CSIRO PUBLISHING

Historical Records of Australian Science, 2017, **28**, 58–65
http://dx.doi.org/10.1071/HR16019

John Melvin Swan 1924–2015

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John Swan began his career as a chemist working in an explosives factory during World War 2, and attending evening classes at the Melbourne Technical College. His subsequent studies at the University of Melbourne and the University of London were followed by employment at CSIRO before he moved to Monash University in 1966 as Professor of Organic Chemistry. He was subsequently Pro-Vice-Chancellor and then Dean of Science at Monash before 'retiring'. His involvement in broader fields of science and technology, that had begun during his university years, then expanded and he made significant contributions to marine ecology, wool scouring and other fields. His was, from start to finish, an astonishing career, one that brought him great satisfaction as he worked with colleagues in government, industry, education and environment.

Family Background

The ancestral heritage of John Melvin Swan is English on his father's side and Scottish on his mother's side of the family. His father, Ernest Swan, was the fourth of five sons born to William and Martha Swan in Melbourne where William was a printer and lithographer, having done his apprenticeship in London. For many years John's grandfather, William, was in charge of the railway map section of the Victorian Railways. John's grandmother Martha (née Robertson) was born in Edinburgh, Scotland, where her father was an engineer with the North British railways. He was killed in an act of bravery when he threw the points to clear the line for an express, but was struck by the train. The grateful passengers raised a sum of money for his widow, Euphemia (née Mitchell), and she and her small child, Martha, migrated to Australia. Euphemia subsequently married again in Melbourne and raised a second family as Mrs Scott.

At the age of sixteen, John's father, Ernest Swan, was employed by the Royal Bank of Australia that subsequently became the English, Scottish and Australian Bank (ES&A Bank). Ernest remained a banker all of his life—he was manager at Moonee Ponds and Ascot Vale during the depression years, then at Oakleigh, and finally for thirteen years at Flinders Lane in Melbourne. After his time the ES&A Bank became the ANZ Bank.

In 1914, Ernest enlisted in the Sixth Battalion and landed at Gallipoli a few days after 25 April 1915. He was moved down the coast to Cape Hellas where on 8 May he fought in the Second Battle of Krithia, and was severely wounded. He was subsequently taken to Alexandria, then to a hospital in England, and repatriated to Australia in 1916. After a long convalescence he rejoined the Bank, and in 1920 married Constance (Connie) Sherar, daughter of William and Barbara Sherar (née Melvin). William Sherar, from England, had a stationer's business in Elizabeth Street, Melbourne; his wife Barbara was from Banff in Scotland.

John Swan was born on ANZAC Day 25 April 1924, and given the second name Melvin: his mother's cousin John Melvin was killed at Gallipoli.

Early Employment and Education

After attendance at primary schools in Surrey Hills, Ascot Vale and Oakleigh, John was enrolled at Scotch College as a day student.

Chemistry soon became his major interest—particularly through the inspirational teaching of 'Tort' Jamieson, the senior chemistry teacher at Scotch College at that time. John graduated from the Leaving Honours class in 1940 at the age of 16. World War 2 was in its second year, and Imperial Chemical Industries of Australia and New Zealand (ICIANZ) was heavily involved with the production of explosives. John obtained a job at the Number 5 Explosives Factory at Albion, near Deer Park, as a junior laboratory assistant earning about £1.10/- a week. He initially worked in the TNT laboratory with Norman Jardine, and then in the General Chemistry Laboratory with Stan Clark. John learned a great deal from Clark who had substantial experience in analytical chemistry with various mining companies. The Number 5 Albion laboratories were entirely concerned with

routine analyses for process control. In those days there were no physical methods for chemical analysis; it was a matter of 'hands-on' wet chemistry. John recalled that in the laboratory there was a large and authoritative 'methods book' that gave details of the complex analytical procedures in use there.[1]

In parallel with his work at ICIANZ, in February 1941 John enrolled as an evening student at the Melbourne Technical College (now RMIT University) to study for an Associate Diploma in Applied Chemistry. This involved attendance at both theoretical and practical classes on four nights per week—two from 7.30 to 10.00 p.m., and two from 5.30 to 10.00 p.m. On days involving the earlier start, he was allowed to leave the explosives factory at 3.45 p.m. to enable him to get to classes on time. His fees were paid by ICIANZ, provided he passed his examinations—he always did! His lecturer at the College was Arthur Hambly,[2] whom John found to be 'a brilliant and inspiring lecturer who opened my eyes to the modern world of organic chemistry, and the equal excitements of physical chemistry'.

