

## James Robert Price 1912–1999

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James Robert Price (who early in life became known as Jerry Price) was one of Australia's leading chemists. After a distinguished career at the University of Adelaide and at Oxford University, where he worked with Professor Sir Robert Robinson, he returned to Australia following the Second World War with wife Joyce to join the then CSIR. He was to participate in a project initiated by the Division of Plant Industry, a search for medicinal drugs in the Australian flora, providing expertise in chemical studies; in time, he developed the project into the extraordinarily productive and co-operative Australian Phytochemical Survey. He became Chief of the CSIRO Division of Organic Chemistry, then a member and eventually Chairman of the CSIRO Executive. In these roles he displayed great organizational and leadership skills. These were particularly needed during his time as Chairman when major changes in the structure of CSIRO were proposed by the government of the day. He was able to preserve the structural integrity and scientific focus of CSIRO during that period. He made major contributions to the discipline of chemistry in Australia particularly through his leadership and redirection of the Royal Australian Chemical Institute and his belief in the need for active interaction between Australian research institutes. He enjoyed an active retirement before suffering the effects of

an unfortunate accident. He spent the last years of his life, supported by Joyce, in a local nursing home where he died on 8 March 1999.

### Family Background and Early Education

James Robert Price was born on 25 March 1912 at Kadina, a small town at the top of the Yorke Peninsula in South Australia. He was the eldest of three children reared by Edgar James Price (1875–1937) and Mary Katherine Price (née Hughes, 1883–1937); the other children were John (b. 1915) and Mary (b. 1917).

James Robert's paternal grandfather, Benjamin James Price, after spending his early years in Kidderminster, England, migrated to Australia in 1857, lured not by the gold rush but by other opportunities offered by the new colony of South Australia. At the time of his marriage to Ellen Mary Carruthers in 1865, Benjamin Price was a Commission Agent in Adelaide; some time later they moved to Kapunda, a copper mining town, where their son Edgar James Price was born in 1875.

James Robert's paternal grandmother, Ellen Mary Carruthers, was descended from a Scottish family that lived on the coast of Solway Firth, south of Annan in the shire of Dumfries. Some time in the 1840s Ellen's father John Carruthers (1806–1887) migrated to South Australia where he established himself as a wine



**Figure 1.** Sir Robert Price. Picture taken in 1975.

merchant in Adelaide. The Carruthers family connection is doubly strong because James Robert Price's maternal grandfather, Henry Chauntrell Hughes, married Mary Catherine Carruthers, a cousin of Ellen Mary Carruthers.<sup>1</sup>

At the time of his marriage to Mary Hughes, Edgar Price was employed by the Savings Bank of South Australia in Adelaide; soon after that he was appointed as the first manager of the new Branch of that institution at Mount Gambier, and subsequently as manager of the Branch at Kadina, where his son James Robert Price was born. About two years later the Bank moved Edgar Price back to the manager-ship at Mount Gambier, but when they asked him to move again, he decided to resign in order to establish his own accounting business; this was originally a partnership but he later operated on his own. Mount Gambier remained the family's home town and it was here that at the age of about six James Robert Price began his education, first at a small Church of England school run by a Miss Warren, and then at Umpherston College, a Presbyterian school in Mount Gambier; Umpherston College was essentially a girls' school, but included a minority of boys. In 1923 James Robert was awarded a Vansittart scholarship to St Peter's College, an élite boys' school in Adelaide. For the first two years he was a boarder in the preparatory part of that school. He then spent four years in the Senior School where he was originally a boarder, but when the economic depression hit Australia in the late 1920s Edgar Price was unable to afford the fees, and for the last year or so of his secondary education James Robert lived with his mother's aunt Mrs Edith Helen Turner (née Carruthers) who was 'very helpful to me but something of a dictator'.<sup>2</sup>

It was at St Peter's College that Price was given the nickname 'Jerry' but he remained 'Bob' to his family — hence his

choice, in due course, to be known as 'Sir Robert' rather than 'Sir James' — the name 'Jerry' came to be used generally and, to all those on first name terms, he was 'Jerry' for the rest of his life.

Upon completion of his Leaving Honours year at St Peter's College in 1928, Jerry wanted to enrol in the Faculty of Science at the University of Adelaide. In a letter dated 12 November 1984 to Dr Rupert Best, who was collecting information for his book on the history of the Chemistry Department of the University,<sup>3</sup> Jerry recalled the circumstances of his entry into the University of Adelaide and the nature of his work there, both as an undergraduate and as a graduate student. Most of the following facts about Jerry's work, study and research at the University of Adelaide have been extracted from that letter.

### University of Adelaide

Jerry had looked forward to undertaking a university course in science in the usual way. However, because of the deepening economic depression, Edgar Price could not finance his son's enrolment and the added expense of his boarding away from home. Hence, at his father's urging, Jerry applied for a cadetship in the Chemistry Department of the University. He was interviewed by Professor A.K. Macbeth<sup>4</sup> who appointed him as a cadet at the beginning of 1929, initially on a wage of 10/- per week and later 25/- per week. This position gave him the right to enrol in such courses as Macbeth approved, without payment of fees. Because of their workload, cadets took four years rather than the usual three to complete a BSc degree. Jerry's duties as a cadet included the preparation of solutions required for qualitative and quantitative chemical analyses in the first-year practical classes, but he also had some contact with third-year students doing analytical work under Dr W.T. Cooke.<sup>5</sup> In 1931 Macbeth transferred

him to the job of Lecture Demonstrator, which entailed preparing and carrying out the experiments demonstrated by the Professor in lectures to the first-year students. This meant that he was now located in the Prince of Wales Building where he came into more contact with third-year and Honours (fourth-year) students. For an enthusiastic undergraduate, this regular contact with research students must have been both enlightening and stimulating. One of the people he met in this new environment was Gordon Kingsley (Bill) Hughes who, after completing his BSc degree in 1929, had become a Demonstrator in the Chemistry Department, and who in 1934 was appointed as Assistant Lecturer in the Chemistry Department of the University of Sydney. They became life-long friends, and their close friendship was to have particular significance in what became the Australian Phytochemical Survey.

In 1933 Jerry began his research career as an Honours student under Macbeth's supervision. In his letter to Best, he describes in some detail the research interests of Macbeth in the 1930s, and his own involvement as a research student. One interest that Macbeth brought with him from the University of Durham was the theoretical attempt to explain the rates of reaction of functional groups in unsaturated, particularly aromatic, compounds developed by Lapworth<sup>6</sup> in 1920 and called 'induced alternate polarity'; another was the application of ultraviolet absorption spectroscopy to organic chemical problems. In Adelaide, Macbeth soon became actively involved in natural products chemistry, in part because his predecessor Professor E.H. Rennie had worked on the constituents of several Australian plants and had isolated two novel red pigments from the tubers of the insectivorous plant *Drosera whittakeri* that grows in the Adelaide Hills. Rennie had suggested that these pigments were probably naphtho-

quinone derivatives, but their structures remained unknown.<sup>7</sup> Here was a challenge, and one of the first projects that Macbeth gave to Jerry as an Honours student was to measure the ultraviolet absorption spectra of a number of known hydroxynaphthoquinones for comparison with the spectra of the *Drosera* pigments (4).<sup>8</sup> This enabled deduction of the structures of these pigments that Macbeth named droserone and Hydroxydroserone.<sup>9</sup> The structure of the latter was firmly established by synthesis by Winzor,<sup>10</sup> a junior and previously unproductive member of the staff whom Macbeth had stimulated into action.

Macbeth was further drawn into natural products chemistry by the fact that P.A. Berry and T.B. Swanson, two full-time employees of the manufacturing company A.M. Bickford and Sons,<sup>11</sup> came to the Chemistry Department as evening MSc students with the desire to work on components of the essential oil of *Eucalyptus cneorifolia*, a product of commercial interest to Bickfords. In a reflection on 'scientific pedigree' in his letter to Best, Jerry recalled: 'I have little doubt that Macbeth's preparedness to move into that field as presented to him by Berry and Swanson was influenced by his earlier contact with Read'. When Macbeth was a Senior Lecturer at the University of St Andrews, prior to his Readership at the University of Durham, the professor there was the terpene chemist John Read who, prior to that, had succeeded Robert Robinson in the Chair of Chemistry at the University of Sydney. While at Sydney, both Read and Robinson had collaborated with H.G. Smith, the terpene chemist who is regarded as the father of organic chemistry in Australia. In connection with the investigations of Berry and Swanson, Macbeth gave Jerry the job of making and characterising the 2,4-dinitrophenylhydrazone of the ketone (-)-4-isopropylcyclohex-2-en-1-one, one of the constituents of the essential oil of *Eucalyptus cneorifolia*. In the course

of this work Jerry observed that the reagent 2,4-dinitrophenylhydrazine (which had only been developed in 1931) was broken down by alkali, and on his own initiative he began studying the products. He recalled:

Macbeth, rather than suggest that this was an unnecessary diversion from the main objective, encouraged me to pursue this study and further, when one of the products of the reaction was established as a 1,2,3-benzotriazole [sic; 1-hydroxy-5-nitro-1*H* 1,2,3-benzotriazole (2)], he suggested an ultraviolet spectroscopic study of 1,2,3-benzotriazoles, which was carried out.

Jerry graduated BSc (Hons, first class) in December 1934, and MSc in July 1935 with a thesis entitled ‘Properties of Nitrophenylhydrazines and Absorption Spectra of Dimethyl-cyclohexanediones and 1:2:3-Benzotriazoles’. He was very industrious and efficient — he was a co-author of four papers (1–4) published in the *Journal of the Chemical Society* (London) in 1934/35, all of them having been received by the Editor between April and December 1934. He was co-author of three more papers (5–7) with Macbeth between 1935 and 1937. Jerry had high praise for his former supervisor: ‘Macbeth was a very good research supervisor — he presented research problems to those moving into research, he encouraged them to ‘do their own thing’ but he also kept a light rein on their movements’. The regard was obviously mutual — Jerry’s initiative, skill and industry were rewarded. In 1935, following Macbeth’s strong recommendation, Jerry was one of two Australians awarded an 1851 Exhibition Science Research Scholarship for that year. He accepted this to work as a DPhil student under Professor Sir Robert Robinson at Oxford.

In 1933, his Honours year, Jerry met his wife-to-be, Joyce Ethel Brooke, daughter of Roy Brooke and Myrtle Victoria Brooke (née Lackington). Joyce was in her first year as a science undergraduate at the University of Adelaide, and Jerry was her

Demonstrator in the First Year Chemistry Laboratory: he escorted her to the Science Ball later that year. From about mid-1934 Jerry was President of the University Science Association and when he left for England in 1935 Joyce succeeded him as the first female President of that body. She graduated BSc (Hons, first class) in botany in 1936 and then worked at the Waite Agricultural Research Institute in Adelaide, doing research that gained her the degree of MSc in 1939, just before she set out for England to join Jerry.

Jerry’s ‘apprenticeship’ in research at the University of Adelaide was very successful, and set the course of his career: ‘my future career was the result of Macbeth’s interest in natural product chemistry’. On 5 September 1935 he boarded the Blue Funnel Line steamer ‘Nestor’ with a free passage to England, a privilege then accorded to 1851 Exhibition and Rhodes Scholarship holders by the Blue Funnel Line.

