

Special issue in honour of Anne Penfold Street AM
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Reminiscences of Anne Penfold Street

From Deborah Street

I've tried hard to think of what might be called a defining set of stories to capture the essence of Anne's life, and this is what I have come up with.

I thought that I would start, however, with a quick overview of her life. As Anne used to put it, she was the last of seven children born towards the end of the Great Depression. Her father was the director of the Baker Research Institute at the Alfred

Hospital, and her mother was a qualified short-hand writer for the courts. Anne met her husband Norm while they were both studying chemistry at the University of Melbourne, but when they moved to Urbana-Champaign in the USA so that Norm could take up a position in Mining and Metallurgy at the University of Illinois, she changed to mathematics. They had two children, Deborah and Anthony. Norm left chemistry in 1980 when he was 60 and became a writer, and Anne looked after Norm to a greater or lesser extent from his first stroke in 1991 until his death in 2004, while continuing with her own research. He was in a nursing home for less than three months of his life. Anne herself had a stroke in 2011 and in 2014 was moved to a dementia unit in Sydney so that her daughter and grandchildren could visit her regularly.

As a child:

- Anne would go to buy biscuits with her brother John. As they could eat any broken biscuits, they used to walk home swinging the string bag with the biscuits in it against the front fences of the houses that they passed.
- During the depression, Anne and John would collect grass for their rabbits. On one occasion an old man took pity on them and gave them sixpence. They were very excited but their mother was mortified when they came home and told her.
- Anne was used to trial a new antibiotic. It was subsequently approved for use, but only in horses.

As her father had a debilitating stroke when Anne was 4 and had to retire, he home-schooled her. He died a couple of weeks after her ninth birthday, and her mother immediately sent her to Fintona School for Girls for the final few weeks of the 1941 school year. There she made a name for herself by beating up on anyone who disagreed with her, just as she had seen her brother and his friends do. This was not the “done thing” in a girls’ school and so Anne was “challenged academically” by being made to skip grade 6 and complete grades 7 and 8 in one year. This appears to have been successful in giving her other things to focus on.

During her time at Fintona School, Anne acted in two plays, spent two years on the committee of *The Fintonian*, the second as *Editress* (as they described it), won many academic prizes, and ended up as *dux* of the school, having obtained Honours First in Biology and Chemistry and Honours Second in Physics and English. But she failed matriculation mathematics.

The following year, as she was only 16, she completed a secretarial training course and worked as a secretary while repeating matriculation maths. She also repeated English as she was keen to get Honours First. This time she passed the maths but came within a bull’s roar of failing English. Thus was born her conviction that exams are not a good way to assess a student.

She then went and studied chemistry and maths at the University of Melbourne, opting in the end to do honours in chemistry. She completed an MSc by research

in chemistry, and during this time met Norm, who was himself doing a PhD in chemistry while working as a demonstrator. She was awarded a CSIRO studentship to support her own PhD studies from the beginning of 1956. She and Norm married in January of that year, and in August they graduated together, Anne with her MSc and Norm with his PhD.

Whatever their intentions might have been professionally, CSIRO withdrew her studentship at the beginning of 1957 because, so we were always told, it was “unseemly conduct for a married woman to become pregnant”, despite Anne’s belief that she had been given a verbal assurance that starting a family would be perfectly acceptable. Norm found a job in the US that made use of his various skills and meant that they would have enough money just with his salary, and they migrated at the end of 1957 with their young baby.

It was the loss of her studentship, coupled with the move to the flexible American education system, which acted as the catalyst for Anne to decide to continue in mathematics rather than chemistry. This was probably the best thing that could have happened to her professionally — she was one of the pioneers in combinatorics, and her research successes were legion. As well, Anne made a significant contribution to the field of mathematics education and this was recognised through her appointment as a Member of the Order of Australia in 2014.

