Plant Pathology in Western Australia: The Contributions of an Australian Woman Scientist

NESSY ALLEN

ABSTRACT *Very few women after the second World War made agricultural science their first career choice. Olga May Goss, however, in her 35 years in the Western Australian Department of Agriculture, saved more than one industry from ruin, thus contributing in no small measure to the economic prosperity of her state and her country. It was by chance that, after a serious illness, Goss was offered a post in the Department to work on plant diseases. The only woman in her Section, Goss faced personal as well as legislative discrimination; nevertheless over the years she tackled many problems confronting growers and through her research illuminated several areas of plant pathology, notably bacteriology and nematology. This article describes the career of this woman who was not only an excellent scientist but also a rare human being.*

Keywords: agriculture, Australia, plant pathology, research, scientists, women.

Introduction

Agricultural science has been traditionally a field for men. In Australia even after the Second World War there were few women scientists concerned with agriculture, and little opportunity for women to contribute in any significant way to the agricultural economy of the country. One who did so was Olga May Goss, a plant pathologist, who in her 35 years with the Department of Agriculture in Western Australia saved more than one industry from ruin. 'Because of her, our tomatoes are more wilt-resistant, our banana crops increased four-fold and our potatoes can throw off powdery scab like an athlete throws off a cold'.[1] This dramatic report gives a sense of the extent of Goss's contribution to the viability of some of the most valuable crops in Australia's economy.

Olga Goss (1916–94) was one of the participants in a major project which I began in 1989 on eminent Australian women scientists who worked during and after the Second World War, concentrating at present on those who have retired and who are available to be interviewed. My aim is to document the major contributions which these women, many of whom are now in their 70s and 80s, have made to the advancement of science and so celebrate them in the context of the history of Australian science and of Australian scientific institutions.

There are some remarkable women in this group. They have made a first-class contribution not only to theoretical knowledge but also to its practical application in human welfare and economic development, within Australia and beyond; yet few are well known. They have worked in almost every scientific discipline, including those, such as physics, usually considered to be an exclusively male domain. Some have been

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recognized by public honours; all are nationally and internationally acknowledged by their peers.

The project is biographical in nature and draws on both personal interviews and archival information. After the interview is recorded, the tapes are transcribed and the transcripts analysed. When all the available archival material has been found, I interview as many of the scientist's colleagues and associates as possible. In the case of Olga Goss, I spoke to staff in the Department of Agriculture with whom she had worked, some university staff with whom she had collaborated, and several of the growers whom she had helped. Officers of The Nursery Industry Association of Western Australia even referred me to a Supreme Court Judge.

The use of oral history methods has the advantage of placing on record the voices of the scientists, lending immediacy and authenticity to the final account. Another advantage of adopting the life-history approach is that the integration of the professional and personal aspects of scientists' lives leads to a better understanding not only of the particular institutional context in which they worked and the personal choices they had to make but also of the nonlinear process of scientific discovery and scientific creativity.

Agriculture in Western Australia

The commercial value of agriculture in Australia has always been recognized even though the relative importance of rural industries has been declining for many years.[2] During the postwar period in which Goss was working, the contribution of agriculture to the Gross Domestic Product decreased from 21% in 1948–9 to 7% in 1979–80.[3] In terms of value, Australia in the 1960s ranked second to the United States as an exporter of agricultural products,[4] yet in the early 1980s dropped to fifth place.[5] As in other developed countries the rural workforce declined (from 15.6% in 1947 to 7% in 1976) despite a continuing growth in the volume of farm production.[6] Yet in Western Australia by 1973–4, when the population was still barely over 1 million, the estimated gross value of rural produce in that state alone was AU$1034 million.[7]