### **Oxford, the John Innes Horticultural Institution, and War**

For two years Jerry lived at Magdalen College, Oxford while working at the Dyson Perrins Chemical Laboratory. His supervisor, Professor Sir Robert Robinson, was pre-eminent in the chemistry and biogenesis of plant natural products, and also in the synthesis of natural products.<sup>12</sup> One of Robinson’s interests at that time was the chemistry of plant pigments, including anthocyanins and their aglycones, the anthocyanidins. Jerry worked on the anthocyanidins in *Bougainvillea glabra* and graduated DPhil in 1937 with a thesis entitled ‘Colouring Matter of *Bougainvillea glabra*’.

Upon completion of the work for his DPhil at Oxford, and with Robinson’s recommendation, Jerry was appointed as Head of the Chemistry Section at the John Innes Horticultural Institution at Merton Park in South West London, near

Wimbledon. Sir Robert Robinson had a close association with the Institution and collaborative research continued with Price's appointment there. At the time of his appointment Jerry was the only chemist on the staff — his colleagues were all eminent geneticists, and all of them were Fellows of the Royal Society.

The research carried out by Jerry at the John Innes Horticultural Institution was on plant pigments — mainly on isolating the anthocyanins and investigating their role in the genetic variation of flower colour. Some of this work was done in collaboration with Sir Robert Robinson: of eleven papers Jerry published from the John Innes Horticultural Institution (12–22), six were jointly with Robinson. The collaborative research included the identity of the yellow pigment of *Dahlia variabilis*, undertaken to facilitate a study of the inheritance of flower colour in *Dahlia* species; also, a study of the yellow *Papaver nudicaule* (Iceland poppy) from which was isolated a nitrogenous diglucoside. Another collaborative study was on the orange-red pigment dunnione from *Streptocarpus dunnii*; dunnione was shown to be a furano-1,2-naphthoquinone — at that time a new class of natural product.

In 1939 Jerry was awarded a Rockefeller Scholarship, and with this he planned to go to the USA, after travelling first to Australia so that he and Joyce Brooke could get married. The outbreak of the Second World War in September 1939, however, enforced drastic changes, both professional and personal. Because of the war, Rockefeller (Travelling) Scholarships were cancelled, and Jerry decided to stay in the United Kingdom to help in whatever professional wartime service might be required. He asked Joyce to come to England. This was no easy matter, since much commercial shipping was being sunk by the German air and naval forces. Mrs Brooke insisted that her daughter Joyce should fly, and gave financial assistance to

help with the additional expense. Joyce journeyed by train from Adelaide to Sydney via Melbourne to catch the Sunderland flying boat that left from Rose Bay, Sydney. The flight from Sydney to Poole in England usually took 10<sup>1</sup>/<sub>2</sub> days. Joyce's flight made overnight stops at Darwin, Sourabaya, Singapore, Rangoon, Calcutta, Karachi, Basra, Athens, Corfu (a replacement for the scheduled stop at Naples due to bad weather over the Appenines) and Marseilles; bad weather over the English Channel caused another stop-over at St Nazaire before the flying boat reached Poole, 11<sup>1</sup>/<sub>2</sub> days after leaving Sydney!

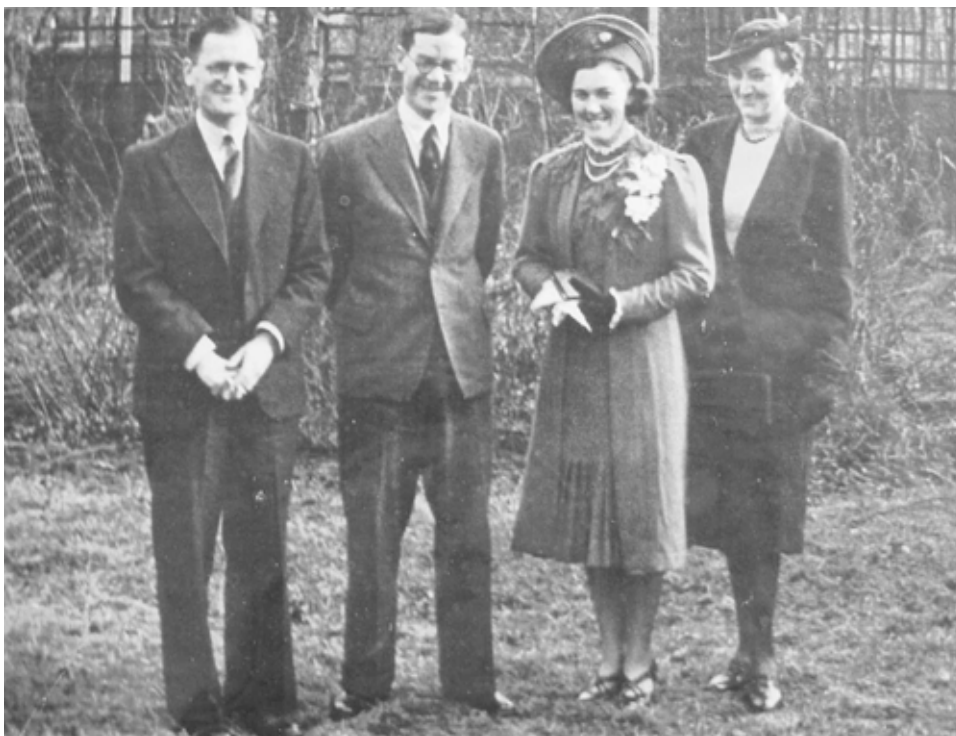
Jerry met Joyce at Poole after a separation of five years and they made plans to get married as soon as possible. On Tuesday 19 March 1940 they arrived in London and proceeded to Wimbledon, where Jerry was living because of its proximity to the Horticultural Institution at Merton Park. Temporary accommodation was arranged for Joyce nearby, and the Vicar of Wimbledon married them on Easter Saturday, 23 March 1940. In the rushed wartime wedding, away from home, there were no relatives present: the only attendants were Bill Hughes and his wife Jean, and Jerry's former landlady Mrs Lacey. Hughes had recently arrived in England to spend a year at Oxford with Robinson. Joyce recalls that it was joked at the time that Bill Hughes was the best man and also gave her away, Jean Hughes was the congregation, and Mrs Lacey wore black and wept because Joyce could not have any family present. The wedding breakfast was a pie in Lyons Corner House! They had a two-week walking honeymoon in the country near Oxford, and on one evening were entertained to tea by Sir Robert and Lady Robinson.

Back at Wimbledon, the newly wed couple rented a flat on the top of a two-storey building near the railway line. This location was far from ideal — on moonlit

nights the Germans bombed along railway lines. Rather than go to the huge air raid shelters, Jerry and Joyce slept in their flat, fully dressed, under a solid dining room table bought for £2.

While awaiting professional assignment in war service, Jerry served in the Home Guard ('Dad's Army') and Joyce worked in first aid stations. In September 1941 Jerry was directed into the Chemical Inspection Department, Ministry of Supply, to supervise work in a group of five ICI factories in southwest Scotland in the manufacture of explosives and munitions. Initially they had six months in Ardrossan while Jerry familiarized himself with the production of munitions at Ardeer, the central ICI factory for the manufacture of explosives. The manager

there was a Mr Lumsden, father of Harry C. Lumsden whom Jerry had met in his first year at Oxford. At that time Harry had taken Jerry to his home in Scotland for a holiday, so arising from this happy coincidence the Lumsdens became, as Lady Price recalls, 'our family in Scotland'. After leaving Ardeer, Jerry became Chemist-in-Charge at the Powfoot Outstation, and later was in charge of the Dumfries area.<sup>13</sup> He and Joyce lived close by in the Royal Borough of Annan, and later in the rural area of Glen Stuart, both places only a bicycle ride from Powfoot. Life there was much safer than in frequently-bombed Wimbledon. Jerry supervised work on propellants and explosives, but no details are available as he left no written records of this period of his career.



**Figure 2.** Wedding photo taken in the untidy back yard (barbed wire entanglement for war-time security) of the house in Wimbledon rented by Jerry Price, 'Horry' Barber, and Perc Thomas, all from the John Innes Horticultural Institution. Left to right: G.K. (Bill) Hughes, Jerry Price, Joyce Price, Jean Hughes. After the War 'Horry' Barber came to Australia through his association with Jerry, initially to a position at the University of Sydney; he later became Professor of Botany at the University of Tasmania.

During the Second World War Australia had to become self-sufficient in the supply of certain drugs. One of these was the anti-seasickness drug hyoscine, very important for naval operations. In late 1940, through the enterprise of Russell (later Sir Russell) Grimwade and his company Felton Grimwade and Duerdins, a part of Drug Houses of Australia, seven ounces of hyoscine were quickly extracted from 108 pounds of leaves of the Australian native tree *Duboisia myoporoides* picked near Grafton, New South Wales. Production was soon scaled up and hyoscine was produced during the war in quantities sufficient to supply British and American as well as Australian needs.<sup>14</sup> At the same time, CSIR became involved in a search for other drugs from Australian plants and in 1945, in anticipation of the end of the war, CSIR advertised a position of Research Officer for an organic chemist to work in the then Division of Industrial Chemistry on a survey of Australian native plants for sources of potentially useful alkaloids. Jerry Price was the successful applicant, and he and Joyce embarked on the first civilian passenger ship to make the trip between England and Australia since the war began; by coincidence, this was the 'Nestor', the ship on which Jerry had travelled to England in 1935. They embarked at Liverpool in early July 1945 with their two children born in Scotland — Margaret Ann (b. March 1944) and Donald Carruthers (b. May 1945). They arrived in Melbourne in the first week of September, ten years to the day since Jerry had left, having heard of the Japanese surrender during the voyage. Their third child, Janet Elizabeth, was born in Melbourne in October 1946.<sup>15</sup>

### CSIR/CSIRO

The circumstances leading to the appointment of Jerry Price as a Research Officer in the CSIR Division of Industrial Chemistry have been described in some detail in a

paper on what became known as the Australian Phytochemical Survey (72). The key points may be summarized as follows:

CSIR's first involvement in Australia's efforts to become self-sufficient in some key drugs during the Second World War was in mid-1940. Dr C. Barnard, Chief of the CSIR Division of Plant Industry, organized extensive field cultivation of some exotic drug plants: extraction of alkaloids and other active constituents from these plants was carried out by Dr H. Finnemore, Head of the Department of Pharmacy, University of Sydney. His limited resources meant that he was unable to cope with the ballooning demand and early in 1941 Professor R.D. (later Sir Douglas) Wright of the Department of Physiology, University of Melbourne, became involved. In his department some native Australian plants that were regarded as potentially interesting were extracted, and bioassays carried out by the pharmacologist Dr F.H. Shaw and his colleagues.

