History of the Department of Physics at UWA

Issue No. 6: “Dr. J.B. Swan, Fulbright Scholarships and International Research Collaboration”

Presented by John L. Robins

Introduction.

The chronicle of Dr John B. Swan’s professional career is very informative in illustrating the way in which even the earliest research within the Physics Department was developed within an international framework. Even then the staff within the Department were establishing cooperation with international colleagues.

John Swan was the first person to be awarded a PhD in Physics by The University of Western Australia and his was possibly only the fourth PhD awarded throughout the whole University. (It was one of about six awarded during 1953.) He undertook his research studies, both here and abroad, whilst a lecturer in this Department. He was also one of the first Australians to gain a Fulbright Travel Grant, receiving it in the second year it was awarded in Australia.

Dr. Swan was my PhD supervisor from 1957 to 1960 and we remained good friends throughout the years from when I returned from overseas to join the staff of the Physics Department in 1966 until his untimely death in November 2001. Following his death, his family kindly made his professional papers available to me and I found among them some reports he had written which are very informative in recording, through his personal experiences and career, the way international research collaboration was initiated in the days when our Department was establishing its research credentials. This international research collaboration has played an important role within our Department and is still a dynamic feature of our current research activities.

I trust that through reading Dr. Swan’s report (reproduce below) you will gain a flavour of research and international collaboration in the early days of the Department and how the connections made could lead to participation in research at the highest level throughout a career. I have also included a brief biography of John Swan, which shows his research in context with his other academic achievements, activities and contributions to the Department and University.

Sources.

The report “The Fulbright Inspiration” was written by John B. Swan, probably soon after his retirement in 1991. The manuscript was found amongst his papers. It may have been written for the benefit of the Fulbright Scholarship Committee. There is no indication that it was ever published but, if it was, then I apologise to the publishers for not quoting a reference.

The “Brief Biography of John B. Swan” was written by myself, John L. Robins, using Swan’s personal papers, including CVs and Study Leave Reports, as well as my own personal recollections. His papers were presented to me by his family, following his death.

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An Unpublished Report

THE FULBRIGHT INSPIRATION

by

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[Probably written in about 1992]

I arrived in New York on September 11, 1951 aboard RMS "Queen Elizabeth" from Southampton, having departed on July 13 from Perth where I held the appointment of Lecturer in Physics at the University of Western Australia. Travel in those days was more leisurely and jet-lag was unheard of, and much of the enjoyment lay in the voyage itself and the sightseeing at the ports of call. Thus I had spent almost a week in England, following my disembarkation at Tilbury on my twenty-fifth birthday, visiting acquaintances at the universities in London, Birmingham and Oxford, and also at the nuclear research establishment at Harwell near Oxford.

My destination in the United States was the University of Illinois, located in the twin cities of Champaign-Urbana some 200 km south of Chicago, amid the vast fields of corn which typify that region of the Middle West. I had been awarded a Postdoctoral Research Fellowship by the University of Illinois and in addition a Fulbright Travel Grant by the U S Educational Foundation. The first of these met my living expenses, while the second was an essential supplement which covered the cost of my fares. Despite having experienced the Second World War and the Korean conflict which was still continuing, the local populace remained both isolated and isolationist so that, while my accent marked me as a foreigner - or an "alien" in IRS parlance - few of the locals knew anything about Australia or where it was, and several commended me on my fluency in their language. In my turn I was equally ignorant of American manners and customs, and found the learning process a series of exhilarating challenges. Not least of these was the requirement that, having gained a licence to drive on the "wrong" side of the road, one had to somehow negotiate a main-road intersection which (before the era of ubiquitous traffic lights) consisted of a "4-way Stop".

Research in Australia in the field of nuclear physics (not to be confused with nuclear power or nuclear weaponry) had its beginnings towards the close of the war with my studies under L H Martin at Melbourne University for the degree of MSc, there being no regulations in effect at the time for the PhD. More advanced research required access to facilities which were unavailable in this country at the time, and the choice of the University of Illinois as my goal was based on several factors. While Great Britain offered attractive possibilities and I have since worked very productively for two extended periods in the Clarendon Laboratory at the University of Oxford, that country had not yet recovered from the ravages of war. Food was still rationed and, as I saw for myself while visiting the 1951 Exhibition, the wartime bomb damage to London had not been made good and there were open fields of wildflowers in the rubble surrounding St Paul's Cathedral. The relative prosperity of America and the greater novelty of going to live in that country persuaded me to try for a position there. Illinois was held in high esteem by the physics community and was attractive to me as the site of
construction of a large electron accelerator which had been invented by D W Kerst, for I had previously been involved in the building of a small-scale version of such a betatron in Melbourne. R D Hill had recently made a permanent move from Melbourne to Illinois, and he strongly supported my proposal to go there to work. Although my decision was certainly based on insufficient information I could not have chosen better, and the outcome was that I spent eighteen months in extremely rewarding research before returning to the University of Western Australia in 1953.