From the foundation of the colony of Western Australia in 1829 agriculture was important in its economy. It is not surprising, then, that a Bureau of Agriculture was established in 1894 to provide farmers with advisory services and the results of recent scientific research. Just before the turn of the century the Bureau became the Department of Agriculture. The need for its services can be gauged by the rise in its annual expenditure from £5500 in 1898 to over £100,000 in 1929.[8] One of the prime objectives of every state Department of Agriculture is the 'protection of agriculture from pests and diseases and the environmental effects of agricultural chemicals, and the promotion of an abundant supply of safe foods and fibres'.[9] The importance of these departments to the national economy can be measured by the fact that in the mid-1970s 55% of agricultural research expenditure in Australia was being allocated by state departments,[10] 88% of available funds for research being supplied by state governments.[11]

As the demand for services grew, several specialist branches were formed within the Western Australian Department. The *Annual Report*, 1909–10[12] records the appointment of a Vegetable Pathologist and approval for a horticultural position. The aim was 'to advise fruit-growers and intending fruit-growers on the suitability of particular soils and locations and varieties, and on the best methods of cultivation and control of pests and diseases'.[13] In 1921 a Botanical and Pathological Branch was formed and research into plant pathology was carried out almost from its inception.

Some of the problems this Branch investigated were the fungal and viral diseases of fruit trees, vines and vegetables, problems caused by nematodes (an organism which

attacks the roots of vines, vegetables and cultivated flowers), viral diseases of potatoes and the spotted wilt virus of tomatoes and flowers.[14] For example, bananas were grown quite early in the century at Carnarvon in the north of the state, but it was not till research by the Department in the late 1950s enabled soil nematodes to be controlled and productivity thereby doubled that the industry grew—to such an extent that by the late 1970s it had a gross value of AU$3,000,000.[15] The production of nematode-resistant rootstocks was an important technical development in the viticulture industry in the Swan Valley in the 1960s and 1970s.[16]

'The plant pathologist, who is usually crop orientated, must, in order to ensure the confidence of his grower clients, always have a working knowledge of the cultural requirements necessary to ensure well-grown plants and must be able to recognize the common pests.'[17] Olga Goss was more than able to fulfil these requirements. She joined the Department in 1945, retiring in 1980 as Senior Plant Pathologist. In the course of her long and productive career, she contributed significantly to the solution of every one of the problems listed above.

Early Years

Goss was born in 1916 in Perth, the elder of two sisters. She was fortunate in that her parents, although they had no formal education, believed in its value and encouraged their daughters in every way. From an early age, Goss was interested in natural science: 'animals and plants—anything small'.[18] She longed for a microscope but her parents' circumstances did not allow them to buy her one until she was in her mid-teens. Then, however, 'I was always gazing into it'.

Scholastically she was brilliant, always coming top of the class. She won a scholarship to one of the best coeducational high schools in Perth, one which, most unusually for those days, taught not only the pure sciences but also agricultural science. At junior level, Goss followed her interests in biology, botany, mathematics and agricultural science. She won the Science Exhibition to the University of Western Australia in 1934;[19] only one such award was made for the whole state each year.

At University, Goss decided to work on the parasites in the gut of cormorants which were disrupting the Swan River fishing industry. The main text on platyhelminths, the worms with which she was dealing, was available only in German. Undeterred, with her school knowledge of French and German she translated not only the whole book but also other relevant books and articles in these languages. This kind of determination, a refusal to be stopped from doing what she wanted to do, what she felt was worthwhile doing, is one of the characteristics that saw her through difficult periods in her life. Her work gained her a BSc with First Class Honours in 1937.

Just before the Second World War, however, jobs were hard to get. Her professor suggested she work for him and, lacking any other suitable alternative, she accepted the position of Laboratory Assistant in April 1938.[20] She had already done some laboratory demonstrating during her Honours year and this she continued to do. She also continued her research in parasitology with a PhD in mind.