This combination of study and work at ICIANZ meant long days that involved travel by bus and train under crowded wartime conditions from East Malvern to Deer Park and return, back to the city for evening classes, and eventually a late meal at home. But John 'never regretted a moment of this intensive study and work period'.

In 1943, John attempted to join the RAAF, but was rejected because of eyesight astigmatism, a genetic inheritance from his mother. He was then called up for army service, but not accepted because his work at ICIANZ was of 'reserved occupation' status—important part of the war effort. At this time (1943), he was invited to move from the explosives factory to the newly established ICIANZ Research Laboratory in Deer Park. The Director was Dr H. Finn, an inorganic chemist from Perth. Organic chemist Dr Kurt Schachnow (a refugee from Europe) was also on the staff, but it was Mr Bob Dewar who was John's principal mentor, and with whom he worked closely.[3] Bob Dewar had an MSc from the University of Western Australia, and John found him 'remarkably inventive and creative'. The main task assigned to this new laboratory was the establishment and commission of a plant on adjacent land for the production of the urgently needed drug Sulphamerazine (4-amino-N-(4-methyl-2-pyrimidinyl)-benzenesulphonamide).[4] This was required for use in Burma, New Guinea and other parts of South East Asia where tropical dysentery was a major problem for the allied troops. Until the commercialization of the penicillins at the end of World War 2, sulphamerazine and related compounds were the main antibacterials.

Early in 1944, John was shown a copy of the Swiss patent describing DDT (1,1,1-trichloro-2,2-bis(4-chlorophenyl)ethane as an important new insecticide, and he was asked to prepare some: he may have been the first Australian chemist to do so. By the end of 1944, ICIANZ was manufacturing 1 tonne per week of DDT at Yarraville. The use of DDT made a major contribution to food production and human health after the end of World War 2, but environmental impacts have caused its use to be restricted under the Stockholm Convention on Persistent Organic Pollutants.

Higher Education and CSIRO

At the end of 1944, John completed his Associate Diploma at The Tech, having studied some additional mathematics subjects. So when he applied in 1945 to enrol for a BSc degree at the University of Melbourne, he was given credit for a full first year. John resigned from ICIANZ, and commenced full time study in March 1945 in the subjects chemistry, physics and pure mathematics: he had saved enough money to pay all of his university fees. After completing his degree at the end of 1946 (with high distinctions in all subjects), in 1947 he commenced work for a Master of Science degree on the synthesis of benzothiophenes under the supervision of Associate Professor Bill Davies. This work was terminated in mid-year because John was awarded a CSIRO Postgraduate Scholarship that enabled him to take the then-traditional path to the PhD degree by studying in Britain.[5] Interest in bio-active organic molecules was on the increase, especially following the elucidation of the structure of penicillin in 1942–5 under conditions of secrecy imposed by the UK and the USA. Swan chose to study under A. H. Cook of the Imperial College of Science and Technology (part of the University of London), who had been part of the wartime work on penicillin and continued to explore its chemistry. In post-war London John completed his PhD thesis 'Studies towards the synthesis of penicillin' in late 1949[6] and returned to Melbourne where he was offered a position as research scientist in the newly created Biochemistry Unit of the CSIRO Wool Textile Research Laboratories. The laboratories of this Unit were housed on the top floor of an old warehouse in Flinders Lane near Spencer Street but moved to Parkville in 1951–2. The Chief was Dr F. Gordon Lennox, an admirable and widely respected leader.[7] John's research involved the synthesis of peptides from individual amino acids, with an emphasis on the use of sulfur-containing amino acids, in recognition of the importance of disulphide cross-links in defining the properties of wool and other keratins. In 1952, he published three sole-author papers on thiohydantoins (2-thioxo-4-imidazolidinones).[8]