Those were exciting times in physics, after the war. For example, the advances in microwave technology resulting from the development of radar were being applied in a number of areas of fundamental research with spectacular success. And in my field the new radioactive isotopes produced by neutron capture in a reactor were becoming available for research into the nature of nuclear forces and the problem of nuclear structure. Although Illinois itself had no neutron source there was a reactor nearby in Chicago, and Illinois did possess a cyclotron in which isotopes were being produced by E Segré, who a few years later won the Nobel prize for his nuclear research. The Chairman of the Physics Department was J Bardeen, who spent considerable time away from the Department at the Bell Telephone Laboratories where he had recently invented a device called a transistor, for which he was awarded the Nobel prize in 1956. (He is the only winner of two Nobel prizes in Physics, the award of the second in 1972 being for the theory of superconductivity. Marie Curie is another winner of two prizes, though one of these was in Chemistry). Another major project under way in the Physics Department at that time, in addition to the electron accelerator referred to above, was the construction of a large state-of-the-art computer. This was physically large because it used hundreds of vacuum tubes, which were notoriously prone to failure and for which the daily "quality control" consisted of striking each rack of electronics with a rubber mallet to induce failure before the day's work began. It was possibly the first hexadecimal processor, for I remember several discussions over lunch on what names to give the digits following 9. But the modern small, powerful and reliable desk-top computer had already been foreshadowed by Bardeen's invention.

My own research made rapid progress and several new radio-isotopes were discovered. The principal method of identification involved the measurement of the energy spectrum of the electrons emitted when the radioactive nuclei decayed, and one form of spectrometer made use of a constant magnetic field which deflected the electrons according to their energy, with the position of arrival of the electrons being recorded on a strip of X-ray film. I can vividly recall opening the spectrometer and developing the film one morning after an overnight exposure, and the thrill of discovery upon seeing a completely new spectrum! The definitive interpretation of the nuclear transformations responsible for such an observation required further experiments, and to enable these to be completed my term was extended in May 1952 by my appointment as a Research Associate in Physics.

This Fulbright experience led very directly to the commencement of a project in electron spectroscopy in Perth. As there was no reactor for the production of isotopes, the new research made a study of the energy spectrum of electrons emitted from a hot-wire filament after they had been scattered from a solid target. Although similar work had been done previously in laboratories overseas, those observations were contradictory and no satisfactory interpretation was possible. Thanks to the advanced experimental techniques which I had learned at Illinois, my students and I were in a position to show that our observations were the result of characteristic energy losses suffered by the incident electrons, arising from the excitation of volume plasma oscillations in the free electron gas of the target.
At this stage a completely unpremeditated collaboration began with a theoretician, D Pines of the University of Illinois, whom I had met only casually during my stay. He had developed an interest in the theory of quantized excitations in solids at about the same time as we in Perth had built our apparatus, and he realized that we were in a position to conduct definitive tests of his calculations. In particular he made a prediction of the existence of surface plasma oscillations, which was quite detailed in regard to the energy quantum for different metals and to the dependence of this energy on the presence of a surface film on the metal. Within a few short weeks of receiving his figures we were able to provide experimental confirmation of all of the details of his theory, much to our mutual delight and satisfaction, and in so doing to provide the explanation for the inconsistencies in the observations of others. Since that time extensive research into solid state plasma oscillations has continued world-wide, and this new knowledge is now being used in the analysis of thin surface films on the one hand and is finding fresh applications in fibre optics on the other.