A very important development was Barnard's appointment in June 1944 of Dr L.J. Webb as a 'peripatetic botanist' to boost the rate of collection of native plant species for chemical examination. Webb's intimate knowledge of the flora of Queensland and his keen interest in poisonous plants and bush medicines,<sup>16</sup> together with his great drive and enthusiasm for the project, led him to provide important stimulation in communications with Jerry's CSIR(O) group and collaborators from the Chemistry Departments of several Universities.<sup>17</sup>

Soon after Webb's appointment it became apparent that there was a need within CSIR for an organic chemist who could give undivided attention to the isolation and characterization of alkaloids and other secondary metabolites, and who could determine the structures of previously unknown compounds that were isolated. In September 1944, Barnard gained the enthusiastic support of Dr I.W. (later



Sir Ian) Wark, Chief of the CSIR Division of Industrial Chemistry, for the appointment of a Research Officer for the Organic Chemistry Section of the Division. The position advertised was 'for work on alkaloids from Australian native plants and trees'. The successful applicant, Jerry Price, was eminently qualified for the position; 16 of his 21 pre-1945 research publications were on the chemistry of plant extractives.

It is of interest to note that, while Jerry included a testimonial from Sir Robert Robinson in his letter of application, Guy Gresford, the Australian Scientific Research Liaison Officer in London, still wrote directly to Sir Robert for a reference. Sir Robert's reply<sup>18</sup> was succinct:

Dear Gresford

In connexion with the appointment to the staff of C.S.I.R. I can strongly support J.R. Price who is an applicant.

The Minister in Charge of Scientific and Industrial Research, J.J. Dedman, approved Jerry's appointment to CSIR on 15 March 1945 and he commenced duty on 24 September 1945.

Jerry's initial scientific objectives were: to discover new sources of alkaloids already of value for medicinal purposes or as insecticides; to discover new alkaloids which may replace or supplement those already in use, and; to work out satisfactory methods of isolating and purifying the alkaloids found and to increase our systematic knowledge of the nature and chemistry of the alkaloids elaborated by plants.<sup>19</sup>

By the time Jerry arrived in Melbourne in 1945, Len Webb's screening tests (some on freshly collected leaves and bark and some on herbarium specimens) had already identified a large number of alkaloid-containing plants. In October 1945, one month after taking up his position in CSIR, Jerry joined Webb at Innisfail, North Queensland, to collect bulk

quantities of leaf, bark and wood of several selected species of rainforest trees belonging to the plant family Rutaceae for extraction and detailed chemical examination.

He very quickly impressed Dr Wark, who wrote, as part of a reclassification case on 18 February 1946:

Price is an excellent organic chemist and within a few weeks of his arrival in Melbourne was already obtaining results of importance in the alkaloid project. An 1851 Scholar, Price has a fine personality, is enthusiastic, and is a skilled experimentalist. He is quite capable of taking over the whole responsibility for the chemical side of the alkaloid investigation now being carried on in conjunction with the Division of Plant Industry and the Physiology Department of the University of Melbourne. It is recommended that he be reclassified as Senior Research Officer on 1/1/47, with a salary of £650 p.a., which is little enough for a man of his attainments who is almost 34 years of age.

It was already apparent to Jerry that to make significant impact in carrying out thorough chemical studies on the large body of Australian flora already known to give alkaloid-positive tests, many research chemists would be needed. He therefore sought help from staff in the Chemistry departments of the Australian universities. This was a remarkable achievement in university/CSIR(O) co-operation, brought about with a minimum of bureaucratic involvement. Probably one of the first university chemists whom he contacted was his good friend Bill Hughes at the Chemistry Department, University of Sydney. For some years, Hughes and his colleague Ern Ritchie (later Professor) had been studying anthocyanin pigments in Australian plants: they now enthusiastically took up the study of alkaloid-containing plants and many research students working for BSc Honours and MSc degrees cut their research teeth on the isolation and structure-determination of alkaloids. The other university chemist who collaborated with Jerry from the very beginning was

F.N. (Norm) Lahey, a senior lecturer in the Chemistry Department of the University of Melbourne for the period 1943–1949<sup>20</sup> before he took up a Research Professorship in Organic Chemistry at the University of Queensland.<sup>21</sup> Jerry's collaboration with Lahey was facilitated and perhaps stimulated by the fact that the CSIR chemistry laboratories at Fishermans Bend were yet to be completed<sup>22</sup> and Price was provided with laboratory space and facilities in the Chemistry Department of the University of Melbourne through the cooperation and generosity of Professor E.J. Hartung. Although parts of the Fishermans Bend laboratories were completed and occupied much earlier, it was 1954 before Jerry and his group of phytochemists could move there.

Three of the six tree species collected by Price and Webb from the rainforest near Innisfail were *Melicope* (now *Medicosma*) *fareana*, *Evodia* (now *Euodia*) *xanthoxyloides* and *Acronychia baueri* (now *Sarcomelicope simplicifolia*): the detailed study of the constituent alkaloids of these three species was undertaken respectively by Price, Hughes and Lahey. All three species proved to be very rich in alkaloids, some of which were common to all three of the above Rutaceous plants. In 1948 Hughes, Lahey, Price and Webb published a note in *Nature* entitled 'Alkaloids of the Australian Rutaceae' (23). This first communication heralded what became a very large and very successful survey of Australian plants for alkaloids and other constituents of chemical and/or biological interest. The full details of Jerry's work on *Melicope fareana* were set out in a series of papers in the *Australian Journal of Scientific Research* (24–27).<sup>23</sup> Parts II and V of this series were in collaboration with W.D. (Bill) Crow and Part III was by Crow alone. Crow was the first organic chemist appointed by CSIR to assist Jerry; he joined him in the laboratory at the University of Melbourne at the beginning of 1947

after having completed his BSc (Hons) degree at the University of Sydney with Hughes, who initiated him into the techniques of isolation and characterization of alkaloids.<sup>24</sup>

The three rainforest tree species that featured in the 1948 note to *Nature* by Hughes, Lahey, Price and Webb gave the alkaloid survey a flying start. In addition to the five papers by Price and Crow on *Melicope* (now *Medicosma*) *fareana*, Lahey and his co-workers published four papers on the alkaloids of *Acronychia baueri* (now *Sarcomelicope simplicifolia*) in 1949–1950,<sup>25</sup> and from 1949 to 1952 Hughes and Ritchie and their collaborators published four papers on the alkaloids of *Evodia* (now *Euodia*) *xanthoxyloides*.<sup>26</sup> At the same time a number of other alkaloid-containing species were being examined by Jerry and his co-workers and by Hughes and Ritchie and their research students at the University of Sydney. The programme of chemical studies that Jerry initiated in 1945 had rapidly gathered momentum. After the early work on *Melicope fareana*, the Price CSIR(O)<sup>27</sup> group examined many other alkaloid-containing species while still working in their temporary accommodation at the University of Melbourne; those that featured in publications included *Glycosmis pentaphylla*, *Pentaceras australis* (now *australe*), *Gyrocarpus americanus*, *Medicosma cunninghamii*, *Heliotropium europaeum*; and *Flindersia bourjotiana* in collaboration with Hughes, Ritchie and Cannon<sup>28</sup> at the University of Sydney.

In 1946 the Chemistry Department of the University of Melbourne had a large increase in the numbers of students doing organic chemistry in the second year and it became necessary to divide the class: Professor Hartung obtained permission to appoint Jerry Price as a temporary part-time lecturer to give one lecture per week for the whole academic year; he was paid an honorarium of £100.<sup>29</sup> There were 200 students and the class was divided, Lahey

taking one group and Jerry the other. This was a convenient arrangement with Jerry working in the Chemistry Department laboratories: it appears to have been operative only for the year 1946, but when Lahey moved to his new position at the University of Queensland in late 1949, Jerry became co-supervisor of some of his research students. One of these was Eva R. Klein (later Mrs Nelson); in her PhD thesis she acknowledged that 'Part I of this work was carried out under the direction of Dr J.R. Price and Part II under the direction of Dr F.N. Lahey.'<sup>30</sup> Part I of her thesis was 'An Investigation of the Sulfur-Containing Alkaloid from the bark of *Pentaceras australis* Hook F.' This project yielded three papers published in 1952 (31–33). Another PhD student supervised jointly by Price and Lahey was John A. Lamberton, who stated in his Acknowledgments that 'This work was carried out under the supervision of Dr J.R. Price and, in part, Dr F.N. Lahey'. Lamberton worked on the alkaloids from *Acronychia baueri* and *Medicosma cunninghamii*<sup>31</sup> (28). After a post-doctoral year overseas, Lamberton was employed in 1951 by the CSIRO Division of Industrial Chemistry, to work under Dr Harold Hatt on plant waxes. In due course Jerry replaced Hatt as the leader of the Organic Chemistry Section. John Lamberton joined the phytochemical group in 1965 and became a major contributor to the expanding alkaloid program.<sup>32</sup> An MSc student who was supervised by Jerry was H.P. Haynes who worked on the alkaloids of *Pentaceras australis*.<sup>33</sup>

A search of the University of Melbourne staff files for the Chemistry Department<sup>34</sup> failed to reveal any correspondence with Professor Hartung formalizing Jerry's supervision of research students: the involvement of non-university personnel in such a role appears to have been less regulated than it is now. Perhaps the apparent lack of formalization

was a consequence of Jerry's 1946 appointment as temporary part-time lecturer and his physical location in the Chemistry Department. The CSIR records show that Jerry was granted permission by CSIR to deliver a series of 25 lectures on Organic Chemistry to second-year students in 1946 but they do not indicate that he was appointed as a temporary part-time lecturer. In 1947 Jerry was invited by Professor Trikojus to deliver three lectures on plant pigments to advanced students of the Biochemistry Department, University of Melbourne. These are the only references to his involvement with the University in the CSIR(O) files.

The next organic chemist to join Jerry's alkaloid group after Crow (1947) was L.J. Drummond (1948); then followed Dr N.V. (Noel) Riggs (1949) and Dr C.C.J. (Claude) Culvenor (1950). Culvenor replaced Drummond who moved to the Defence Laboratories, Salisbury, South Australia. Like John Lamberton, Claude Culvenor remained with CSIRO, going on to make a major contribution in the study of alkaloids, particularly those in plants poisonous to farm animals; in 1971 he moved to the CSIRO Division of Animal Health where this work continued. In 1951 Riggs took the Chair of Organic Chemistry at the University of New England and was replaced in the group by Dr Emery Gellert. All these chemists worked together with Jerry in the laboratory space provided by Professor Hartung in the Chemistry Department of the University of Melbourne, until they moved to the Fishermans Bend laboratories in 1954.

In 1952 Jerry, now a Principal Research Officer, gave the Liversidge Research Lecture at the 29th Meeting of ANZAAS, held at the University of Sydney (38). In this lecture he summarized the alkaloid work being carried out by the CSIRO and university chemists, but he also described other phytochemical studies being pursued in Australian universities.

In his introduction he referred to the early pioneering work on essential oils that had:

dominated Australian plant chemistry for the past fifty years. One result of this domination is a fine record of achievement in terpene chemistry, but another, inevitably, is that remarkably little has been accomplished with other classes of plant products. However, this situation is gradually changing today — plant chemistry in Australia rests on a broader basis than at any time in the past. In addition to essential oils, cellulose, lignin, tannins, waxes, colouring matters, triterpenes, steroids, alkaloids, coumarins, cyclitols and lignanes are being actively investigated. It is my intention to give you some idea of the kind of work being done and where it is leading.