On 17 May 1952, John married Ailsa Macvey Lowen, a chemical engineering graduate of the University of Melbourne. Ailsa had completed a PhD in physical organic chemistry at Royal Holloway College of the University of London, under the supervision of Professor Gwyn Williams.[9] Returning to Australia, she became personal assistant to Dr Ian Wark in the CSIRO Division of Industrial Chemistry, studying the stability of bubbles within foams, a matter of great significance to the mineral flotation industry.[10]

Later in 1952, John was awarded a Fulbright Fellowship for study in the USA. He and Ailsa went to New York where they both worked in the research group of Vincent du Vigneaud at the Biochemistry Department of Cornell University. John worked with a small team on the synthesis of the hormone oxytocin. During his time in London, Swan would have been aware that du Vigneaud had also contributed to the penicillin work that was described in the 'official' report of the great project.[11] Back in Australia after his PhD studies, he would also have known that du Vigneaud, at the Cornell University Medical School, was researching the structure and synthesis of the peptide hormone oxytocin, a nonapeptide amide that initiates powerful contractions during childbirth. The Senior Fulbright Award enabled John to spend a year in du Vigneaud's laboratory and to contribute to the final synthesis of this substance.[12] The peptide was synthesized in the traditional way, amino acid by amino acid, with each intermediate substance isolated, purified and characterized. Today such a synthesis would be conducted by the solid-phase method invented in 1963 by Bruce Merrifield and earning him the Nobel Prize in Chemistry for 1984. Swan's contribution to the synthesis

of oxytocin, the linking of glutamine and asparagine, was recognized in a separate publication.[13] Du Vigneaud was awarded the Nobel Prize in Chemistry for 1955 for his work on oxytocin and the related peptide hormone, vasopressin.[14] Ailsa also worked in the team, identifying particular amino acids released from oxytocin by the action of the enzyme papain.[15]

John and Ailsa left New York in September of 1953, bound for Cambridge in the UK, where John visited relevant laboratories, and for a few months worked in the Chemistry Library. During that time their first child, Margaret Macvey Swan, was born (4 November 1953). In January 1954, the family returned to Melbourne where John continued at CSIRO with investigations in peptide synthesis and protein chemistry. They purchased a house in Parkville close to the CSIRO Laboratory, and while there had three more children—Barbara Lowen Swan (5 August 1955), Sally Martha Swan (15 September 1958) and William Angus Swan (24 February 1964).

In 1960, at the request of Dr J. R. Price, Chief of the newly established Division of Organic Chemistry, John moved into that Division at Fishermans Bend to head a group on the exploration of aspects of organometallic and organophosphorus chemistry, with emphasis on the use of these classes of compounds in industrial synthesis. With Judith Maynard, a recent graduate from the University of Melbourne the focus of the research was the preparation of organophosphate esters under mild conditions.[16] Reaction of a terminal alkene with phosphorus pentachloride, followed by hydrolysis, yielded the 2-chloroalkylphosphonic acid (R-CH(Cl)-CH_2-$PO(OH)_2$. Reaction of the phosphonic acid with an alcohol R'OH in the presence of an organic base effected the transfer of the phosphate group to form the corresponding phosphate ester. Even the hindered tertiary alcohol, *t*-butanol (2-methylpropan-2-ol), could be phosphorylated in this way. The organophosphorus research continued with his CSIRO colleague Tony Meisters and then, after Swan's move to Monash University, with a succession of graduate students and the head of Swan's research group, Dr David Collins. Explorations of the chemistry of benzazaphospholes deriving from the research of PhD student Peter Drygala brought the series to an end in 1984.[17]

The organophosphorus work was begun at CSIRO with an eye to the uses of such compounds in chemical industry. This aim was never met, but a patent taken out by Swan and his CSIRO colleagues some years after he had left the organization, claimed the synthesis of organophosphorus compounds with structures loosely based on that of morphine and possessing analgesic activity.[18] No medical applications of these compounds has ensued.