In 1939 she was officially appointed Demonstrator;[21] soon she found herself giving second- and third-year lectures besides taking on the supervision of an Honours student. Despite the fact that her first love was always research ('I wanted to do research. I wanted to work in a laboratory investigating anything at all that I could'), in order to fulfil what she regarded as the requirements of her job, she felt she must abandon her research as well as her PhD. There was simply not the time. She was relieved when in 1943 she was offered a job as Pathologist at the Princess Margaret Hospital for Children

in Perth. Unfortunately, however, the four years of driving herself caught up with her and her health was undermined. She was hospitalized for months; the prognosis was that she would never walk again.

Her courage was extraordinary. She did indeed walk again, though not for about two years. The risk of contracting an infection, however, prevented her returning to the hospital, and she had to seek another position. She notified the University that she was looking for work and on the same day was contacted by the Department of Agriculture. The Department needed someone to work on plant diseases and respond to problems raised by farmers and orchardists. At the end of the War many ex-service personnel entered various agricultural industries and the Department was kept busy giving assistance to them and to the leading commercial growers in the state, all of whom were anxious to learn of and apply any newly developed disease control measures. Goss immediately joined the Department.

Career and Areas of Research

During her 35 years in a job which initially she took only because her illness had changed her direction, Goss made major contributions to the agriculture and economy of her country. Her interests were wide and over the years she developed an enormously broad range of knowledge. She worked on all crops and pastures which the plant pathology group handled, although her major interest was in horticulture, vegetable diseases and vegetable production.

When she began in the Agriculture Department, Goss naturally worked under direction. Later, however, she was instrumental in determining which problems were to be tackled. Plant pathology is an applied science but it is based on several branches of pure science: Goss clearly recognized the debt of applied studies to pure science in plant pathology.[22] Although her applied work had immediate practical benefits, she also pursued purely scientific goals.

One of the first problems she tackled was seed treatment of tomatoes to control bacterial canker, a disease which had recently been identified in the state.[23] At that time she also began to establish her expertise in diseases of ornamental garden plants. Another task was the production of cultures of *Rhizobium* in commercial quantities undertaken with other members of staff.[24] In the same year, 1947, she began work on 'Flor' yeast for sherry production. The following year, when apple scab broke out on 23 properties, she was involved in demonstrating that the infection was being imported to Western Australia from Victoria and Tasmania in the dormant buds of young trees. The trade was stopped and scab ceased to be a problem till it was accidentally reintroduced in 1989.

By 1949 Goss had established herself as the Branch's bacteriologist and general vegetable pathologist, and was working on diseases of apples, apricots, tomatoes and cauliflowers.[25] Bacterial studies were mainly concerned with nitrifying rhizobia but in the harsh, sandy soils of Western Australia the bacteria died before plants could be inoculated. She and her co-workers improved a previously developed method of 'lime-pelleting of seed to enhance nodulation in acid soils ... [which was] later used by research workers and farmers throughout Australia'.[26] The production of legume inoculants continued as a 'mini factory'; Goss was involved in culture preparation and as an extra operator to help produce the 9503 cultures sold in 1954. Later, in the mid-1960s, when land was being opened up north of Perth, she worked on establishing the *Rhizobium* bacteria in the light sandy soils of that region.

An important year in Goss's professional career was 1951, for it was in that year that she began to specialize in plant nematology, the area in which she made her principal

contributions to plant pathology in Australia.[27] (By 1960 the pattern of her specialization in both nematology and bacteriology had been set and remained unaltered until her retirement.) As at the time there was no-one in Western Australia who knew much about plant nematology, she taught herself and gradually became an acknowledged expert in the field.[28]

She began by working on a vine decline problem which was solved by grafting on to nematode-resistant rootstocks.[29] Developing nematode-resistant peach rootstocks was another of her projects at this time, as was taxonomic work identifying the Western Australian nematodes and listing them. In 1958 she published a list of plant parasitic nematodes. Throughout the 1950s she worked on disease problems in the developing banana industry at Carnarvon, mentioned above. It was she who discovered that nematodes were attacking the banana roots and that the roots were becoming progressively more diseased from season to season. She recognized that more than one nematode was involved and recommended applying a fumigant in liquid form via the irrigation water; this was a simple, practical and relatively cheap solution to the problem which not only saved the banana industry but, because it controlled the nematodes in the soil, helped other crops as well.[30]