Jerry played a key role in a conference held at the University of Melbourne in February 1947 on 'Research into the Pharmacological and Other Chemical Constituents of Native Plants'. Six more such conferences were held (Melbourne, January 1949; Sydney, May 1951; Melbourne, August 1955; Adelaide, August 1958; Sydney, August 1962; and Melbourne, August 1965).

Jerry was awarded the DSc from the University of Adelaide in 1954 and was elected a Fellow of the Australian Academy of Science in 1959. Jerry was subsequently active on Academy business. He was a member of the National Committee for Chemistry from 1960 until 1966 and then Chairman of that committee 1969. From 1962 to 1968 he was a member of the Sectional Committee for Chemistry and Applied Chemistry (Chairman 1965–1966); a member of the Editorial Board of *Records of the Australian Academy of Science* 1965–1970; Chairman of the Publications Committee 1966–1970; and in 1969 a member of the Science and Industry Forum.

Of great significance for Jerry and for Australian phytochemistry was the decision of the International Union of Pure and Applied Chemistry (IUPAC) to hold a

symposium on the Chemistry of Natural Products in Australia in 1960. The invitation to IUPAC was made in 1958 by Dr A.L.G. Rees, CSIRO Division of Industrial Chemistry, through the Australian Academy of Science. With Rees as Chairman of the Organizing Committee, Jerry responsible for the scientific programme and Sir Alexander (later Lord) Todd, Nobel Laureate, as President, the symposium was highly successful. Sessions were held successively in Melbourne, Canberra and Sydney (72, p. 347). Many eminent organic chemists from overseas participated, but particularly significant for Jerry was the presence of Sir Robert Robinson, who had retired from the Wayneflete Chair of Chemistry at Oxford in 1955 but was still very actively involved in chemical research.<sup>35</sup> This symposium put Australian chemistry, particularly the Phytochemical Survey, firmly on the international stage. Nine years later Jerry was chairman of the organizing committee for two IUPAC conferences that were held at the University of Sydney in August 1969. These conferences attracted considerable media interest. A.L.G. Rees was at that time the President of IUPAC.

Jerry was promoted through the CSIRO research officer ranks until in March 1960 the then Officer-in-Charge of the Organic Chemistry Section, Dr Harold H. Hatt, informed the CSIRO Executive that he wished to resign from that position in order to devote his time to research. Hatt assumed the role of Head of the Sugar Research Group located at the University of Melbourne. Dr Wark recommended that Jerry be appointed to the vacant position. He wrote:

It is unnecessary to advertise this position. Throughout the world it would be regarded as certain that Dr Price would be offered it, and there is no prospect whatever of finding anybody more suitable for it. The Executive is well aware of Dr Price's standing as an organic chemist, of his ability as an administrator and of the originality he has brought

to bear with respect to the work of his group in the Organic Chemistry Section. I have no hesitation in stating that he has the capacity to lead a larger group with distinction.

CSIRO's Chemical Research Laboratories<sup>36</sup> operated under the following terms of reference: to promote technical efficiency in established industries; to stimulate the establishment of new industries; to encourage the use of raw materials of Australian origin; to seek substitutes for imported materials; to find uses for by-products not utilized; and to study national problems to which its officers could contribute by virtue of their experience in other fields.<sup>37</sup>

These terms of reference are quite broad but the Annual Reports from that period indicate that individual scientists were given considerable freedom to develop separate projects within the overall strategy.

The Organic Chemistry Section was raised to Divisional status on 14 March 1961. Jerry was appointed as the first Chief of the new Division in which there were sixteen Research Officers supported by ten Experimental Officers.<sup>38</sup> The Division was thus only a fraction of the size of current CSIRO Divisions that now comprise 200–600 people. The five Divisions at Fishermans Bend were part of the Chemical Research Laboratories and until 1960 the Divisional reports were consolidated into the Annual Reports of the Chemical Research Laboratories. From 1961 separate introductory material was presented for each Division<sup>39</sup> and that from the Division of Organic Chemistry provides some insight into Jerry's views on the purpose of the Division and how these influenced project selection.

In 1960<sup>40</sup> projects were underway in the study of the chemistry of wool wax, sugarcane wax, long chain organic compounds (looking at insecticides and naturally occurring acetylenic compounds), brown coal tar constituents, the chemistry of stock poisons

(largely pyrrolizidine alkaloids), the phytochemical survey of Australian plants, the chemistry of root exudates and the search for new uses for sugar. An important component of the work of the Division, and the Section before it, was done by the Micro-analytical Unit, which provided a service to Australian universities and companies. Jerry often referred to the importance of the services that the Division offered to other organizations and of the interaction between all participants in Australian chemistry. The projects that had been referred to above had been in place with little change since 1951, apparently representing the continued work of the individual scientists. That is, it appears that scientists with particular research interests were appointed and that it was this research interest that dictated the choice of project, rather than projects being actively changed to reflect changes in strategic intent.

In his first Report as Chief, Jerry maintained that research in organic chemistry fell broadly into three categories: the investigation of natural products that provided much of the background information for the science, synthetic organic chemistry that was responsible for the tremendous output of the organic chemical industries, and physical organic chemistry. He stated that it was the first two of these that directly related to the utilization of the country's natural resources and to other national problems on which organic chemistry impinges, hence it was in those areas that emphasis was placed in planning the Division's research. He indicated that much of the previous work in the Section had favoured natural products and that while this would continue he had initiated a reorientation that would broaden the synthetic activities of the Division. The principal feature of the new programme was the investigation of organic compounds of the metals of which Australia has large reserves, particularly aluminium, gold, zirconium, tungsten and titanium, with the

objective of finding new uses for these metals. A second project closely integrated with the study of organometallic compounds was the study of organophosphorus chemistry.

In the 1962–63 Report<sup>41</sup> Jerry reported on the expansion of the Phytochemical Survey and the stock poison work. He again noted the importance of collaboration and reported that the Division was working with the CSIRO Division of Animal Health, the Western Australian Department of Agriculture, the Queensland Department of Agriculture and Stock, the Victorian Lands and Survey Department, Smith Kline and French Laboratories, the Cancer Chemotherapy National Service Centre, the US National Institutes of Health, the Population Council, the Queensland Department of Forests, the National Herbarium, the University of Sydney Department of Agricultural Microbiology, the University of Tasmania Department of Botany and Imperial Chemical Industries of Australia and New Zealand.

The 1963–64 Report<sup>42</sup> continues with a similar theme, again highlighting the service the Division provided to Australian chemistry.

The divisional projects that were underway when Jerry's term as Chief concluded (at which time the Division of Organic Chemistry was merged with the Division of Physical Chemistry to form the Division of Applied Chemistry) illustrated how his views of the relevance of organic chemistry to Australia's development had affected the Division's work. He had terminated the work on the various waxes but had strengthened other areas. The projects reported in the 1964–65 Report<sup>43</sup> were synthetic organic chemistry aiming at the synthesis of new products of commercial value, organometallic chemistry, phytochemical investigations, toxic plant investigations and the recently introduced project on arthropod chemistry, principally considering the chemistry of insect and

crustacean moulting hormones. At this time the impact of instrumental methods of chemical analysis was being felt and there was a corresponding decline in the reliance on microanalytical methods, coupled with a large decrease in the time required to determine chemical structures. The nature of organic chemistry had changed significantly away from bench chemical towards spectroscopic techniques and this was reflected in the acquisition by the Division of crystallographic, mass spectroscopic, NMR, and other major instrumentation. In the original establishment of the Division of Industrial Chemistry the spectroscopic work and the then relatively rare ultraviolet and infrared spectrophotometers were allocated to the Chemical Physics Section (later Division). By the mid-1960s it was clear that such expertise needed to be closely integrated with the organic chemists and Jerry recognised that scientists specializing in the application of the spectroscopic techniques were needed, rather than scientists concentrating on designing and developing new instruments.

Jerry was promoted to Chief Grade III on 1 July 1963 and wrote to the Chairman of CSIRO, Sir Frederick White, in characteristic style:

Dear Sir Frederick

I thank you very much indeed for your letter of 23rd July informing me of my reclassification to Chief Grade III. I appreciate this very much indeed though I must confess I don't think it was warranted!

### **Royal Australian Chemical Institute (RACI)**

Jerry felt strongly about the importance of professional relations between chemists in Australia, seeing effective interactions as critical to the success of the discipline. He was President of the Victorian Branch of the RACI in 1959 and Federal President from 1962 to 1964. He was Associate Editor of Institute publications (1949–1953), a member of the Editorial

Board (1954–1955) and Editor of both *Proceedings of the Royal Australian Chemical Institute* and *Reviews of Pure and Applied Chemistry* (1956–1958)

Jerry was keen to promote the publication of Australian chemistry in the *Australian Journal of Chemistry* and to boost the image of the journal overseas. Jerry noticed that Australian publications appeared in *Chemical Abstracts* only after considerable delay. Enquiry revealed that *Chemical Abstracts* at that time preferred to have abstracting done in the country of publication, and that for Australia, this was in the hands of a person at CSIRO Head Office. To the abstractor's relief, Jerry offered to take it over, arranging a group of people to help. Claude Culvenor, who had abstracted for *British Abstracts*, took this role for a period.

To understand the abstracting load, it must be remembered that in the 1950s and before, *Chemical Abstracts* wanted every chemical detail recorded in the abstract so that work was repeatable from the abstract. In organic chemistry each abstract required close reading and could be quite lengthy. By the late 1950s *Chemical Abstracts* recognised that this was too ambitious (also too costly, for publication and to purchasers) and abstracts began to be merely a summary of what was done. From then on, abstracting was done 'in-house' at *Chemical Abstracts*.<sup>44</sup>

In an article published in *Proceedings of the Royal Australian Chemical Institute* in September 1967 entitled 'The Organization of Chemists and Chemistry' (61), Jerry argued that Australian chemists must follow the example of chemists in the UK and unite their organizations rather than fragment them into special-interest groups. He described as regrettable the formation of the Australian Institute of Food Science and Technology and the Australian Oil and Colour Chemists Association, arguing that the best way forward was to adopt an organizational framework that integrated

regional loyalties and interests with scientific and technological activities.

As mentioned above, Jerry was President of the Institute for an unprecedented two years from November 1962 to November 1964. When elected President he was already Chief of the Division of Organic Chemistry and in that position was on an overseas visit to: IUPAC Symposium on Pharmaceutical Chemistry in Florence (Italy); Dr J.S. Anderson, National Chemical Laboratory; Chemistry School, Cambridge University; ICI Pharmaceuticals Division, Research Laboratories; Department of Chemistry, University of Manchester; Boots Ltd, Research Department; Department of Chemistry, University of Nottingham; National Institute for Medical Research, Mill Hill; Smith, Kline and French Laboratories, Welwyn; School of Pharmacy, University of London (UK); International Symposium on Chemical Plant Taxonomy (France); Professor Kjaer, Copenhagen University (Denmark); Stockholm University, Professors Erdtman and Sandberg, Professor Sorenson, Trondheim University (Sweden); Division of Pure Chemistry, National Research Council, Ottawa (Canada); Dr Warren Nelson, Population Council, New York; National Institutes of Health, Bethesda, Maryland; Smith, Kline and French Laboratories, Philadelphia; Department of Chemistry, UCLA, Los Angeles; Department of Chemistry, University of Hawaii (USA). He left Melbourne on 13 September and returned on 21 November. The extensive list of contacts on this visit is an indication of how widely Jerry interacted with the international chemical community.