She took the lesson of always being sure to get everything in writing to heart. In 1969 she was eligible to apply for promotion to senior lecturer and as it happened a senior lectureship in mathematics was also advertised by the University of Queensland. She used to say that she was assured verbally by the then head of department that she did not need to bother to apply for the job as she would be promoted. Once bitten, twice shy — she applied for both the promotion and the vacant position. She was not promoted — a committee member told her that the head said that there was no need to promote her since she would stay anyway as Norm had just got a job in Brisbane too — but she was offered the advertised position which, of course, she accepted.

Family, both nuclear and extended, was very important to Anne. When admitted to hospital, very ill, at age 25, she gave Norm instructions to send three telegrams if she didn’t pull through. They were to say, “Anne is sick”, “Anne is sicker” and “Anne has died” and to be spaced about 12 hours apart. These were to help soften the news of her passing for her Melbourne relations.

Anne enjoyed her two grandchildren, Amelia and Thomas, and liked to do things with them that they enjoyed whatever her own feelings. The most memorable instance of this, for me, was when she agreed to sit in a canoe while Thomas, then aged 4, paddled her out to the mangroves at Coochie Mudlo Island. Wearing a life jacket and gripping the gunwales with white knuckles she said to me, “What should I do if it capsizes?” “Stand up”, I said, “the water will be at most knee-deep.”

Anne’s sense of humour was eclectic. Not much amused her, but when it did it could keep her giggling on and off for hours. For example on Amelia’s kindie orientation day, the 42 children were each given a sheet of paper with the letter S

on it and asked to make it into an animal. After a few minutes there were 41 snakes and Amelia's duck. This appealed to Anne greatly.

Anne's final paper was published in 2010 when she was 78. Until her stroke, she pursued her research with passion and vitality, travelling to conferences around the world every year even in her seventies. Her commitment to the establishment and success of this journal for which she was an "editress" for more than fifteen years, and as chair of the Australian Mathematics Olympiad Committee for a decade, are tangible legacies, as is the generation of young mathematicians whom she mentored.

From Sheila Oates-Williams

I first met Anne when I arrived to take up a position in the Mathematics Department of the University of Queensland in February 1967. I was pleased to find that not only was there another woman holding a tenured position in mathematics (at the time I did not realise how rare this was in Australia) but, like me, she had taken her doctorate in Group Theory. That we started working together almost immediately is evidenced by the fact that our first paper (joint with John Cossey) appeared in 1969 (remember it took much longer for a paper to appear in those days). This was concerned with varieties of groups. We published three joint papers in this area before being attracted into the rapidly expanding area of Combinatorics. Three of the papers we published about colour groups of crystallography straddle the two areas whereas others, such as the one on Conway's conjecture for integer sets, the one on universal fabrics and the three on balanced binary arrays are more purely combinatorial. We were also two of the five authors of both editions of the text-book "Discrete Mathematics: Logic and Structures".

However, I have always believed that our greatest success was in being role models for female students attracted to mathematics. We showed it was perfectly possible to be a full-time mathematician even when married and, in Anne's case, bringing up children. I think the number of women graduates in mathematics at UQ who went on to do doctorates, and the number who came to do doctorates with us is in no small part due to this effect. (One of our particularly distinguished students is Cheryl Praeger, who went on to become Professor of Mathematics at the University of Western Australia, and has recently been awarded an Honorary Doctorate at the University of Queensland.) No doubt there were some who were determined enough to be able to withstand society's pressures and do what they really wanted, but I hope that our mere existence tipped the balance for those who were wondering if it was worth the struggle to become a mathematician.

From Diane Donovan*A dear friend and a valued mentor*

I came to the University of Queensland in 1983 as a graduate student. I was welcomed into the combinatorics group, which included, amongst others, three very strong and supportive females: Anne Street, Sheila Williams and my supervisor Elizabeth Billington. From the very outset this group encouraged me to become an active member of the mathematics department and more generally the mathematics community.

Anne's leadership, and her strong international connections, ensured a vibrant research environment with a healthy seminar series including talks by many internationally respected researchers. Coffee sessions, lunches and outings provided many opportunities to work and socialise with these visitors and to establish strong collaborative ties which have not only been invaluable to my career, but have evolved into close friendships. It is these friendships that I treasure.

