Chapter 7. Macquarie University

Joe Moyal was 62 when he decided to throw his hat back into the academic ring in Australia — not an ideal age for a new appointment. Ironically, one or two of his former Ph.D. students now held Professorships in the country and other Professorships coming on stream at Sydney, Melbourne and Monash Universities went to younger men. Yet, in a surprising stroke of coincidence and good fortune, he found himself in contact with the renowned British theoretical and particle physicist, John Clive Ward, who, four years earlier, had taken up his post as the Foundation Professor of Theoretical Physics in the School of Mathematics and Physics at the relatively new Macquarie University in the north of Sydney.

John Ward had a formidable history. Described variously as ‘one of the most brilliant British physicists of the post-war era’, and one whose research ‘met Nobel Laureate standards’, Ward’s academic trajectory had taken him from his first degrees in engineering and mathematics and a Ph.D. in theoretical physics at Oxford University in 1949, to a series of appointments from 1951 that embraced the Institute for Advanced Studies in Princeton (1951–52), Bell Laboratories (1952–53), and a succession of posts in American universities, including the Universities of Maryland and Miami, Carnegie Institute of Technology (1959–60), back to Princeton (1955–56 and 1960–61), and Johns Hopkins University (1961–66). In 1966, he moved to the Antipodes (he had spent a year at the University of Adelaide in 1953–54), and wended his peripatetic way to New Zealand at Victoria University in Wellington. The following year, he moved to Australia where he anchored and completed his career at Macquarie University, until his retirement in 1984.

Ward’s brilliance blazed from the outset of his career. In 1950–52, working from Freeman Dyson’s paper on the renormalization of quantum mechanics and applying mathematical operations, he obtained an identity for consistency which expressed the gauge invariance of electrodynamics,
and, in his famous paper, ‘An identity in quantum electrodynamics’, he stamped the name ‘Ward identity’ or ‘Ward identities’ upon field theory and, subsequently, in systems of nucleons, mesons and photons.¹

Spectacularly, during 1955, with the British Government’s decision to build a thermonuclear bomb, ‘this titan of quantum electrodynamics’, as the Russian physicist Andrei Sakharov dubbed him, was appointed to Aldermaston Laboratory on the advice of Churchill’s scientific adviser, Lord Cherwell, to head the ‘Green Granite’ project for the construction of the bomb. Here, in short order, Ward conceived a ‘two-stage device’, the radiation from the first fission stage being used to compress the light elements of the second stage, leading to a thermonuclear explosion. On this occasion, however, his design was not understood by his superiors, who declined to accept the model. Nonetheless two-stage devices were subsequently used for three British thermonuclear tests on Malden and Christmas Islands in the late 1950s, after other theoretical physicists had arrived to continue Ward’s work. Deeply disappointed, John Ward returned to Princeton and to his subsequent academic peregrinations.²
John Clive Ward, an eminent figure in physics at Macquarie

Figure 7.1. John Clive Ward, an eminent figure in physics at Macquarie

John Ward was a Fellow of the Royal Society of London and the recipient of several prestigious medals and prizes across his career. His originality and ability to ‘find his way through complicated systems with many degrees of freedom’, as his obituarists described it, ‘resulted in fundamental contributions in quantum electrodynamics, elementary particle physics, quantum solid-state physics, and quantum statistics.’

His presence at Macquarie University was itself something of a quiddity and a phenomenon in Australia. Joe knew of Ward’s work and reputation, and, communicating with him from Argonne in October 1971, discovered that the new interdisciplinary Macquarie University was thinking of setting up a new Chair of Mathematics for which John Ward would, he reported, ‘strongly support my candidacy if I apply’.

Joe’s appointment as the new Professor of Mathematics at Macquarie in the School of Mathematics and Physics was finalized — as bureaucratic wheels creaked — late in 1972. Significantly, it was to create a juxtaposition of two men of remarkable research distinction and range in the formative early years of one of Australia’s newer universities.