During this time he was also able to visit the headquarters of the Royal Institute of Chemistry, the Canadian Institute of Chemistry and the American Chemical Society, although none of these visits was mentioned on the official itinerary. On his return he wrote what was to be a very influential article for *Proceedings of the*

*Royal Australian Chemical Institute* entitled 'Home Thoughts from Abroad' (53), in which he set out his views of the role and purpose of the RACI.

Jerry was very impressed with the structure of the Canadian Institute of Chemistry, particularly the disciplinary-based, nation-wide Divisions and the existence of a small Board separate from the larger Council. At that time the RACI did have an Australia-wide Cereal Chemistry Group and a newly-formed Polymer Group and Jerry strongly encouraged the formation of other divisions. These were the forerunners of the current Divisions of the RACI. He also floated the possibility of the Branches (state-based) encouraging more independent Sections. At that time there were Sections at Newcastle, Geelong and Canberra. He thought that there should definitely be Sections at the Latrobe Valley, Launceston, Wollongong, Ballarat, Port Pirie, Armidale and Bendigo. With some greater effort there could also be Sections at Broken Hill, Mount Isa, Kandos, Mackay and Townsville.

By 2003 there was in fact a Branch in Canberra and also in the Northern Territory, and Sections at Geelong, Gippsland and Ballarat/Bendigo in Victoria; New England, Newcastle, Northern Rivers, Riverina Murray, Western Sydney and Wollongong in New South Wales; and North Queensland, Central Queensland and Darling Downs in Queensland, even though centralization of the chemical industry in Australia has prevented strong regional growth of the RACI of the type that Jerry may have envisaged. The RACI now has a highly successful Divisional structure, although it is still searching for an ideal operational model. In 2000 the RACI went to a new structure of the type suggested by Jerry, consisting of a Board to manage its business affairs, separate from an Assembly that sets policy direction and implementation.

The RACI awarded Jerry the H.G. Smith Medal (awarded in recognition of contribution to the field of organic chemistry) in 1956 and the Leighton Medal (its highest honour) in 1969.

### **Chairman of CSIRO**

Jerry was appointed as a member of the CSIRO Executive from 27 January 1966 and attended his first meeting on 3 February 1966. He replaced another organic chemist, Professor G.M. Badger. His salary increased marginally from \$12,108 to \$13,200!

John Shelton recalls:<sup>45</sup>

In retrospect, Price's appointment can be seen as the key step in Sir Frederick White's objective of better preparing CSIRO to meet the political and bureaucratic assaults which he predicted would come. It was this apprehension that had prompted him to move to Canberra, to restructure Head Office and to replace retiring members of the Executive with younger and innovative policy makers; Ives, as a member, Lewis Lewis as associate member. It was the addition of Price, having the cachet of a former Chief, which gave the impetus to change, which Ives and Lewis could not themselves have achieved. Added to that was Price's willingness to support changes that would benefit CSIRO, even though not popular with some chiefs — particularly a small but vocal and influential group who regarded CSIRO as a collection of 'autonomous research institutes'. This group had already been suspicious of White's restructuring of Head Office, following the departure of Mr. G.B. Gresford. In place of the single secretary as leader of Head Office, White created three secretaries, Administrative (L.G. Wilson), Agricultural & Biological Sciences (A.F. Gurnett Smith), and Industrial and Physical Sciences (J. P. Shelton).

On joining the Executive, Price made it widely known that he intended to make up his mind on what his role on the Executive should be after seeing from the inside how the Executive functioned. This was the first indication that Price was not a supporter of the 'autonomous' concept, and as it turned out, he would be largely responsible for the Executive becoming increasingly involved in what went on inside Divisions, especially



in setting priorities and allocating resources at programme level. This came about first by the adoption of programme budgeting, and then through a greatly increased Executive involvement in detailed reviews of Divisions, such reviews having been in the past made only when a Chief had retired. However, that was to come later. Price's first initiative on the Executive led to the Divisions of Organic Chemistry and Physical Chemistry being merged into a new Division of Applied Chemistry. He reasoned that the existing titles gave the impression that their role was to advance knowledge respectively in organic and physical chemistry. That, Price said, was a function of Universities, and distinct from the role of CSIRO in which these branches of chemistry were applied and, if necessary, further researched to provide solutions to industrial, economic, and in present day parlance, environmental problems, in terms of the Act, and of their respective divisional terms of reference. CSIRO was not, and should not seem to look like, a place where research was done for its own sake. CSIRO required both quality of research and relevance.

Price then took up his examination of Executive and Head Office procedures. He started information gathering with Shelton to assist but within a short time, Ives and Lewis had joined in what became a working party aimed at exploring and developing proposals for improvements in procedures in order to strengthen the effectiveness of the Executive and to prepare CSIRO to face the expected bids for external control of CSIRO. The key to this was formulated as follows — How can the Executive allocate funds and staff requested by a chief for growth without knowing, first, how much of current resources are going into that activity already in that and other divisions; second, how sure can the Executive be that the need for growth could not be better met, not by new funding, but by closing down unproductive or lower priority activities.

As it happened, the Finance group in Head Office had some time earlier appointed Nicholas Clarke to examine and report on the possible merit of CSIRO adopting the latest American management tool — programme budgeting. Clarke's recommendation that this be adopted was turned down, as the finance group did not see how it could help them in their role,

which was to use the Treasury headings of salaries, overtime, travel, equipment and so on. Clarke left. Shelton fed Clarke's report into the working party, as the way to provide the Executive with the information it needed, as defined above. It was eventually adopted, initially as an information presentation to the Executives of the Industrial and Physical Sciences Divisions, then later to all Divisions and after Price became chairman, as the budget format.

It was a key change and enabled the Executive to be better informed, to allocate funds according to its priorities, and to be able to counter, in detail, the frequently raised canard that CSIRO was doing too much basic research. Programme budgeting identified each activity with a relevant industrial and economic problem which, if it could not be solved by applying existing knowledge, was being tackled by 'basic' research to seek new information that could lead to a solution, as it so often successfully achieved.

Professor David Solomon FAA, Foundation Chief of the CSIRO Division of Applied Organic Chemistry (1974 to 1987) and its successor the Division of Chemicals and Polymers (1988 to 1989), recalls that after Jerry had joined the executive of CSIRO he maintained an active interest in the business of the Division and, indeed, visited the Fishermans Bend Laboratories on one occasion to propose, after typically brief pleasantries, that Solomon attend a meeting at Thredbo that was to discuss the forgery threat to Australia's currency. Professor Solomon attended the meeting and initiated the project that eventually, under Solomon's leadership, produced the Australian polymer banknote technology.<sup>46</sup>

Jerry was appointed Chairman of the CSIRO Executive from 26 May 1970. The then Chairman, Sir Frederick White, wrote a personal letter to the Minister for Education and Science, Nigel Bowen, on 16 March 1970:

My dear Minister

I promised to let you know Dr Price's plans for coming to Canberra. Dr Price will be

renting a flat in Canberra in April and intends to spend most of his time here. This arrangement will persist until a house is available for him. He hopes this will be towards the end of the year and he will then bring his wife to Canberra.

Our building on Mt Ainslie is due to be completed in November and will, I think, be handed over to us not long after that. Plans are already afoot to move the staff from Melbourne to Canberra towards the latter part of the year.

An insight into Jerry's integrity and modesty can be found in the discussion of his travelling allowance during this interim period in Canberra. He intended to commute to Canberra from Melbourne, spending the weekends in Melbourne. The maximum that he was entitled to was \$105.00 per week if he chose the usual 'per diem' rates. He chose instead a modified package of \$37.60 that included the actual cost of his flat and a special rate of \$25.00 per week allowance.

One of Jerry's first tasks as Chairman was to clarify the roles of the CSIRO Executive, the Head Office staff and the Chiefs. This was done for two reasons:

First, because I believe that the definition of these functions would be a worthwhile exercise in itself, but secondly, because it seems to me that we can't usefully examine the relations between these three groups until we are reasonably clear as to their respective functions.

He studied the Science and Industry Research Act that governs CSIRO and came to the conclusion that:

It is therefore clear that the Executive, subject to the approval of the Minister, bears the responsibility for determining the policy of the Organization, for determining priorities and for allocating funds as it thinks best. But it goes a little further than this. In addition to determining policy or policies it is the responsibility of the Executive to see that such policies are implemented.

He was keen to develop a system of 'cabinet solidarity' with respect to Executive decisions and rejected the proposal of

the Chiefs that individual members of the Executive should take line management responsibilities for particular activities such as finance and human resources. The consequence of this thinking was that the Executive had to rely on the Head Office staff to initiate the implementation of Executive decisions.

Jerry stated the role of the Chiefs in unambiguous terms:

While the Executive does call on you for advice and assistance in meeting its responsibilities, it also relies on you for many other things. You have the immediate responsibility for the first and most important function of the Organization laid down in the Act: '...the carrying out of scientific researches and investigations in connexion with or for the promotion of primary or secondary industry in the Commonwealth...'

In retrospect, Jerry was struggling with a management structure that did not separate the role of the Chairman from that of Chief Executive. This was not resolved until the appointment of a Board with an independent Chairman by the Hawke Government in 1986.

The election of the Whitlam Government on 2 December 1972 was the start of the most turbulent time in Jerry's career. An insight into just how much he was affected by some of the decisions of that government's ministers can be found in a speech that he gave to Melbourne staff on 3 July 1975, three and a half weeks after the Government announced that the Mineral Research activities of CSIRO were to be transferred to the Department of Minerals and Energy.

He started by saying: 'This has been a period of considerable difficulty for all of us, and it is imperative that we now pause and look closely at the situation'. After congratulating the staff on their patience and restraint he continued:

it is necessary to go back about two years, CSIRO fully recognises its responsibility to do research to meet national needs and therefore to be responsive to Government

policies. After the new Government came into office we immediately started thinking about our role in relation to the new Ministries that had been established. ...As part of this communication exercise we drafted a letter to Mr Connor that Mr Morrison<sup>47</sup> signed on 5 April 1973 advising him of our research programme on solar energy and suggesting that discussions take place at officer level. Then on the 3 July that same year a review of our Minerals Research Programme went from Mr Morrison to Mr Connor. Mr Morrison invited Mr Connor to establish direct contact with CSIRO if he had any questions about the review, or if he wanted further information.

Unfortunately, no reply was received from Mr Connor to either of these letters.

Then in December 1973 Mr Connor made a statement in Parliament about the Government's intention to undertake a crash programme on coal hydrogenation. Mr Morrison again wrote to Mr Connor telling him CSIRO was prepared to help in this programme and he asked Mr Connor to let him know details of the proposed crash programme.

Again, Mr Connor did not reply.