Goss's special interest in nematodes, however, did not mean that other areas were neglected. Her further outstanding contributions were to do with cereal eelworm (or cereal cyst nematode) and annual rye grass toxicity. The former is a major pest of cereals in south eastern Australia and is one of the main root diseases contributing to economic loss. During the 1960s she identified this disease in Western Australia but found it to be of importance in only a few very localized areas and of no consequence in most of the cereal belt of the state. In the mid-1970s it was found that sheep were being poisoned by eating ryegrass. A group of researchers of which she was a member worked on annual ryegrass toxicity, establishing that it is caused by both a nematode and a bacterium—a set of circumstances unique to Australia.

Goss was also involved in the successful production of a rust-resistant runner bean ('Westralia'). She worked on crown gall, on club root of crucifiers and ornamentals, and isolated Fusarium yellows disease of *Gladiolus* in corms imported from Holland.[31] The declining vigour of older apple orchards was a long-standing problem of great economic importance; she was in a position to address it because of her experience with fumigation treatment. In 1958 the Department's Annual Report makes the first mention of *Spongospora* on seed potatoes, a fungal disease which continued to occupy her for the next 20 years.

Another of her prime interests was plant nurseries. In 1978 she wrote a handbook on nursery hygiene, her *Practical Guidelines for Nursery Hygiene*,[32] which was based on the work of Dr Ralph Baker of the USA. These guidelines, developed largely from principles established over the previous two decades, are still the foundation of nursery hygiene[33] and remain popular because they are not only scientifically sound but are also practical.[34] One officer of the New South Wales Department of Agriculture considers these guidelines to be one of Goss's major contributions.[35] The book provided the groundwork for the Western Australian accreditation scheme for nurseries.

In another practical way Goss helped the nursery industry. In 1980 Waldeck Nurseries Pty Ltd, then the largest nursery in Western Australia, challenged the Australian Taxation Department on behalf of the industry on the right to write off the capital expenditure on limestone and blue metal as a standing area for the production of healthy container-grown stock. Goss had applied the principles of nursery hygiene to combat diseases such as the 'die-back' fungus, *Phytophthora cinnamomi*, that had begun to attack the jarrah forests and had spread to other plants, particularly native species. She demonstrated that it was possible to prevent infection in nurseries by using a clean growing area with a base of specified depth of limestone and blue metal. The Taxation

Department claimed that nurseries using such a base were not primary producers since they were not cultivating the land, nor did the base improve the productive capacity of the land—therefore the cost of the base was not deductible as a business expense. Goss was the key witness on behalf of the nurseries and because of her testimony they won their case, right up to the Full Court of the Federal Court.[36]

She represented her Department at many conferences in Australia dealing with rhizobia, plant pathology, nematology and horticulture, giving papers at each. Although she occasionally published in *Australasian Plant Pathology* and *The Australian Journal of Agricultural Research*, most of her 50 articles were as a matter of course published in the Department's journal so that growers would know where to look for information. Some of her research was never written up because time defeated her ('I just didn't have the time. I needed to be two or three of me'), though she was aware that it would have helped her career and her visibility to publish in more prestigious journals.[37]

Had she been on the staff of CSIRO,[38] where at that time it was less unusual to find women scientists,[39] she might have been freer to follow her own research inclinations, but she felt that her position with the Department enabled her to be of more practical use.