The Monash Years

Prelude: Swan and the Monash University Name

In a letter written in October 1956, and published the following month in the *Proceedings of the Royal Australian Chemical Institute*,[19] Swan suggested the name 'Monash University' for the new university of technology being planned for Victoria. 'In this way', he wrote, 'the State of Victoria would honour her most outstanding engineer, a man who achieved world renown both as a military leader, and as the organizing genius who created Victoria's greatest technological undertaking' the establishment of brown coal mining and electricity generation in Victoria's Latrobe Valley. His letter prompted one from another chemist[20] who expressed strong support for Swan's suggestion. At the same time Swan had also conveyed this suggestion in a letter to the Victorian government. Gillis later wrote a letter to the *Age* in which he said that he and Swan had suggested the name[21] but subsequent correspondence indicated that the wording of Gillis' letter was merely unfortunate and did not constitute an attempt to deny Swan's priority in the matter.

Appointment

Although he was not unhappy at CSIRO, John had enjoyed giving lectures at the Royal Australian Chemical Institute (RACI) and other places, and begun to think of a university position. The opportunity came when Monash University advertised a chair of organic chemistry and John, encouraged by the head of the Chemistry Department, Professor R. D. Brown,[22] applied for and was appointed to the position. In 1966, he thus became the third professor in the department, with Brown and the Professor of Inorganic Chemistry, B. O. West.

Teaching

John was soon active in the department, joining in enthusiastically with undergraduate teaching and engaging his graduate students in the organophosphorus research he had begun at CSIRO. The year before he arrived, the organic chemists had taken up the vogue for program learning (using material developed in England)[23] that helped students with the task of memorizing the basics of organic chemistry as a foundation for their advancement in the subject. The Monash team produced their own version[24] that was used for many years at Monash and other Australian universities, with sales of ~ 30,000 in the period 1969–88.[25] John joined with another colleague to produce a graduate-level text on the use of organometallic substances in organic synthesis.[26]

Studies of Tobacco Tar

In 1957, the American Surgeon General, Leroy E. Burney, declared that there was sufficient evidence to identify tobacco smoking as a cause of lung cancer. Responding to this stimulus, the Anti-Cancer Council of Victoria began a series of anti-smoking campaigns that continue to the present day. The Council's quarterly newsletter, *Victorian Cancer News*, carried reports of the campaigns including information on the tar content of cigarettes. Tar is the major vehicle for transmission of carcinogenic substances and it was a reasonable proposition that higher tar contents would be associated with greater risks of lung cancer. Following the determination of tar and nicotine content of American cigarette brands by scientists at the Roswell Park Memorial Institute (in Buffalo, NY) in 1967, the Council sent ten Australian brands there for testing. The results—tar 23–40 mg/cigarette, nicotine 1.4–2.6 mg—fell towards the upper end of the American range and it was observed that filters made no significant difference to the results. One result of the publication of these data was an increase in the proportion of sales of cigarettes with the lowest tar content, and this encouraged the Director of the Council, Dr Bill Keogh, to institute a local testing program in 1968 and to engage Professor Swan to build a smoking machine to international standard and to oversee the work in his Monash laboratory.