Jerry reminded his audience of a press statement dated 11 September 1974 in which the two Ministers had agreed that CSIRO would pursue research in many areas that would bear on the utilization of solar energy and that the Department of Minerals and Energy would take over the development phase of those CSIRO results that were approaching practical realisation.

Many other attempts were made to work with the Department of Minerals and Energy but, according to Jerry, they were all ignored until 13 May 1975 when Mr Connor replied that at least the responsibility for liquid fuels from coal had been assumed by the recently formed Coal Conversion Sub-committee of the Coal Research Advisory Committee.

Jerry then gave a detailed account of developments after Thursday 5 June 1975:

Now to more recent developments. You probably all remember that on Thursday 5th June the Prime Minister issued a press statement outlining new Ministerial respon-

sibilities. One sentence of his statement said, and I quote: 'The Department of Minerals and Energy will take over responsibility for the Minerals Research Laboratories and the Solar Energy Studies Unit.'

...but let me reiterate my attitude, the attitude of the Executive and I believe the attitude of the Organization as a whole. This is that we object most strongly to the manner in which this decision was made and announced — without prior consultation with the former Minister for Science, Mr Morrison, his successor Mr Cameron, with the Organization, with the recently established ASTEC — the Australian Science and Technology Council — or with industry. We also object to the disregard of the practical requirements for conducting effective government-based scientific research in this country. We do not question the Government's right to so order the affairs of CSIRO — that is its right — but such ordering should be brought about with the full understanding of all the factors involved and I believe we have preserved our credibility as responsible scientists and administrators by using every proper means to express our point of view to the Government. We have explained in very clear terms that the *ad hoc* dismemberment of CSIRO in this way could be disastrous to Australia's scientific output for years to come.

Lady Price recalls that before Jerry went to give that speech he told her to expect that he would lose his job over his stand.

History records that the Government, already under pressure from adverse reactions to many of its decisions, and with the urging of the Acting Minister of Science and Consumer Affairs, Dr Moss Cass, finally rescinded the 5 July administrative orders. Jerry had thus very effectively preserved the integrity of CSIRO and enhanced his reputation both inside and outside the organization.

Jerry retired on his 65th birthday, 24 March 1977. The Prime Minister, Malcolm Fraser, wrote:

I thought I should write to you on the occasion of your retirement as Chairman of the Executive of CSIRO.

My two periods as Minister of Education and Science enable me to write to you with first hand knowledge. I am well aware of the contribution you have made, successively, as an individual scientist, Chief of Division, member of the Executive and finally as Chairman of the Executive. Your appointment as Chairman designate was of course made while I was Minister responsible for CSIRO.

May I, as Prime Minister and personally, express my gratitude and appreciation for the service which you have rendered the Government and the nation, in your various capacities — but more particularly as Chairman of the Executive. The very high world wide standing of CSIRO (and CSIR before it) is due in no small part to the quality of the leadership over the years of its existence.

However I believe it is fair to say that your period as Chairman has occurred at a time when contemporary circumstances have never been more challenging. Throughout your service, your sense of dedication and loyalty, and your integrity, have been manifest for all to witness.

In conclusion, may I once again both thank and congratulate you for a job well done. I would like to express my very best wishes for a long and happy retirement.

Yours sincerely  
(Malcolm Fraser)

Jerry was awarded KBE in 1976 in recognition of his services to science and government. He was made an honorary member of the Royal Society of New South Wales in 1977.

### Retirement

Retirement afforded Jerry the opportunity to spend much more time with his grandchildren and to enjoy his garden. Jerry was also a great support to Lady Price in her many activities, as Lady Price was to him. When the Prices arrived in Melbourne in 1945, Joyce was aware of the great shortage of science teachers in secondary schools in Victoria. She suggested to Jerry that she embark on a teaching career but Jerry was not comfortable with his wife working. She abandoned that idea and went on to devote her time and consider-

able intellect and organizing ability to the Girl Guides.

She rose to be the Victorian State Commissioner for Guides, the Chief Commissioner of the Girl Guides Association of Australia, 1968–1973, and the Chairman (for two terms) of the World Committee of the World Association of Girl Guides and Girl Scouts (1975–1981). She had been a member of that committee from 1972. Lady Price was made a Life Vice-President of the Girl Guides Association of Australia in 1984 and was honoured to speak at the funeral service for Lady Baden Powell.

Lady Price was in England on Girl Guide business in 1974 when Jerry rang her to say that he was likely to be dismissed because of the stand he was taking against the Government (see above). He reassured her that he would be able to return to a Research Scientist position!

In retirement Jerry served as a director of Humes<sup>48</sup> for seven years. He accepted the position in the hope that he could persuade the company to use Australian R&D to develop new technology rather than buying technology from overseas. While he did not succeed in that aim, he found working with business people intensely interesting and confided to Lady Price that he came across attitudes and processes that he had not experienced in his long career in public service science.

He was a member of the Monash University Council and on the Clunies Ross Foundation. In July 1986, Jerry was attending a meeting of the Clunies Ross Foundation at Clunies Ross House in Melbourne. He had parked his car on Royal Parade but was informed that a parking place had been reserved in the underground parking area at Clunies Ross House. Upon leaving the building via the back lane he was struck by a delivery truck. As a result of that accident Jerry suffered permanent lung damage and some brain damage. He withdrew from active public life after that.

After a period in the Shoreham Nursing Home Jerry died on 8 March 1999. A Memorial Service was held to commemorate his life on Friday 16 April 1999 at the Monash University Chapel where friends and colleagues were invited to speak and to contribute with others to a booklet commemorating Jerry's life that was presented to Lady Price on the day on the service.<sup>49</sup>

In 1990 the CSIRO Division of Chemicals and Polymers (later CSIRO Molecular Science) instituted a named lecture series in tribute to Jerry's influence on organic chemistry in CSIRO. There have been nine Sir Robert Price Lecturers to date, Mr Rod Rickards of the Australian National University in 1990, Dr Dan Kleier of DuPont Agricultural Products in 1991, Nobel Laureate Sir John Cornforth FRS of the University of Sussex in 1992, Professor Emmanuel Vogel of the University of Cologne in 1993, Associate Professor (now Professor) Max Crossley of the University of Sydney in 1994, Professor Paul Knochel of University of Marburg in 1996, Professor Steven Ley FRS of the University of Cambridge in 1998, Professor Tony Barrett FRS of the Imperial College of Science, Technology and Medicine in 2000 and Professor David Solomon FAA of the University of Melbourne in 2001. These lectures bring industry, CSIRO and university scientists together in a way that Jerry approved.

Sir Robert Price was a great organizer and project developer with the ability to make wide and useful contacts with influential people in associated fields. He made a significant contribution to the growth and development of chemistry in Australia, and to the development of public sector research. He was a great organic chemist and a great man.

### Acknowledgments

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### Notes and References

1. Information kindly supplied by Lady Price CMG, OBE; some details extracted from a handwritten document 'My Family History', by Catherine Joyce Price, granddaughter of Sir Robert Price. Various personal details outlined below about Price's life have been drawn from documents made available by Lady Price.
2. J.R. Price, handwritten memoir in the possession of Lady Price.
3. Best, R.J., *Discoveries by Chemists: A History of the Chemistry Department of the University of Adelaide, 1885–1984* (Adelaide, 1987). Parts of Sir Robert Price's letter to Dr Rupert Best are quoted on pp. 85, 86. A copy of this letter was made available by Lady Price.
4. Alexander Killen Macbeth was appointed in March 1928 as successor to E.H. Rennie in the Angas Chair of Chemistry at the University of Adelaide: Best op. cit. (n. 3), pp. 75,78.
5. Dr William Ternent Cooke, who graduated from the University of Adelaide in 1900, won an 1851 Exhibition Scholarship which he took up in 1902 at University College, London to work with Sir William Ramsay. In 1906 Cooke was appointed as the first full-time Lecturer in the Chemistry Department, University of Adelaide [Best, op. cit. (n. 3), pp. 28–30].

6. Lapworth, A., 'A Theoretical Derivation of the Principle of Induced Alternate Polarities', *J. Chem. Soc.* 121 (1922), 416–427.
7. Rennie, E.H., 'The Colouring Matter of *Drosera whittakeri*', *J. Chem. Soc.*, **51** (1887), pp. 371–377; *idem*, 'Notes on the Colouring Matter of *Drosera whittakeri*', *Trans. Proc. & Report of the Phil. Soc. Adelaide*, **10** (1888), pp. 72–73; 'On the Colouring Matter of *Drosera whittakeri*', *Report Second Meeting Australasian Assoc. Adv. Sci.*, **2** (1890), pp. 398–399; *idem*, 'The Colouring Matters of *Drosera whittakeri*', *J. Chem. Soc.*, **63** (1893), pp. 1083–1089.
8. Numbers in brackets refer throughout to papers in the Bibliography below.
9. Macbeth, A.K., and Winzor, F.L., 'The Colouring Matter of *Drosera whittakeri*. Part II', *J. Chem. Soc.* (1935), pp. 334–336.
10. Winzor, F.L., 'The Colouring Matter of *Drosera whittakeri*. Part III. The Synthesis of Hydroxydroserone', *J. Chem. Soc.* (1935), pp. 336–8.
11. A.M. Bickford and Sons was a chemical drug manufacturing company in Adelaide that produced, *inter alia*, eucalyptus oil under the trade-mark 'Our Jack Brand'; D. Shiel, *Eucalyptus, Essence of Australia: The Story of the Eucalyptus Oil Industry – and of the 'Eucy' Men, and their Contribution to the Australian Bush Tradition*, Queensberry Hill Press, 1985, pp. 204, 212; see also J.R. Poynter, *Russell Grimwade*, (Melbourne, 1967), pp. 31–33, 162. In 1930, A.M. Bickford and Sons amalgamated with a number of other companies to form Drug Houses of Australia Ltd. Felton, *Grimwade and Bickford Pty Ltd: A Brief Chronological History*, www.fgb.com.au.
12. Lord Todd and J.W. Cornforth, 'Robert Robinson, 13 September 1886–8 February 1975', *Biographical Memoirs of Fellows of the Royal Society*, **22** 1976, pp. 415–527.
13. J.R. Price, notes on his early career in his 1946 application for Associate Membership of the Royal Australian Chemical Institute (RACI), *The Records of the RACI*, listed by Bill King, Gavan McCarthy and John Spink; Membership Files, Series 1, 1918–1956, Box 8; held at the Australian Science and Technology Heritage Centre, University of Melbourne.
14. Grimwade, J.F.T., *A Short History of Drug Houses Australia Ltd to 1968* (Melbourne, 1974).
15. Margaret Ann Devlin née Price was trained as a physical education and mathematics teacher and is now the Deputy Principal of Strathcona Baptist Girls Grammar School, Melbourne; Dr Donald Carruthers Price is a physicist and is Senior Science Fellow with CSIRO Telecommunications and Industrial Physics, Sydney; Janet Elizabeth Price studied Russian and German at ANU and works with refugees.
16. In 1948 Webb published an important document that became very useful to participants in the Australian Phytochemical Survey; L.J. Webb, *Guide to the Medicinal and Poisonous Plants of Queensland*, CSIR Bulletin No. 232, 1–202, Melbourne, 1948.
17. Over a period of about 14 years (1949–1963) L. J. Webb wrote a series of confidential Phytochemical Newsletters, copies of which were distributed to all CSIRO and University personnel participating in the Australian Phytochemical Survey. Two photocopy sets of these have been bound by David Collins; one is held by him and one by L.J. Webb.
18. CSIRO Archives, Archive Box PH/PRI/1; the contents of this file were used extensively as the source of information about Price's career in CSIRO.
19. Report of the CSIR Chemical Research Laboratories, 1945.
20. J. Radford, *The Chemistry Department of the University of Melbourne: Its Contribution to Australian Science 1854–1959* (Melbourne, 1978), pp. 201, 227, 228.
21. B. Chiswell, *A Diamond Period: A Brief History of the Chemistry Department of the University of Queensland 1910–1985* (Brisbane, 1986), p. 45.
22. I.W. Wark, 'The CSIRO Division of Industrial Chemistry 1940–1952', *Records of the Australian Academy of Science*, **4** (1979), 7–41. The building of the CSIR chemical laboratories at Fishermans Bend was authorized in 1946; work began in 1948 but was not completed until 1954.
23. After volume 5 (1952) the Australian Journal of Scientific Research, Series A Physical Sciences, was differentiated into the Australian Journal of Chemistry and the Australian Journal of Physics, each beginning with Volume 6 (1953). Publication of the Australian Journal of Scientific Research, Series B Biological Sciences also ceased in 1952 and was replaced by the Australian Journal of Botany and the Australian Journal of Zoology, each beginning with volume 1, in 1953.
24. W.D. Crow, personal communication.
25. F.N. Lahey and W.C. Thomas, 'Alkaloids of the Australian Rutaceae: *Acronychia baueri*. I. The Isolation of the Alkaloids', *Aust. J. Sci.*