Several years and several postgraduate students later I returned to work in the United States, again on an 18-month research project. During this period at Brookhaven National Laboratory I successfully sought a grant for research in electron spectroscopy at the University of Western Australia from the US Army, which was at the time prepared to support non-military fundamental research outside the United States. This support was more liberal than that forthcoming from local sources and it continued for five years to 1966, and during this period many advances in instrumentation were incorporated into the apparatus. I was also able to attend several conferences in America and Europe, to keep abreast of progress in other laboratories and to report our own most recent work. In 1966, as US Army support for research in foreign laboratories was being wound down, the European Office of the US Army funded a project which I had proposed with a colleague in Sweden. And so it came about that after fulfilling a prior commitment to research on plasma oscillation dispersion at the University of Munich, where I had been appointed Guest Professor, I arrived in Stockholm on June 1, 1967 for a six-month stint at the Nobel Institute for Atomic Physics. There the founding Director (by then retired), Manne Siegbahn, who won the 1924 Nobel prize, still worked and had his residence. The current Director was a physicist and friend who had succeeded me, with a brief overlap, at Illinois some 15 years previously. Meanwhile at the nearby University of Uppsala, Siegbahn’s son Kai Siegbahn was energetically developing a specialized application of electron spectroscopy to chemical analysis. We had corresponded previously on the interpretation of the energy losses which he observed in his spectra, and I now had the opportunity to visit his laboratory and see his work, for which he was later awarded the Nobel prize. My Institute appointment provided only a small but intriguing insight into the working of the award committee, but it did carry with it an invitation to attend the Nobel Prize Award Evening in the Stockholm Opera House on December 10 – a remarkable mix of formality and festivity in which the King of Sweden played a prominent part.

One further study leave was spent in America, at the Oak Ridge National Laboratory in the hills of Tennessee in 1981. This laboratory had grown out of one of the wartime uranium enrichment plants and had diversified to include research into aspects of plasma excitation by electromagnetic radiation in connection with which I had made previous visits and now came to work with former colleagues from Stockholm and elsewhere as a member of an international team. One of the methods of excitation employed laser radiation, so that after my return to Perth I set about installing a laser laboratory in the Physics Department there. But before long, and largely as the result of twelve months spent at the University of Otago in New Zealand, there was a change of direction, as my interest grew in the use of a tuneable dye laser
for atomic spectroscopy, and this in turn led me back to Oxford in 1985, and again in 1988, to work in (rather than merely to visit) the Clarendon Laboratory, and to participate in the high-resolution spectroscopy of atomic hydrogen.

So it was that as my research career neared its conclusion, I could look back to my first visit to Oxford many years before on my way to the United States as a Fulbright Scholar, and discern how that experience in America had profoundly influenced a lifetime of teaching, study and research. And not only did it shape my own career, but also that of several of my graduate students who went to the United States to study, of whom at least two settled permanently in that country.

Is it conceivable that Senator Fulbright could have seen so far into the future, or possibly imagined the consequences of his inspired legislation, for even just this one small group?

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An Unpublished Report

“A BRIEF BIOGRAPHY OF JOHN BARRETT SWAN”

by

John L. Robins

John Barrett Swan died suddenly, at home, on 1 November 2000. John had retired from the University of Western Australia (UWA) in December 1991 after 43 years as a member of the Physics Department, including many years spent overseas on various research-related appointments and study leaves. When he was awarded his PhD at UWA in 1953, it was the first PhD awarded within the Physics Department and only about the fourth within the University. By the time of his retirement in 1991 he was one of the last remaining Readers within the University, where a Readership was the traditional appointment for senior staff involved in research, preceding the current title of Associate Professor.

The period of his professional association with the University spanned an interesting era and he certainly contributed to, as well as benefited from, the developments that occurred during that period. From the outset he actively pursued his research in the international arena despite the fact that at that time travel to America or Europe took many weeks by ship and correspondence around the world was correspondingly slow. His career also illustrates how the outward-looking vision and activities of the earliest staff of our Australian universities, which he personified, led to the current recognition of our academics and students as active contributors to international research.
John Swan was born in Melbourne on 1st September 1926. In 1943, at the age of 16, he entered Melbourne University from Scotch College, with four First Class Honours subjects at the 1942 Leaving Honours Examinations. He was awarded an Exhibition by examination at Ormond College, and a Senior Government Scholarship to the University, being one of about ten students invited to enrol in a special war-time course leading to Physics III in the second year at University. He completed this course in 1944 and proceeded to an MSc by research in 1945, having been awarded a Minor Research Scholarship and the Curdie Research Scholarship in Physics. He completed his thesis titled "The Scattering of Neutrons by Deuterons", and related publications, in 1947 and his MSc with First Class Honours was conferred in April 1948. He then became a member of staff at the University of Western Australia and enrolled as a part-time PhD candidate, commencing a project in cosmic ray studies.