The machine was constructed in the Department and a technician was engaged to conduct the tests. By the end of the year, 25 Australian brands had been tested, revealing tar contents 7.1–32.3 mg/cigarette. Tests on 56 brands, published in March 1971,

showed that the average tar content was falling and it was claimed that publication of the measurements had 'put strong pressure on manufacturers to lower tar'. The Monash project came to an end in the early 1970s when Swan became Pro-Vice-Chancellor and had less time to spend in the Department of Chemistry. Testing continued, however, at the Australian Government Analytical Laboratory (AGAL), part of the Commonwealth Department of Science, and it showed that both tar and nicotine levels continued to fall. Tobacco companies fought back against this interference with their markets and Keogh's successor, Dr Nigel Gray later reflected that the resultant cigarettes, although exposing the smoker to less tar and nicotine, were just as dangerous to health. The reason was the increased concentration in the tar of carcinogenic substances such as the N-nitrosamines formed by interaction of nicotine and its degradation products with nitrates used in curing tobacco.[27]

Pro-Vice-Chancellor

After ten years in the job, Monash's foundation Vice-Chancellor, Louis Matheson, felt the need for a senior colleague to share his load and Council appointed John Swan as Pro-Vice-Chancellor for the period 1971–5. Listing Swan among several 'splendid appointments' made at the university in its early years, Matheson lauded Swan's 'quick mind and flashing imagination'.[28] Monash was probably the first Australian university to appoint Pro- and (later) Deputy Vice-Chancellors, 'reflecting an expansion in the size and number of executive responsibilities' and 'extension of the central academic leadership whose growth was to be a striking feature of later years'.[29] Other universities soon followed suit.

Among his other responsibilities, John chaired the Union Board and in other ways had extensive contact with students. The early 1970s were times of unrest in Australian campuses, where students challenged the systems of university governance under which they studied, and used the relatively open society of the university as a base for protest about Australia's involvement in the Vietnam War. The interaction had its extremes: on one occasion, as Acting Vice-Chancellor, Swan had to call the police on campus to break up an occupation of the administration building.[30] On the other hand, it was he who led work to introduce the gap year—a break between school and university with the university place assured. Most students taking the gap year did return to study. Monash was the first university to offer this opportunity but many others took up the idea. In another development typical of the evolution of higher education in this period, John's strong support in 1972 was important in getting the Professorial Board to approve the establishment of the Graduate School of Environmental Science, headed by Dr Tim Ealy, accepting that it represented a serious academic discipline, not just 'bushwalking and bird-watching'.

Pro-Vice-Chancellor's Research Unit

By arrangement with Professor Brown, and with support from the University, John was able to maintain a research presence in the Department of Chemistry. This enabled his research students to complete their studies of organophosphorus chemistry under the joint supervision of Dr David Collins, an organic chemist who was recruited from Sydney to head the Unit. Collins was also able to pursue his own research that included a study of alkaloids of Australian *Solanum* species with carbon skeletons akin to those of the steroids on which he had concentrated in his earlier career. The project was undertaken jointly with Swan and Dr Frank Eastwood, and had as its aim the commercial production of *Solanum* alkaloids that could be converted in the laboratory into hormonal steroids, including those used in contraceptive pills. The project led to the discovery of several new steroidal alkaloids,[31] but did not achieve a commercial outcome. This was partly due to developments in the total synthesis of steroids, but also because by 1978, the market price of the steroidal alkaloid solasodine, produced in Russia from the Australian plants *Solanum aviculare* and *S. laciniatum* had fallen by 50% since initiation of the Monash project in 1973. Before Swan left the University, Collins became a regular member of the chemistry staff.

Dean of Science

John did not seek to extend his time as Pro-Vice-Chancellor, but instead applied for the position of Dean of the Faculty of Science, which became vacant at that time. He was appointed and served for ten years in the position before taking early retirement in 1985. As well as providing leadership in one of the University's strongest faculties, John continued to play an important role in the broader university. For example, he gave strong support to the establishment of the Monash Centre for Human Bioethics in 1983, with Philosophy Professor Peter Singer as its first Director 1983–91.[32] As combined degrees were becoming popular, Swan worked with the Dean of Engineering, Professor Endersby, to agree on a joint science-engineering degree that, from the outset, proved popular with students.