- Res., 2A (1940), 423–426. A second part in this series was: R.D. Brown, L.J. Drummond, F.N. Lahey and W.C. Thomas, 'II. Some Reactions of the Alkaloid Acronycine', *Aust. J. Sci. Res.*, 2A (1949), 622–629. Related papers were: R.D. Brown and F.N. Lahey, 'The Ultraviolet Absorption Spectra of the Acridone Alkaloids I. Compounds Containing the Acridone Nucleus', *Aust. J. Sci. Res.*, 3A (1950), 593–614; *Idem*, 'The Ultraviolet Absorption Spectra of the Acridone Alkaloids. II. Compounds Related to 4-Quinolone', *Aust. J. Sci. Res.*, 3A (1950), 615.
26. G. K. Hughes and K.G. Neill, 'Alkaloids of the Australian Rutaceae; *Evodia xanthoxyloides* F Muell. I. Evoxanthine' *Aust. J. Sci. Res.*, 2A (1949), 429–436. G. K. Hughes, K. G. Neill and E. Ritchie, 'The Synthesis of Melicopine and Some Trimethoxy–10-methylacridones', *Aust. J. Sci. Res.*, 3A (1950), 497–503. G. K. Hughes, K. G. Neill and E. Ritchie, Alkaloids of the Australian Rutaceae: *Evodia xanthoxyloides* F. Muell. II. Isolation of the Alkaloids from the Leaves', *Aust. J. Sci. Res.*, 5A (1952), 401–405. J. R. Cannon, G. K. Hughes, K. G. Neill and E. Ritchie, 'Alkaloids of the Australian Rutaceae: *Evodia xanthoxyloides* F. Muell. III. The Structures of the Coloured Alkaloids, Evoxanthidine, Xanthevodine and Xanthoxoline', *Aust. J. Sci. Res.*, 5A (1952), 406–411.
  27. CSIR became CSIRO in May 1949: C.B. Schedvin, *Shaping Science and Industry: A History of Australia's Council for Scientific and Industrial Research, 1926–1949* (Sydney, 1987), pp. 350, 355–361.
  28. J.R. (Jack) Cannon in due course took up an appointment in the Chemistry Department, University of Western Australia, where he actively pursued studies in phytochemistry.
  29. University of Melbourne Archives: Chemistry Staff Files 1946/196. Also op. cit. (n. 22), pp. 201, 202, 227.
  30. E.R. Klein, 'The Chemistry of Some Australian Alkaloids and Sesquiterpenes', PhD thesis, University of Melbourne, 1951.
  31. J.A. Lamberton, 'The Chemistry of Some New Australian Alkaloids', PhD thesis, University of Melbourne, 1950.
  32. C.C.J. Culvenor, 'Obituary: J.A. Lamberton FRACI 1925–2002', *Chem. in Aust.*, 69 (2002), 38–39.
  33. H.F. Haynes, 'The Alkaloids of Some Australian Plants', MSc thesis, University of Melbourne, 1954.
  34. University of Melbourne Archives: Chemistry Staff Files 1946/196; 1947/178; 1948/187; 1949/189; 1950/189; 1951/186.
  35. Op. cit. (n. 12).
  36. At this time the Organic Chemistry Section was part of the Chemical Research Laboratories, along with the Mineral Chemistry, Cement and Ceramics, Foundry Sands, Physical Chemistry, Chemical Physics and Chemical Engineering Sections, under the overall leadership of Dr Ian Wark.
  37. Chemical Research Laboratories, Annual Report for the Year ending 30th June, 1959.
  38. It is interesting to note that non-research staff were not identified in CSIRO Reports from this period.
  39. Chemical Research Laboratories, Annual Report for the Year ending 30th June, 1961.
  40. Chemical Research Laboratories, Annual Report for the Year ending 30th June, 1960.
  41. Chemical Research Laboratories, Annual Report 1962–63.
  42. Chemical Research Laboratories, Annual Report 1963–64.
  43. Chemical Research Laboratories, Annual Report 1964–65.
  44. C.C.J. Culvenor, personal communication.
  45. John P. Shelton, personal communication.
  46. Professor David Solomon, personal recollection.
  47. Minister for Science.
  48. The Humes business was formed in 1911 by the inventor of spun concrete pipe, Walter Hume. From the original plant in Adelaide, success of the product had led to operations being established throughout Australia and in many countries around the world. By the end of the 1920s, Walter Hume had established businesses in USA, United Kingdom, Japan, Germany, Brazil, South Africa and several Asian countries. Today, in many of these countries Hume pipe is well-known as high-quality spun-concrete pipe. In November 1988, CSR acquired Humes Ltd's concrete products division.
  49. A copy of the presentations is kept at CSIRO Molecular Science. Speakers at the Memorial Service were Dr Donald Price, Professor David Solomon, Dr Claude Culvenor, Dr Peter Wailes, Professor John Swan, Professor Roy Jackson, Mr Alan Pierce, Mr Jack Coombe, Mr Grattan Wilson, Ms Amy Tran, Ms Amina Price, Ms Janet Devlin, Ms Catherine Price, Mr Andrew Devlin and Mr Ben Price.

## Bibliography

- Hooper, P.L., Macbeth, A.K. and Price, J.R., 'The "Hydrosulphides" of Carvone and laevo-4-isoPropyl- $\Delta^2$ -cyclohexen-1-one', *J. Chem. Soc.* (1934), 1147–1150.
- Macbeth, A.K. and Price, J.R., 'The Action of Bases on Nitrophenylhydrazines: 2:4-Dinitrophenylhydrazine', *J. Chem. Soc.* (1934), 1637–1639.
- Macbeth, A.K. and Price, J.R., 'The Action of Titanous Chloride on Nitrophenylhydrazones: *p*-Nitro- and 2:4-Dinitrophenylhydrazones', *J. Chem. Soc.* (1935), 151–153.
- Macbeth, A.K., Price, J.R. and Winzor, F.L., 'The Colouring Matters of *Drosera whittakeri*. Part I. The Absorption Spectra and Colour Reactions of Hydroxy-naphthoquinones', *J. Chem. Soc.* (1935), 325–336.
- Macbeth, A.K. and Price, J.R., 'The Absorption Spectra of Nitrophenylhydrazines', *J. Chem. Soc.* (1935), 1563–1567.
- Macbeth, A.K. and Price, J.R., 'The Absorption Spectra of 1:2:3-Benzotriazoles', *J. Chem. Soc.* (1936), 111–119.
- Macbeth, A.K. and Price J.R., 'The Action of Bases on Nitrophenylhydrazines. Part II', *J. Chem. Soc.* (1937), 982–984.
- Price, J.R. and Robinson, R., 'Nitrogenous Anthocyanins. Part IV. The Colouring Matter of *Bougainvillea glabra*', *J. Chem. Soc.* (1937), 449–453.
- Price, J.R. and Robinson, R., 'A New Natural Colouring Matter of the Naphthalene Group', *Nature*, **142** (1938), 147–148.
- Price, J.R., Sturgess, V.C., Robinson, R. and Robinson, G.M., 'Some New Anthocyanin Types', *Nature*, **142** (1938), 356.
- Price, J.R., Robinson, G.M. and Robinson R., Note: 'Occurrence of Kaempferol in *Crocus*', *J. Chem. Soc.* (1938), 281.
- Lawrence, W.J.C., Price, J.R., Robinson, G.M. and Robinson, R., 'A Survey of Anthocyanins. V', *Biochem. J.*, **32** (1938), 1661–1667.
- Price, J.R. and Sturgess, V.C., 'A Survey of Anthocyanins. VI', *Biochem. J.*, **32** (1938), 1658–1660.
- Lawrence, W.J.C., Price, J.R., Robinson, G.M. and Robinson, R., 'The Distribution of Anthocyanins in Flowers, Fruits and Leaves', *Phil. Trans. Roy. Soc. London B*, **230** (1939), 149–178.
- Price, J.R., 'The Yellow Colouring Matter of *Dahlia variabilis*', *J. Chem. Soc.* (1939), 1017–1018.
- Price, J.R., Robinson, R. and (in part) Scott-Moncreiff, R. (Mrs Meares), 'The yellow pigment of *Papaver nudicaule*. Part 1', *J. Chem. Soc.* (1939), 1465–1468.
- Price, J.R. and Robinson, R., 'Dunnione, Part I', *J. Chem. Soc.* (1939), 1522–1529.
- Price, J.R. and Robinson, R., 'Dunnione, Part II', *J. Chem. Soc.* (1940), 1493–1499.
- Lawrence, W.J.C. and Price, J.R., 'The Genetics and Chemistry of Flower Colour Variation', *Biol. Rev.*, **15** (1940), 35–38.
- Beale, G.H., Price, J.R. and Scott-Moncreiff, R., 'The Genetics of *Verbena*. II: Chemistry of the Flower Colour Variations', *J. Genet.*, **61**(1) (1940), 65–74.
- Barber, H.N. and Price, J.R., 'Nature of the Feulgen Reaction with Nucleic Acid', *Nature*, **146** (1940), 335.
- Beale, G.H., Price, J.R. and Sturgess, V.C., 'A Survey of Anthocyanins. Part VII. The Natural Selection of Flower Colour', *Proc. Roy. Soc. London B*, **130** (1941), 113–126.
- Hughes, G.K., Lahey, F.N., Price, J.R. and Webb, L.J., 'Alkaloids of the Australian Rutaceae', *Nature*, **162** (1948), 233–234.
- Price, J.R., 'Alkaloids of the Australian Rutaceae: *Melicope fareana*. I. Isolation of the Constituent Alkaloids', *Aust. J. Sci. Res. A*, **2**(2) (1949), 249–254.
- Crow, W.D. and Price, J.R., 'Alkaloids of the Australian Rutaceae: *Melicope fareana*, II. Preliminary Examination of Melicopine, Melicopidine and Melicopicine', *Aust. J. Sci. Res. A*, **2**(2) (1949), 255–263.
- Price, J.R., 'Alkaloids of the Australian Rutaceae: *Melicope fareana*. IV. Some Reactions of 1-Methyl-4-quinolone-3-carboxylic Acid, A Degradation Product of the Alkaloids', *Aust. J. Sci. Res. A*, **2**(2) (1949), 272–281.
- Crow, W.D. and Price, J.R., 'Alkaloids of the Australian Rutaceae: *Melicope fareana*. V. Structure of the Alkaloids', *Aust. J. Sci. Res. A*, **2**(2) (1949), 282–306.
- Lahey, F.N., Lamberton, J.A. and Price, J.R., 'Alkaloids of the Australian Rutaceae. The Structure and Reactions of Acronycidine', *Aust. J. Sci. Res. A*, **3**(1) (1950), 155–171.
- Price, J.R., 'Acridine Alkaloids', in *The Alkaloids, Chemistry and Pharmacology*, Manske, R.H.F. and Holmes, H.L. (eds.), Academic Press, New York, **2** (1952), 353–368.
- McKenzie, A.W. and Price, J.R., 'Alkaloids of the Australian Rutaceae; *Glycosmis pentaphylla* (Retz.) Correa', *Aust. J. Sci. Res. A*, **5**(3) (1952), 579–580.