John Ward and Joe shared many affinities. Both were trained initially in engineering and mathematics and were deeply involved in the particle world, in quantum mechanics, quantum statistics, and nuclear and...
theoretical physics where their specializations overlapped. Born in 1924, Ward was 14 years Joe’s junior, yet British by birth and personal accommodation — for Joe chose to remain a British citizen all his life — they had a close intellectual relationship.

To the observer, Ward was a high eccentric, ‘a bundle of neuroses’, as one colleague put it; a very shy man with a strong sense of self-regard, often distant and austere, yet cultivated, interested in wine and wine-making, and intensely musical. He was also, to his cost, a man of startling honesty with a naivety in human and administrative affairs that had clearly complicated his relations with managers and colleagues in a string of universities. At Macquarie, this brilliant individualist found his natural habitat.

It was Professor Frederick Chong, the Foundation Professor of Mathematics at Macquarie from 1965, and first Head of the School of Mathematics and Physics, who had brought John Ward to the School of Physics and Mathematics. Chong came from a well established Chinese family in Australia. A medallist from the University of Sydney and a Wrangler of St John’s College, Cambridge, with a Master’s degree in Mathematics from Sydney University and a Ph.D. from Iowa State University, he had a varied academic background. From 1940 to 1955, he held teaching posts at the Universities of New England and Sydney, and served for nine years as Professor of Mathematics at the University of Auckland before he came to Macquarie University. Far-sighted and benign, with a mathematical physics bias in his own research and teaching, he strongly supported Joe’s candidacy. Freddie Chong, as one senior student observed, was ‘a very talented picker of people, both young and older’. He brought together ‘an incredible galaxy of stars in science at Macquarie’. He was reputedly a dazzling lecturer, ‘a total lecturer and total showman’, greatly enjoyed by students in his classes, but also a presence with his professional feet firmly on the ground.

Another senior member of the School was the lively, ‘up-front’ Professor of Physics, Peter Mason, a biophysicist and radical thinker on the role of science in society. Born in England, he had a career in industry before joining Macquarie in 1966. Mason set a standard of openness and an
innovative lecturing style devising courses for his physics students very different from the more rigidly structured instruction at Sydney University. A highly articulate communicator, he became a prominent science broadcaster and, in the period before he died of a brain tumor in 1987 at the age of 65, he had kept up an enlightening public commentary on the processes his brain endured.

Richard Makinson, Associate Professor of Physics, a Sydney graduate with a Ph.D. from Cambridge, had taught physics at Sydney University from 1939 until 1968, when, as an active member of the Australian Association of Scientific Workers and perceived as a Communist sympathizer in the Cold War, he had cast off the shackles of a conservative ivory tower and moved to Macquarie University where he was a distinctive intellectual figure in the team.
Importantly, scattered among the older galaxy of stars was a remarkable cluster of young Australian researchers and lecturers who would go on to forge outstanding reputations. In mathematics they included the
brilliant, self-effacing Alan McIntosh who rose to hold a personal Chair in Mathematics at Macquarie and, renowned for his fundamental work in harmonic (wave) analysis and partial differential equations, moved on to become Head of the Centre for Mathematics and its Applications at The Australian National University. Category theorist Ross Street mounted the ladder to a Professorship and remained at Macquarie through a highly productive career, becoming Director of the Centre of Australian Category Theory and, together with Alan McIntosh, a Fellow of the Australian Academy of Science.

In physics there was Dr John Corbett, a mathematical physicist with interests in scattering theory and general relativity, widely read in philosophy, whom Joe had first met at the ANU as the enquiring young postgraduate student from Adelaide with a question on phase space, and J.A. Piper, a young physics lecturer trained in New Zealand, who had an important future in quantum electronics and laser research and became in time Professor of Physics and Head of the School of Mathematics and Physics, Director of the Centre for Laser and Applications, and subsequently, Deputy Vice-Chancellor of Macquarie University.