ANZAAS Festival of Science

The Australian & New Zealand Association for the Advancement of Science (ANZAAS) had held congresses for a century at which Australian scientists met with their peers to hear lectures on the latest developments in their fields. Over the years, ANZAAS had been gradually displaced as a meeting venue by the rise of specialist societies that brought chemists, engineers and biologists—less so social scientists—together under discipline headings. John Swan took a different direction when he organized the 1985 congress in Melbourne, rebadging it as the ANZAAS Festival of Science and moving it away from 'scientists talking to scientists' to a format in which members of the public were invited to meet with scientists to discuss matters of interest and concern. Chairman of the Festival was Sir Edmund Hillary, of Mount Everest fame, and other presenters included Charles Perkins, Permanent Secretary of Australia's Department of Aboriginal Affairs, Professor Fred Hollows of Sydney's Prince of Wales Hospital and Dr Peter Kershaw, environmental scientist and rainforest expert. Publicity for the Festival of Science was accompanied by the publication in the Melbourne *Age* of a cartoon by W. Horner (Fig. 1). The 1985 Festival was a turning point for ANZAAS, an organization that has since redirected its activities to Youth ANZAAS, an annual residential forum for students in years ten to twelve.

Research in Biological Science

While most of John's research was in main-stream organic chemistry, throughout his career he maintained interests that took him further into biological science than his early work on penicillin and oxytocin. Research in immunology was shared with colleagues in

Figure 1. Cartoon by W. Horner published in the Melbourne *Age* on Monday 15 July, 1985 (published by permission of the *Age*).

the Monash Department of Immunology and pathology[33] and later, during a period of study leave at the Australian National University, with colleagues in the John Curtin School of Medical Research.[34] In biological systems the concentration of free iron species is very low due to complexation with iron-binding substances known as siderophores and some synthetic analogues of the natural substances with high binding constants were synthesized by MSc student Cherie McDougall (later Lewis).[35]

John wanted to continue research after he retired, but unlike many of his peers in the world of science he elected to move away from the University. Following his interest in biological chemistry, he worked with Dr Geoff Tregear in the Peptide and Oligonucleotide Laboratory of the Howard Florey Institute of Experimental Physiology and Medicine and also collaborated with Professor David Jackson at the Cooperative Research Centre for Vaccine Technology at the University of Melbourne.[36]

After Monash

Consultancy

As a university professor Swan had been engaged from time to time as an expert adviser to government and industry, but this work expanded after he left Monash. He provided scientific advice in legal matters and led reviews such as that on Trade Waste for the Melbourne and Metropolitan Board of Works.

Dry Scouring of Wool

Bringing together the knowledge of wool and wool textiles gained in his first appointment at CSIRO, and his later environmental concerns, especially with water quality, Swan envisioned a method of removing waxy material (lanolin) from raw wool that would not result in the production of waste water rich in detergents and waxy material, as was the case with typical scouring effluent. The technology involved shaking the wool with a finely divided solid absorbent such as alumina that could take up the waxes. The waxy material could be recovered from the alumina or the organic-rich mixture could be used in agriculture, as described in the patent that embodied the technology.[37] The technology was developed under the auspices of a public company, Hallmark Dell, but while it worked well with one-kilogram/hour of raw wool, it could not be scaled up to an industrial level.

As interest in the dry scouring project waned, Swan sought improvements in the traditional wet scouring technology by employing anionic detergents, typically sulfonic acid salts, at lower pH values than are customarily employed. Under these conditions, the emulsion resulting from the scouring process is more easily 'broken' so that wool wax can be recovered and the waste water carries a lower load of organics.[38] His partner in the venture was Albright & Wilson (Australia), and together they were able to interest about half of the wool scourers in Australia to adopt the new technology. Before it made the proponents any money, however, the industry moved offshore to countries where labour was cheaper and environmental laws less onerous.