Difficulties

A great deal of Goss's work was in the field. She was keen, keener than most, to go out and select her own samples for investigation; she always wanted to evaluate the growers' problems for herself.[40] But the physical conditions under which she worked were rugged and harsh. Several of the people I have spoken to have commented on her endurance and disregard of extreme conditions that women were not usually expected to suffer. Her experiences here are comparable with those of the Australian atmospheric physicist, Jean Laby, whose fieldwork demanded the handling of heavy, unwieldy equipment in extreme weather conditions, with long hours and strenuous travelling.[41]

At first the growers mistrusted her because she was a woman, but within a short time many insisted on getting her personal attention to their problems. She earned the confidence of the district advisers throughout the state. She built up a network of relationships with staff within her Department, with other state Departments of Agriculture, the University of Western Australia, the CSIRO.

Though the number of scientific personnel employed in state Departments of Agriculture more than tripled during the postwar period,[42] she remained the sole female plant pathologist during the whole period of her employment. Being a woman in a male-dominated scientific world did have its drawbacks, but once she joined the Department of Agriculture, she was not aware of direct personal discrimination, though former colleagues comment that she had a hard time because she was a woman.[43]

During her working life, however, Goss certainly endured legislative discrimination. In the Public Service in all states and in CSIRO women did not at that time get equal pay for equal work.[44] Her salary was therefore lower than that of male scientists at the same level even though, because plant pathology was in the early days not taught at the University, she had the additional task of teaching it to the technical staff and new graduates in the Department. Had she worked in industry, she would have been no better off; Margaret Dick, the Chief Microbiologist of Kraft Foods Ltd during this period, was also paid less than male scientists at a lower level on the staff.[45]

At a more personal level Goss was discriminated against in two areas because of her sex. First, she was not permitted to go on field excursions on her own, nor to stay away overnight, which meant that she was unable to spend as much time in the field as she wished. Secondly, until the end of 1967 women had to resign from the Department on

marriage.[46] This was not unusual for women in Australia. The Agriculture Department was bound by state Public Service regulations and the same restriction would have applied had Goss worked for CSIRO and been subject to Commonwealth regulations. The difference between her case and that of some other Australian women scientists[47] was that she wanted to marry. She had a lifelong relationship but was unable to legitimize it and so have children and lead a normal family life. She accepted the situation as her work was important to her and she was not bitter about it.

Goss considered herself to be a feminist though not a militant one. She acted according to the mores of her generation, as 'a typical female acted in those times', and in this resembled other Australian women scientists of her generation. For example, Professor Charlotte Anderson, who was largely responsible for establishing paediatric gastroenterology as a discipline in its own right, also did not believe in flouting accepted ways; she would have given up her career had she married.[48]

Personal Attributes

In the *Who's Who of Australian Women*[49] Goss wrote, 'My ideal is to try to make the world a better place to live in by helping people with their problems in any way I can.' These were not empty words. All her life, from her University days, she was involved in voluntary work of one kind or another. For example, during the War a group of young people formed the Emergency Service Corps. Some members of the group from the Zoology Department at the University also formed the Blood Bank for the Red Cross Blood Transfusion Service. When a mobile blood transfusion service was later set up, she was asked to take charge of it, but by this time she was ill in hospital and had to refuse. Another of her voluntary activities concerned the blind. Goss drove the blind switchboard operator at the Agriculture Department to and from work every day, making other arrangements for him when she was away. Through her friendship with this man and his blind wife, she became interested in and for many years supported the Guide Dogs for the Blind Association. In a court case when her expert evidence was needed, she gave her services gratis because of the limited means of the farmer involved.[50]

Goss's generosity of spirit revealed itself in her selflessness; yet her own life was not easy. Her early illness had long-term effects and the asthma which developed during those crushing years at the University remained with her, requiring daily medication. Towards the end of her life she was bedridden and in constant pain; but her courage and altruism continued to shine through. The Hon. Mr Justice Seaman[51] said she came from a different era: for her, helping people was more important than her personal advantage. He remembers that she always behaved with great dignity even on occasions when, as a woman, she was treated in ways which would not be acceptable today.