For Joe, such a group proved a rewarding and intellectually rich fraternity. In turn, he went about advancing his talented younger research colleagues to higher posts. It was, indeed, his singular good fortune, after the twists and disappointments at Argonne, that he should come to ground in the last years of his career in such a community, and in an arena where he could have a vital influence.

Their voices shape the record. Corbett, strongly attuned to Joe’s interests in quantum physics and philosophy, found Joe ‘always ready to stimulate conversation and discuss ideas’:

He was available for people and he was always encouraging which made a really big difference to the sort of research that was done at Macquarie. You didn’t feel you were on your own; that it was worth trying things even if you didn’t get results. In sum, I felt that we had someone who was extremely intellectually active and someone to whom you could turn as a source of knowledge.”
'We found’, said Professor Chong, ‘we had a giant among us.’

But there was no particular ‘giantness’ in Joe’s style. David Forrester, a mature-age student of 24, who had come to Macquarie from a year of physics at Sydney University and revelled in the research atmosphere of the School, recalled:

Joe always had the most wonderful jaunty spring in his step, and a cheekiness, and was as friendly to me as a Professor and a student could be. He was the most modest man, he never gave any impression that he knew he was sitting on a remarkable brilliance … His ideas from his 1949 paper were floating around in those days; there was confusion about quantum mechanics, the wave particle business, confusion about what is the wave, what is the particle going on right into the ‘80s. In The Feynman Lectures on Physics, which was eventually adopted for teaching at Macquarie, Feynman finally gets it right, but that perfection had to come from Joe’s contribution and others. Joe talked to me and used to say remarkably clear things; he completely understood that the wave aspect was in the probability function. Go back to Joe’s 1949 paper and you will see how resoundingly clear it is.6

In this early interacting environment, Joe set about changing and extending the core of courses in the School, adding his own Probability and Stochastic Processes for mathematics (and physics students if desired) to his teaching in electromagnetism and quantum mechanics in 1973, while an honours year program in applied mathematics was prepared for 1975. Looking back from the vantage point of the diverse courses provided in the School today, it is revealing to discern from Minutes of School Committees and Subcommittees and the Mathematics Syllabus Committee this early thrust to upgrade course offerings at Macquarie, to support as many promising students as possible, to offer honours courses as a starting point for promising candidates to undertake research, and to widen the opportunities for graduate degrees.7
In mathematics, Joe was the prime mover. In this he had the ready support of Freddie Chong. During 1974, as Chairman of the Mathematics Honours and Postgraduate Committee, he initiated a proposal, adopted by the School of Mathematics and Physics and taken to the Senate, to ‘allow suitably qualified candidates from other tertiary institutions to enrol in the honours degree at Macquarie University’. Simultaneously, plans for an M.A. Programme in Applied Mathematics took shape. By 1976, Joe, an advocate for further research degrees, moved that the Senate be asked to reconsider regulations that precluded part-time students participating in postgraduate, and notably, Ph.D. degree courses at Macquarie.8

At first, John Ward showed an entrenched resistance to this emphasis on research and to the development of honours and master’s courses. Intellectually elitist, he had from the outset of his appointment considered it inappropriate to encourage a research direction in a university he judged initially as having only a ‘secondary status’. ‘He thought of everyone,’ said one disenchanted younger colleague, ‘as second-rate.’ He was, as John Corbett recalled frankly, ‘very covert about his own research ideas, terrified that other people might take them and negative with people who wanted to do research. He was not interested in supporting the younger staff or students in this way.’ Joe was the reverse and his example brought change. ‘Eventually,’ said Corbett, ‘when Joe suggested an honours course, Ward was goaded into declaring that he would put one on. It was a great victory for Joe. After that John Ward started with some research students and there was a notable change in his attitude.’9