John Swan and the Environment

In the early 1970s, the Victorian Government was examining proposals for industrial development on the shores of Western Port, and they commissioned a report from an American expert on the likely impact on the bay. Swan was appointed as chair of the advisory committee and his local knowledge was invaluable. The major finding of the Shapiro report was that industrial and agricultural activities in the catchment could affect the quality of the marine environment, notably the seagrass, mangrove and wetlands in the bay that were covered by the RAMSAR Convention on the conservation and sustainable use of wetlands.[39] As a result most of

the proposed developments were abandoned. Since 1959, the Swan family had owned a holiday house on Phillip Island, at the mouth of Western Port. John was already active in the Phillip Island Conservation Society and the Shapiro report caused him to take a heightened interest in development in the region and protection of its natural features. After retirement, he told an Academy of Science interviewer, he 'did something I never dreamed I would do: I actually stood for public office'.[40] He was elected to the Western Port Water Board in 1991 and when in 1994 the Victorian Government replaced the elected bodies, he continued as an appointed member of Western Port Regional Water Authority.

Another of his involvements was with the Victorian Institute of Marine Sciences that had been set up in 1978, following the passing of the relevant Act in 1974 that formalized an initiative of John Swan, Martin Canny, Professor of Botany at Monash, and Dr Phillip Law.[41] The value of Swan's input was recognized in several other appointments as adviser to studies of marine ecology in Victoria, including the Port Phillip Bay Environmental Study undertaken by Melbourne Water and CSIRO in 1992–6, the Western Port Seagrass Partnership, and the Victorian Coastal Council (2001–3). Nationally, he was a member of the Australian Marine Sciences and Technologies Advisory Committee (chair 1979–81), Chair of the Crown-of-Thorns Starfish Advisory Committee of the Great Barrier Reef Authority (1985–9) and the Crown-of-Thorns Starfish Research Committee (1989–92). In the early 1990s he was a member of an Independent Scientific Review Committee appointed by the Australian Petroleum Exploration Association (APEA)[42] and the Energy Research and Development Corporation to study the environmental implications of offshore oil and gas exploration and production in Australia. After carefully examining conditions in Bass Strait and on the North West Shelf the panel complimented the petroleum group on their environmental record, and noted that what little oil was getting into the oceans came from run-off from urban roads.

John's involvement as a critical friend of marine ecologists made him a popular speaker. In his overview of the proceedings of the Australian Academy of Science's 1991 Fenner Conference on the Environment, he addressed the *policy of minimum regret* that 'if in the face of growing human numbers we are to lose habitat, species, and species diversity, our conservation insurance policies should at least be such that our regrets to future generations can be minimized'.[43]

Although marine ecology was a major interest for John for several decades, his interest in the broad sweep of science and science policy ranged from the biological—one of his last public addresses was a 2010 talk to the Wallaby Club, of which he was a long-time member, on the subject of 'Plants, Insects, Microbes and Food'—and his role as chair of the Co-operative Research Centre for Southern Hemisphere Meteorology that was founded in 1993 at Monash University and brought together researchers from the University, the Bureau of Meteorology and CSIRO. A full list of Swan's contributions to public life through his involvement in institutions and investigations may be found in Supplementary Material to this memoir, together with a bibliography and patent list.

Recognition and Awards

In 1964, John Swan was awarded (jointly with ANU medical chemist D. J. Brown) the H. G. Smith Memorial Medal of the Royal Australian Chemical Institute, awarded annually on the basis of research publication over the previous decade. In the following year he was awarded (jointly with CSIRO entomologist L. R. Clark) the David Syme Research Prize of the University of Melbourne. He was elected to Fellowship of the Australian Academy of Science in 1968, and the Australian Academy of Technological Sciences and Engineering in 1994.

The degree of Doctor of Science (DSc) was conferred on Swan by the University of Melbourne in 1968 for a collection of his published work entitled 'Proteins, Peptides and Amino Acids' and the DSc *honoris causa* by Monash University in 1994. In 2001, he was awarded the Centenary Medal of the Australian Government for service to improving the environmental health of Western Port Bay. In January 2002, he was admitted as an Officer of the Order of Australia (AO) for service as an outstanding contributor to the advancement of Australian science, particularly in the fields of chemistry, marine science and meteorology, to education, and to the management, protection and conservation of the natural environment.

