation and manufacture from the days of the first white settlers to the highly successful enterprises of the late nineteenth century have been published, *A Settlement Amply Supplied* is the first overall survey. Dr Farrer is particularly well qualified because his working life has been occupied as chief chemist and research director in a leading food manufacturing company; he is also a former president of the Australian Institute of Food Science and Technology.

Farrer has brought to light many new facets of pioneering men and their innovations through studies of historical records in the Mitchell, Latrobe and other libraries, Patents Office records, newspapers and many obscure journals.

For about fifty years after the first settlers arrived, traditional domestic and village methods were used in the preparation of foods. The limited market and the lack of a sophisticated engineering industry stifled innovation. The rapid growth of the pastoral industry between 1825 and 1850 resulted in excess meat production which could only be met by the boiling-down of millions of sheep and cattle carcasses for the recovery of the tallow and hides. This waste of valuable food was only partly relieved by the introduction of canning (preservation by heat in sealed metal cans) in 1847 by Sizar Elliott whose ingenuity overcame many shortages in equipment which were inevitable in a primitive pastoral community. The techniques of canning had been devised by Nicolas Appert in France in 1809, but such was the state of knowledge at that time that he was unable to account for their effectiveness. Indeed, the eminent French chemist Gay-Lussac maintained that oxygen was responsible for putrefaction, and this view was generally held until Pasteur's discoveries sixty years later.

The author has uncovered many fascinating details of Elliott's life, how he managed to gain his knowledge of canning through contacts in England and how he struggled to gain a profitable market. While the canned meats, vegetables and soups produced by Elliott and other Australian processors were generally of good quality, they did not gain wide acceptance in Britain, their best market being ships' stores. Lack of general acceptance is indicated by the annual exports of canned meats in the period to 1890 never exceeding 11 000 tons.

Interesting new light is thrown on the manufacture of jams and canned fruits, particularly in

Tasmania where George Peacock began to produce canned jams in 1861. Much to the dismay of mainland manufacturers he preserved fruit pulps in bulk by pre-heating, a technique which enabled him to continue canning the year round and to send fruit pulps to Sydney for manufacture.

While the gluts of meat and butter were temporarily relieved by the upsurge of demand by the gold miners mid-century, permanent relief did not occur until the problems of long-distance transport of 'fresh' meat by refrigeration were solved. In this field Australia had several pioneering inventors, particularly James Harrison, the owner-editor of the *Geelong Advertiser*. Harrison built the world's first successful mechanical refrigerator, which he used in Geelong in 1851 to manufacture ice. Later he set up cold stores in Melbourne not only for ice but for perishable foods. He spent large amounts of money in the succeeding years in experiments aimed at finding the conditions and equipment which would provide safe transport of frozen meat to the United Kingdom. In 1873 he put his ideas to the test in a shipment by s.s. *Norfolk* which proved unsuccessful.

Eugene Nicolle was another notable inventor of refrigeration machinery. Financed by T. S. Mort, the prominent Sydney merchant, he produced a series of machines of different designs, one of which was used in 1873 to provide refrigeration for Sydney's large cold store at Darling Harbour. Nicolle's procrastination delayed Mort's efforts to establish an export meat trade. When a shipment was loaded on s.s. *Northam* in 1877, the refrigeration equipment failed and Mort made no further experiments.

The conditions for handling and cooling the meat and for thawing and distribution after cold storage had been worked out by Harrison and Nicolle. The key to success in long distance transport now lay in having refrigeration equipment which was not only reliable but also suited to the stringent safety conditions needed on shipboard. The syndicate headed by the shipping company, McIlwraith, MacEacharn & Co. decided that the Bell-Coleman cold air machine, which compressed and expanded air to reduce its temperature, was best-suited for shipboard refrigeration. Their experimental shipment of meat and butter transported to London by s.s. *Strathleven* in 1879 was a success financially and technically, and marked the start of a rapidly growing export trade in meat and butter (and later fruit) from Melbourne and Sydney.

From the days of the first settlers, flour milling, an ancient art, was vigorously developed in Australia, but Australian millers made few innovations, depending on Britain and Europe for new technology. The major advance in milling came late in the century with the installation of European rolling mills, first at Gawler, South Australia, by Messrs W. Duffield & Co.

The rise of large-scale food manufacture made adulteration financially attractive. In Australia, and elsewhere, adulteration took many forms including water added to milk, red lead to fish paste and alum to bread. For the first time, Farrer has given in detail the history of the fight for effective legislation to curb adulteration and protect the health of consumers. Initially the main action took place in the 1860's in Britain and a little later in Victoria. It then spread to other States. Food legislation is effective only by adequate policing and through the use of reliable chemical, physical and microbiological analyses. From 1870 onwards, Victoria was fortunate in having two competent analysts, Newbery and Dunn, who also took a major part in framing food regulations based on their analytical findings. Australia owes a great debt to these public servants who provided the means to prevent deception and to protect public health.

Dr Farrer has set a high standard for a history of food technology in twentieth century Australia, when it eventually comes to be written.

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