While Professor Chong took a key lead in undergraduate matters in the School, Joe Moyal provided leadership and stimulus across the areas of honours, postgraduate and research developments. He readily joined Chong’s scheme (fashioned as a long-time and prominent member of the Board of Senior School Studies) to introduce a Master’s Degree in Mathematics for Teachers. Initiated in the early 1970s and held every Saturday morning, the course, designed to elevate the quality and status of maths teaching in secondary schools, proved a marked success.
For institutions of learning, and particularly the younger universities, it is, as yet, unusual to turn back formally to the foundations of their teaching or to a consideration of the influences and structures that shaped their degrees. Yet archival evidence and oral recollections from participants shed a particular light on the influence of research ideas and distinguished research experience in the formative days of the School of Mathematics and Physics at Macquarie and on the forces that have provided a vital platform from which, over ensuing decades, the Department of Mathematics and the Department of Physics have come to hold a leadership position across a number of scientific fields.

For his honours students — for whom, with his later MA students, he was especially valuable — Joe customarily lectured in research fashion from the blackboard and sought to involve his students in this open, exploratory approach. At the same time, both senior students and staff members were exposed in seminars to his important quantum and probabilistic work. ‘The lectures he gave in the honours year,’ David Forrester recalled, ‘was almost his own deep algebraic distillation of quantum mechanics. Joe would do his proofs in four lines while others would be doing the proofs in four pages. The economy of it was perfect; grace, elegance and perfect economy.’

In addition, Joe’s friendship and methods stirred a slowly growing readiness on John Ward’s part to link physics teaching more directly with research. As Franke Duarte, a former physics graduate student observed in his obituary of Ward some 30 years later: ‘Under his influence, and with the assistance of several colleagues, the foundations of Macquarie physics education became a combination of courses in electromagnetism, quantum physics, solid state physics, advanced electronics and experimental physics in addition to applied mathematics … He played a major role in creating a high class physics program at Macquarie University.’

Other Moyal initiatives related to the introduction of Statistics at Macquarie. Travelling overseas for the University early in 1976, he recruited Professor Don McNeil, a former Ph.D. from Pat Moran’s expanding stable at the ANU and at this time on the staff at Princeton.
University, to fill the new Chair. Clearly, in this appointment, Joe saw the opportunity for his dream of integrating mathematics, physics and statistics and the rapidly growing study of computing in an interdisciplinary field. Attached to the University’s Department of Economic and Financial Studies, McNeil succeeded in drawing students to statistics. ‘The Statistics Department at Macquarie University,’ he contended in interview, ‘has become, arguably, the strongest in Australia in terms of undergraduate and postgraduate enrolments and in the production of Ph.D.’s. Joe’s dream worked out in statistics here.’ But the forward-looking hope of a close institutional integration of these disciplines with computing science failed to mature.

Joe would remain at Macquarie University until 1978, two years beyond the normal retiring age. In February that year, a conference was held at the university in his honour at which papers were presented by former and contemporary colleagues, Professors Maurice Bartlett, H.S. Green, Eugene Seneta, Chip Heathcote and C.C. Heyde, and Dr. John Corbett. At his death he was perceived as ‘one of the pioneers of Macquarie’s multidisciplinary approach to learning’. In a university whose motto drew on Chaucer’s words, ‘And Gladly Teche’, it was perhaps not surprising that Joe should choose to focus his activities on teaching and offering encouragement to younger colleagues to conduct research, rather than increasing the output of his own papers. There he stimulated a research enterprise in mathematics and physics that has grown significantly in subsequent years. The J. E. Moyal Medal and Lecture, established at Macquarie University in 2000, commemorates his diverse contribution.
ENDNOTES


4 David Forrester, Interview with Ann Moyal, May 2005.

5 Oral Interview with John Corbett, May 2003, *op. cit.*

6 Forrester interview, *op. cit.*

7 Macquarie University Records and Archives, School of Mathematics and Physics, 1973 and 1976.

8 Ibid.

9 Interview, *op. cit.*

10 Interview, 2005, *op. cit.*