Some years after his retirement, the Department of Chemistry at Monash University established the John Swan Honours Scholarship in Chemistry. It provides $5000 to support study in the critical period between undergraduate and postgraduate study where other scholarship support is not normally available.

A full list of recognitions and awards may be found in Supplementary Material to this memoir.

Family and Recreation

John grew up in a loving and supportive family and enjoyed his own childhood as the third in a family of four siblings. He and Ailsa created a similarly supportive environment for their own children. After the birth of their first child, Ailsa retired from the workforce. She managed home and family while John was active in professional life, but at the holiday house on Phillip Island they were both involved in local affairs. John was an enthusiastic member of a venerable walking club, the Wallaby Club, eventually becoming a life member as he was of several other organizations.

Raising a family involved teaching the children to sail, and to enjoy vigorous activities as well as passive recreations. Bushwalking and bird watching, field naturalist excursions and cycling were complemented by musical activities and reading. By choice, the family did not acquire a television set until the 1970s. The purchase of a property on Phillip Island provided a great incentive for the propagation and planting of native trees.

Ailsa died in 1998 and three years later John married Nancy Campbell, who also predeceased him, in 2005. With Nancy's encouragement he took up Bridge and joined the Glenferrie Hill Recreation Club, where both his parents had been leading members. Soon after he joined the Club it amalgamated with another group (the Melbourne Cricket Club's Bowls Section) so he co-authored a history of the Glenferrie Hill club to mark its conclusion. Lawn bowls was his recreation, but not content just to enjoy the contest he saw a need that captured his innovative spirit. Several of his peers experienced difficulty in bending low enough to release the bowl on the required trajectory, so together with several of his colleagues John developed a new variation of a 'Bowler's Arm'—a device that overcame this disability by means of a metal prosthesis. In later life John purchased a folding bicycle, joined the Too

Old Bicycle Club,[44] and set off to explore the less-hilly parts of Melbourne.

More than 150 people attended a family celebration of his 90th birthday. In the following week he was diagnosed with cancer and his health declined rapidly after that.

Tributes

Following John's death on 24 July 2015 there were many obituaries and tributes. ABC radio's Robyn Williams replayed a 1999 interview with Swan in which he spoke at some length about his wool scouring project. The breadth of Swan's interests and involvements is attested by the extensive collection of his papers, held by the Australian Academy of Science but they were brought home to us by the eulogies delivered at the Memorial Service hosted by Monash a few weeks after his death, and by the presence there of his friends and colleagues from many walks of life.

Barbara Roberts wrote in the *Sydney Morning Herald*[45] about her father's early years and his Monash experience. She recalled comments of his colleague Tim Ealy that Swan was 'the locomotive' who 'got things done' and that 'it was always better to be aboard the train than to stand in front of it'. The Fairfax Press also published a shorter version of Barbara's piece in the Melbourne *Age*.[46]

Conclusion

How better to end this memoir than with a poem by John written in April 2013. It was read at his Memorial Service.

Future Tense

Could you somehow arrange a good life?
Make it sure—
Rich or poor.

Spell it out,
As a riotous rout?
A burden? a joy?
A sharing with a partner—
A husband, a wife?
Contentment,
With all actions well meant?

Here is the plan,
No need to despair—Just picture yourself on your deathbed,
And work backwards from there.

Acknowledgements

We acknowledge the assistance of the Monash University Archives, many of John's colleagues and graduates, and especially his daughter, Margaret Birtley.

Endnotes

1. Australian Academy of Science interview of John Swan by R. D. Brown, www.science.org.au/learning/general-audience/ history/interviews-australian-scientists/professor-john-swan-1924-2015, accessed September 2016. Another important oral history interview was commissioned by the National Library of Australia: Swan, John Melvin and Pockley, Peter (interviewer). *John Swan interviewed by Peter Pockley, 2010*. http://trove.nla.gov.au/work/38432294?q&versionid=50941732, accessed September 2016.
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