Despite her health problems, Goss enjoyed her varied and exciting work tremendously; she felt satisfied with her life. She even had teaching opportunities: University students were sent to her for nematology lectures throughout her time with the Department. For many years, until a suitable appointment was made at the University, she also gave the plant pathology lectures. She taught her own laboratory assistants and encouraged them to undertake further studies in order to improve their career prospects.

International Comparisons

Women scientists of Goss's generation faced un uphill battle for status, for recognition, for reasonable salaries. Historians interested in the role women have played in science in

the last hundred years have pointed out that 'Even the most successful women scientists could be challenged, dismissed as eccentric, excluded from prestigious societies, and literally displaced from jobs and professional affiliations.'[52] 'It is not easy, 50 and more years on, to comprehend the magnitude of the barriers, both institutional and social, that faced earlier women following a scientific profession.'[53]

Marriage was often discouraged by employers. A number of English women did marry but experienced more setbacks in continuing their careers than their unmarried counterparts. Not that marriage was in itself a bar to employment as it often was in Australia. Kathleen Lonsdale, the crystallographer, one of the first two women to be elected a Fellow of the Royal Society, was given support by her head, William Bragg, who found money for domestic help so that she could continue working while she had a pre-school child at home.[54] But she did not get a permanent position until she was 43 years of age.[55] The Nobel Prize winning chemist, Dorothy Hodgkin, worked at Oxford University for the greater part of her life, having a 'commuter marriage' for most of it.[56] Women in England were also able to work in the same institution as their husbands; this was indeed the experience of two Australian women scientists (Ruth Sanger, a haematologist, and Joan Freeman, a nuclear physicist) whose careers were based there.[57]

In North America, women scientists tended not to marry. An exception was the Harvard astronomer, Cecilia Payne-Gaposchkin, one of the first successful research scientists who managed a home life with children.[58] Generally, however, the difficulties facing those who wanted to combine marriage with a career were clearly evident and many chose to remain single. The Canadian nuclear physicist, Ellen Gleditsch, was one; 'A woman who wants to be a researcher has to reconcile two opposing demands. The research requires first and foremost a tranquil atmosphere, opportunity to think in peace and quiet, and to concentrate on a particular problem. Material worries, concern for a husband or children who are left at home without adequate help or care, will kill all chances of a first rate effort.'[59] The only successful women geologists in Canada remained single.[60]

Lower salaries were common everywhere. For example, Kathleen Culhane Lathbury, one of the first English chemists to be awarded a fellowship of the Institute of Chemistry in recognition of her research, discovered that upon her resignation from her company, her inexperienced male successor started on a salary which was more than £100 greater than her finishing salary.[61] The Canadian social scientist, Mabel Frances Timlin, though a full professor by 1950 at the University of Saskatchewan, nevertheless received a lower salary than her male colleagues.[62]

Goss was not the only woman scientist prohibited from doing the fieldwork she wanted. The Canadian geologist, Alice Wilson, the first woman to be employed, albeit reluctantly, by the Geological Survey of Canada, was not allowed to undertake extended fieldwork.[63] In fact women were barred by the Survey from fieldwork until the 1970s.[64] Furthermore, like Goss, Alice Wilson found that her promotions were much slower than those of her male colleagues.[65] This was also the case for women zoologists at Canadian universities (who were also paid less than their male colleagues).[66]

Recognition

A few Australian women scientists have been recognized by the award of an honour such as the Order of Australia,[67] but in Goss's case the highest accolades have come from her colleagues. Every person to whom I have spoken about her—staff in the Department, University staff, officers of the Nurserymen's Association and growers—expressed nothing but admiration for her contributions to agriculture and to specific rural industries, for her energy, her selflessness, her devotion. And the recognition given by her peers all over