In 1951, having been awarded a Fulbright Travel Grant and a Postdoctoral Fellowship at the University of Illinois, he traveled to that university to undertake research in nuclear physics. This work was so successful and fruitful that he was invited to continue at the University of Illinois during 1952 as a Research Associate. This work included a study of radioactive nuclei decay schemes and resulted in the discovery of several isomeric nuclei, the states of which are now embodied in the charts of the nuclides. He then returned to the University of Western Australia where his PhD was conferred in 1953, based on his thesis "Cosmic Radiation and Nuclear Isomerism" which included research performed at the two universities.

Upon his return to Perth, he set about the design and construction of an electron spectrometer incorporating several novel features. Using this to measure the characteristic energy losses of scattered electrons, the experimental identification of elementary excitations in solids was achieved. Several of these original observations have been reproduced in advanced texts by authors describing this definitive work on solid state plasmons. The work also involved the first use of Auger electron analysis to monitor changes on atomically clean surfaces.

On the basis of this research he was offered an appointment at the Brookhaven National Laboratory in the USA to work for eighteen months in the then new field of the Mössbauer effect. Following this, he received substantial support for several years from US sources to continue his work in Western Australia. Following this his research was funded primarily through grants from the Australian Research Grants Committee.

In the period between 1966 and 1968 his standing in the international research community led to other invitations, including an appointment as Guest Professor at the University of München, Germany (funded by sources in Germany) and as Visiting Scientist at the Nobel Research Institute for Physics in Stockholm, Sweden (where he was funded as a European Research Officer by the US Army).

Back in Western Australia, his spectrometer was converted during 1970-1971 to the study of positive ion spectra including investigations of the nature of collisional interactions between positive ions and target gas atoms, and the study of metastable states and their energies and lifetimes. However, in this period his administrative duties began to consume more and more of his time.

Nevertheless, he did have four further very productive and stimulating study leaves. In 1978, as a Research Visitor at the University of Otago, New Zealand, he contributed to a study of
the application of laser spectroscopy to atomic excitation and in 1981, at the Oak Ridge National Laboratory in Tennessee in the USA, he worked with an international team on the study of plasma excitation by electromagnetic radiation. His final two leaves, in 1985 and 1988, were take in the Clarendon Laboratory at Oxford University, UK, where he participated in the high-resolution spectroscopy of hydrogen. The objective there was to carry out a precision test of the theory of quantum electrodynamics by measuring the energy of the 1s to 2s transition in hydrogen by inducing a Doppler-free two-photon transition in the far ultraviolet. John considered that it was extremely satisfying as a research physicist to have been involved, during his final study leaves, with the preparations to make such a fundamental measurement, requiring the transition energy to be measured to an accuracy of better than one part in a billion.

During his 43 years in the Physics Department at UWA, John Swan was involved with a wide range of teaching, planning and administrative duties. Positions he held ranged from Secretary through to Chairman of the WA Branch of the Australian Institute of Physics, Secretary of the University Staff Association, membership of committees such as ANZAAS, the Fulbright Selection Committee, the State Advisory Committee of the Perth Observatory, the TAE Physics Syllabus Committee, Chairmanship of the Scholarships Committee with its associated membership of the University Research Committee and various other Faculty and Departmental committees. In addition he served two terms as Head of the Physics Department.

John Swan originally joined the University of Western Australia as a Temporary Lecturer in 1948, and was promoted to Lecturer in 1950, Senior Lecturer in 1955 and Reader in 1962, finally retiring in 1991. Whilst it was a time of growth for the University itself, it is clear that John contributed significantly to that growth and particularly to the rapid development of the extent and culture of scientific research within the University and the University’s interaction with research institutions around the world.

John Swan was clearly an academically talented youth. He gained one of the first PhDs awarded by the University of Western Australia. He also gained one of the first of the prestigious Fulbright Travel Grants. He traveled widely to establish international research collaborations in the USA, the UK, Continental Europe and New Zealand. He brought some of the earliest international research funding into his Department. He made significant fundamental contributions to scientific knowledge by involving himself and his students in what were then new fields, such as cosmic rays, radioactive nuclei decay, electron spectroscopy, plasmon excitations in solids, elementary Auger spectroscopy, Mössbauer spectroscopy, laser excitations, and a test of the theory of quantum electrodynamics.

In his personal life John, with his wife Beverley, had three daughters and a son, and eleven grandchildren, and was rightfully proud of all of them.

His colleagues and those who knew him well, as well as the many hundreds of students, both undergraduate and graduate, whose lives he influenced, will always remember him for his genuine friendship and support, his wisdom and knowledge, and for his scientific integrity.