31. Haynes, H.F., Nelson, E.R. and Price, J.R., 'Alkaloids of the Australian Rutaceae; *Pentaceras australis* Hook F.I. Isolation of the Alkaloids and Identification of Canthin-6-one', *Aust. J. Sci. Res. A*, **5**(2) (1952), 387–400.
32. Haynes, H.F., Nelson, E.R. and Price, J.R. (1952) Alkaloids of the Australian Rutaceae: *Pentaceras australis* Hook F. II. Identification of 5-Methoxycanthinone', *Aust. J. Sci. Res. A*, **5**(3) (1952), 563–569.
33. Nelson, E.R. and Price, J.R., 'Alkaloids of the Australian Rutaceae: *Pentaceras australis* Hook F. III. Identification of 4-Methylthiocanthin-6-one', *Aust. J. Sci. Res. A*, **5**(4) (1952), 768–781.
34. Cannon, J.R., Hughes, G.K., Price, J.R. and Ritchie, E., 'The Chemical Constituents of Australian *Flindersia* Species. IV. The Constituents of *Flindersia bourjotiana* F. Muell.', *Aust. J. Sci. Res. A*, **5**(2) (1952), 420–422.
35. McKenzie, A.W. and Price, J.R., 'The Alkaloids of *Gyrocarpus americanus* Jacq.', *Aust. J. Chem.*, **6**(2) (1953), 180–185.
36. Lamberton, J.A. and Price, J.R. 'Alkaloids of the Australian Rutaceae: *Acronychia baueri* Schott. IV. Alkaloids Present in the Leaves', *Aust. J. Chem.*, **6**(1) (1953), 66–77.
37. Lamberton, J.A. and Price, J.R., 'Alkaloids of the Australian Rutaceae: *Medicosma cunninghamii* Hook F.', *Aust. J. Chem.*, **6**(2) (1953), 173–179.
38. Price, J.R., 'Recent Developments in the Study of the Chemistry of Australian Plant Products' (Liversidge Lecture), *Rept. Australian and New Zealand Assoc. Advancement Sci.* (29th Meeting, Sydney, 1952), **29** (1953), 67–80.
39. Johnstone, R. and Price, J.R., 'N-Chloroacetylisatic Acid', *Aust. J. Chem.*, **7**(2) (1954), 209–210.
40. Culvenor, C.C.J., Drummond, L.J. and Price, J.R., 'Alkaloids of *Heliotropium europaeum* L. I. Heliotrine and Lasiocarpine', *Aust. J. Chem.*, **7**(3) (1954), 277–286.
41. Price, J.R., 'Plant Chemistry in Australia', *Rec. Chem. Progr.*, **16**(3) (1955), 153–163.
42. Price, J.R., 'Structure of Lunamine' (title only, paper read at Section B), *Rept. Australian and New Zealand Assoc. Advancement Sci.* (31st Meeting, Melbourne, 1955), **31**(1955), 47.
43. Price, J.R., 'Alkaloids Related to Anthranilic Acid', *Fortschr. Chem. Org. Naturst.*, **13** (1956), 302–345.
44. Price, J.R. and Smith, L.W., 'The Reaction of N-Chloroacetylisatin with Alkali', *Aust. J. Chem.*, **9**(1) (1956), 139–140.
45. Price, J.R., 'Some Aspects of Organic Chemical Research as Applied to Agriculture', *J. Aust. Inst. Agr. Sci.*, **22**(1) (1956), 3–10.
46. Price, J.R., 'A Novel Type of Naturally Occurring Quaternary Base'. In *Current Trends in Heterocyclic Chemistry, Proc. Symp. Canberra, 1957* (Albert, A., Badger, G.M. and Shoppee, C.W., eds.), Butterworths, London (1958), 92–109.
47. Johnstone, R., Price, J.R. and Todd, A.R., 'Alkaloids of the Australian Rutaceae; *Lunasia quercifolia*. I. 7-Methoxy-1-methyl-2-phenyl-4-quinolone', *Aust. J. Chem.*, **11**(4) (1958), 562–574.
48. Price, J.R., 'Alkaloids of the Australian Rutaceae: *Lunasia quercifolia*. II. The Nature of Lunasine', *Aust. J. Chem.*, **12**(3) (1959), 458–467.
49. Price, J.R. and Willis, J.B., 'The Infra-red Spectra of 2- and 4-Quinolones', *Aust. J. Chem.*, **12**(4) (1959), 589–600.
50. Price, J.R., 'Australian Natural Product Research', *Pure Appl. Chem.*, **2** (1961), 367–381.
51. Baldwin, M.E., Bick, I.R.C., Komzak, A.A. and Price, J.R., 'Some Ketones from *Acradenia franklinii*', *Tetrahedron*, **16** (1961), 206–211.
52. Price, J.R., 'The Distribution of Alkaloids in the Rutaceae'. In *Chemical Plant Taxonomy* (Swain, T., Ed.), Academic Press, London, 1963, 429–452.
53. Price, J.R., 'Home Thoughts from Abroad'. *Proc. Roy. Aust. Chem. Inst.*, **30** (1963), 89–93.
54. Price, J.R., 'The Future of the Institute', *Proc. Roy. Aust. Chem. Inst.*, **30**(8) (1963), 297–309.
55. Price, J.R., 'Studies in Alkaloids', *Pharmaceutisk Revy*, **62** (1963), 145–155.
56. Price, J.R., 'Antifertility Agents of Plant Origin'. In *Agents Affecting Fertility, Symp. London, 1964* (Austin, C.R. and Perry, J.S., eds.), Churchill, London, 1965, 3–16.
57. Hart, N.K. and Price, J.R., 'Alkaloids of the Australian Rutaceae: *Lunasia quercifolia*. III. Isolation of (-)-O-Methylaluminium Salts', *Aust. J. Chem.*, **19**(11) (1966), 2185–2187.
58. Inubushi, Y., Sano, T. and Price, J.R., 'Triterpene Constituents of *Lycopodium complanatum* L. from New Guinea', *Aust. J. Chem.*, **20**(2) (1967), 387–388.
59. Lamberton, J.A., Price, J.R. and Redcliffe, A.H., 'Micromelin, a New Coumarin from *Micromelum minutum* (Forst.f.) Seem (Family Rutaceae)', *Aust. J. Chem.*, **20**(5) (1967), 973–979.

60. Johns, S.R., Lambertson, J.A. and Price, J.R., '(±)-N-Benzoyl[2-hydroxy-2(4'-methoxyphenyl)] ethylamine from *Clausena brevistyla* Oliver (Family Rutaceae)', *Aust. J. Chem.*, **20**(12) (1967), 2795–2797.
61. Price, J.R., 'The Organisation of Chemists and Chemistry', *Proc. Roy. Aust. Chem. Inst.*, **34**(9) (1967), 239–241.
62. Hart, N.K., Johns, S.R., Lambertson, J.A. and Price, J.R., 'Alkaloids of the Australian Rutaceae: *Lunasia quercifolia*. IV. Identification of a Minor Constituent as 5-Hydroxy-1-methyl-2-phenyl-4-quinolone and Preparation of an Angular Isomer of (-) Lunine', *Aust. J. Chem.*, **21**(5) (1968), 1389–1391.
63. Johns, S.R., Lambertson, J.A., Price, J.R. and Siomis, A.A., 'Identification of Coumarins Isolated from *Lepiniopsis ternatensis* (Apocynaceae), *Pterocaulon sphacelatum* (Compositae) and *Melicope melanophloia* (Rutaceae)', *Aust. J. Chem.*, **21**(12) (1968), 3079–3080.
64. Johns, S.R., Lambertson, J.A. and Price, J.R., 'Isolation of Isomultiflorenol, a Possible Triterpenoid Artefact, from *Pleiococca wilcoxiana* (Rutaceae)', *Aust. J. Chem.*, **23**(6) (1970), 1283–1284.
65. Price, J.R., 'The Communication of Scientific Knowledge for Useful Application'. The 1970 Leighton Address. *Proc. Roy. Aust. Chem. Inst.*, **38**(5) (1971), 113–121.
66. Price, J.R., Graduation address. Australian National University, Canberra, April 1971. *Australian National University News*, **6**(2) (1971), 15.
67. Price, J.R., New Inventions and Riches. *Australian Director*, **2**(2) (1972), 13–16.
68. Price, J.R., Report on 28th Annual Conference. Opening remarks. *Appita Journal*, **27**(6) (1974), 382–383.
69. Barnes, C.S., Price, J.R. and Hughes, R.L., 'An Examination of Some Reputed Antifertility Plants', *Lloydia*, **38** (1975), 135–140.
70. Price, J.R., CSIRO: Fifty Years of Research. Looking to the Future. *Nature*, **261**:(5562) (1976), 631–632.
71. Collins, D.J., Culvenor, C.C.J., Lambertson, J.A., Loder, J.W. and Price, J.R., 'Plants for Medicines: A Chemical and Pharmacological Survey of Plants in the Australian Region', CSIRO Publishing, Melbourne, 1990.
72. Price, J.R., Lambertson, J.A. and Culvenor, C.C.J., 'The Australian Phytochemical Survey: Historical Aspects of the CSIRO Search for New Drugs in Australian Plants', *Historical Records of Australian Science*, **9**(4) (1993), 335–356.