Australia, as well as from visiting nematologists and plant pathologists with whom she could discuss her work, all gave her great satisfaction. The many tributes paid to her recognize both her scientific contributions and her nature.[68] Dr Pat Barkley of the New South Wales Department of Agriculture considers Goss to have been one of the few leading women scientists in agriculture in Australia.[69] One group of people, the nurserymen of Australia, formally honoured her (in fact, one of her former colleagues states that they revered her.)[70] In 1978 she was the first woman to receive the Australian Nurserymen of the Year Award, something of which she was very proud.[71] As well, the Western Australian branch, which had recommended the award, presented her at the same time with a very fine opal ring,[72] a gesture of which she was just as proud; it is rare for a tangible acknowledgment of this kind to be made.[73]

Goss justly deserves recognition for her achievements in the context of the history of agricultural science.[74] In a country as dependent on agriculture as Australia was in the immediate postwar period, scientific contributions to the eradication of diseases and the improvement of agricultural products were of vital importance. Through her research Olga Goss contributed in no small way to the health of the economy, thereby helping Australia achieve the position it held in world agriculture. More than that: her scientific work helped elucidate fundamental aspects of plant disease applicable to world agriculture.

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36. *Waldeck Nurseries Pty Ltd* v. *The Commissioner of Taxation of the Commonwealth of Australia*, Appeal No. 317 of 1980. Information supplied by The Hon. Mr Justice Paul Seaman, of the Supreme Court, Western Australia, February 1994. The Hon. Mr Justice Seaman, who was the QC at the time, retains the highest admiration for the way in which Goss gave evidence not only in this but in two other court actions involving individual growers (*Cutt* v. *Shire of Kalamunda*, No. 2892 of 1973, a case concerning damage by flooding to the business of a gladioli grower; *Duffy* v. *Wesfarmers Ltd*, No. 1424 of 1982, then the longest civil trial in the Supreme Court of Western Australia). 'She dealt effortlessly with the material, in a marvellously deceptive manner—if you met her in the supermarket you would think she was anybody's grandmother. But she is a woman of very superior intelligence with an acute aura about her.'
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43. Associate Professor W.A. Shipton of the Department of Biomedical and Tropical Veterinary Sciences at James Cook University, and Mr L.K. Price, former Senior Laboratory Technologist, Western Australian Department of Agriculture, in conversations with the author in February and March 1994.
44. See, for example, N. Allen, 'Australian women in science—a comparative study of two physicists', *Metascience*, 8, 2, 1990, pp. 75–85.
45. N. Allen, 'A microbiologist in industry: the career of an Australian woman scientist', *Prometheus*, 14, 2, 1990, pp. 35–50.
46. Public Service Act, 1904–1963 (Western Australia), Regulations, Part I—Preliminary, No. 35.
47. N. Allen, 'Test tubes and white jackets: the careers of two Australian women scientists', *Journal of Australian Studies*, 52, 1997, pp. 126–137.
48. N. Allen, 'A pioneer of paediatric gastroenterology: the career of an Australian woman scientist', *Historical Records of Australian Science*, 11, 1, 1996, pp. 35–50.
49. A. Lofthouse (ed.), *Who's Who of Australian Women*, Methuen, Sydney, 1982.
50. Stated by The Hon. Mr Justice Paul Seaman (see Note 36).
51. See Note 36.
52. S.G. Kohlstedt, 'Women in the history of science: an ambiguous place', *Osiris*, 10, 1995, p. 44.