Anne's leadership extended beyond UQ. Together with Jennie Seberry and others, she was a driving force in establishing combinatorics as a leading Australian and international research field. This work has endured the test of time, with combinatorics still playing a major role in the Australian mathematics community. It is worth reflecting on and acknowledging Anne's outstanding contribution in this arena.

Personally, I benefited greatly from Anne's efforts through financial support, opportunities in terms of teaching and research, through her generosity with course materials and more generally through her valued advice. In later years we became very good friends and enjoyed working together. I was always in awe of her energy and her quest to achieve the very highest standards. She never seemed flappable. When presented with a challenging situation she quietly, with confidence and aplomb, worked her way towards a good resolution. I visited Anne not long before her death, and being a while since I had seen her, quipped "You probably don't remember me" and got the very strong reply "I certainly do!" I believe this strong response was testament to Anne's commitment to her working life, her love for mathematics and the many friends she made. We spent several enjoyable hours with Anne actively engaging in the visit. It gave me great pleasure to know she remembered this aspect of her life and the times we shared, just as I did.

I sincerely admired Anne's commitment and contribution to mathematics, and while she is sadly missed, I am sure her legacy will endure.

From Elizabeth Billington

I was Anne's first PhD student, deciding to switch from group theory to combinatorics a few years after my move to Australia. So in the mid 1970s Anne agreed to supervise me. Anne had arrived at the University of Queensland in 1967 as a Lecturer, and was soon appointed to Senior Lecturer (1970), and then promoted to Reader (1975) and Professor (1985). I can remember her encouraging me to present

my first paper at an annual conference, and being always ready to help when some problems were tough. One Sunday we exchanged several phone calls while working on some supplementary difference sets involving cyclotomy; Anne was working at home and I was in my postgraduate office at the University of Queensland. She always treated her PhD students extremely well. Her eight PhD students, in order, were: E.J. Morgan; K.R. Gray; M.J. Sharry; A.T. Moran; B.D. Gray; C. Ramsay; B.M. Maenhaut; and M.R. Nester.

Anne was, at various times, on the Editorial Boards of *Ars Combinatoria*, *Ars Textrina*, *Journal of Combinatorial Designs*, *Scientia Iranica*, *Bulletin of the Institute of Combinatorics and its Applications*, and the inaugural Editor-in-Chief of the *Australasian Journal of Combinatorics*, which started with Volume 1 in 1990.

Anne was instrumental in setting up the Combinatorial Mathematical Society of Australasia (CMSA), informally begun in 1972, and officially formed in 1979 after the drafting of its Constitution. The Society was then incorporated in 1996, and Anne was the inaugural President of the CMSA Inc.

In 1990 Anne established the Centre for Combinatorics at the University of Queensland, which expanded to become the Centre for Discrete Mathematics and Computing in 1998. Her research areas have included: group theory; sum-free sets; enumeration and construction of binary arrays, together with their applications to neighbour designs and woven structures; construction and properties of block designs, including large and overlarge sets; defining sets of designs and applications in access schemes.

Besides her substantial research work, Anne has been President of the Australian Mathematical Olympiad Committee, and she served for twelve years on the Problems Committee of the Australian Mathematics Competition. In recognition of this work for young mathematicians, in 1994 she received a Bernhard H. Neumann Award for Excellence in Mathematics Enrichment.

In 1991 Anne was one of the Founding Fellows of the international Institute of Combinatorics and its Applications, and was President of this Institute for a period from 1996. In 1996 she received a D.Math. (honoris causa) from the University of Waterloo in Canada, and in 1996 she received the inaugural Medal for Outstanding Service from the CMSA. In 2014 the Australian Mathematical Society set up the “AustMS Women in Mathematics Special Interest Group (WIM-SIG) Anne Penfold Street Awards”, to assist mathematical academics with family care responsibilities while travelling for conferences or research purposes; see <http://www.austms.org.au/Street+Awards>. In that same year Anne was appointed as a Member of the Order of Australia for services to education in mathematics.

The last few years of Anne’s life were sadly taken from her and her family long before she died in late 2016, as her daughter has described above, although her legacy lives on.

List of Anne Penfold Street's publications

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