53. J. Mason, 'The Women Fellows' Jubilee', *Notes and Records of the Royal Society of London*, 49, 1, 1995, p. 132.
54. *Ibid.*, p. 137.
55. M. Julian, 'Women in crystallography', in V.I. Birss, P.W. Codding & G. Rayner-Canham (eds), *Women's Contributions to Chemistry: An Historical Perspective and Women at the Forefront*, 76th Canadian Society for Chemistry Conference and Exhibition. Quebec, 1993, p. 5.
56. S.B. McGrayne, *Nobel Prize Women in Science: Their Lives, Struggles and Momentous Discoveries*, Birch Lane Press, New York, 1993, p. 243.
57. N. Allen, 'Cross-national careers: the interchange of women scientists to and from Australia', in D. Grant & G. Seal (eds), *Australia in the World: Perceptions and Possibilities*, Black Swan Press, Perth, 1994, pp. 92–96.
58. P.A. Kidwell, 'Cecilia Payne-Gaposchkin: astronomy in the family', in P.G. Abir-Am & D. Outram (eds), *Uneasy Careers and Intimate Lives: Women in Science, 1789–1979*, Rutgers University Press, New Brunswick, 1987, p. 217.
59. Quoted in A.M. Kubanek, 'Ellen Gleditsch—Norway's pioneer nuclear scientist', in Birss, Codding and Rayner-Canham, *op. cit.*, Ref. 55, pp. 72–73.
60. M.G. Ainley, 'Last in the field? Canadian women natural scientists, 1815–1965', in M.G. Ainley (ed.), *Despite the Odds: Essays on Canadian Women and Science*, Vehicule Press, Montreal, 1990, p. 34.
61. R. Bramley, 'Kathleen Culhane Lathbury', *Chemistry in Britain*, 27, 5, 1991, p. 430.
62. M. Ainley, 'Mabel Frances Timlin, FRSC (1891–1976)', *Canadian Women Economists Network*, November, 1995, p. 3.
63. W.A.S. Sarjeant, 'Alice Wilson, first woman geologist with the Geological Survey of Canada', *Earth Sciences History*, 12, 1, 1993, p. 125.
64. Ainley, *op. cit.*, Ref. 60, p. 34.
65. Sarjeant, *op. cit.*, Ref. 63, p. 125.
66. Ainley, *op. cit.*, Ref. 60, p. 50.
67. N. Allen, 'Australian women in science: two unorthodox careers', *Women's Studies International Forum*, 15, 5/6, 1992, pp. 551–562.
68. For example, Mr Ian Cameron, Senior Technical Officer, Western Australian Department of Agriculture with whom she worked closely, said in conversation with the author in January 1994, 'she had no equal', she was 'absolutely phenomenal', 'her like will never be seen again'. Mr Bill Dawson, Dawson's Garden Centre and Nurseries, Perth, said, 'she left her mark'; Mr George Gay, Sunnyvale Plants, Perth: 'she did way over and above what was expected, she was unbelievably helpful'; Mr Roger Middleton of Middleton's Nursery, Perth, a grower who knew her well: 'if ever a woman deserved recognition, Olga Goss does. She was the most able and competent woman who ever came out of the Department of Agriculture'; Mr Ray Owen, Western Australian Department of Agriculture, later orchardist, Perth: 'she was an enthusiastic worker, she helped the industry a

lot'; Associate Professor W.A. Shipton (see Note 43): 'she was very good to work with, very patient'. These are but some of the comments made to me. The countless people she helped all acknowledged her worth—the farmers, the orchardists, the nurserymen, the home gardeners, the vignerons of Western Australia.

69. Dr Pat Barkley (see Note 35).
70. Dr George McLean (see Note 28).
71. This was reported in the popular press. 'Olga won the farmers over,' *The Australian Women's Weekly*, 5 April 1978, p. 7.
72. Minutes of Nursery Association of Western Australia, 9 March 1978.
73. Stated by Mr Barry Waldeck, now of Fraser Nursery, Canning Vale, Perth. Mr Waldeck, formerly of Waldeck's Nursery, was for many years a member of the Executive Committee of The Nursery Industry Association of Western Australia.
74. Many offered me help in identifying them, including Dr A.G.P. Brown (see Note 27) and Dr Gordon McNish, Senior Plant Pathologist in the Western Australian Department of Agriculture and President of the Australasian Plant Pathology Society.