Curriculum Vita: Peter Jephson Cameron

Since I am not expecting to be applying for jobs in the near future, I have taken a more informal approach to my CV: rather than simply a list of jobs, publications, positions held, and so on, it is more a discussion of how I got to where I am now.

So, to start at the present: I am a professor emeritus in Mathematics at Queen Mary, University of London, and still teaching there (on a temporary basis).

1. Education

I was born in Toowoomba, an inland city in southern Queensland, Australia, on 23 January 1947, and grew up on a dairy farm in the village of Biddeston, outside Toowoomba. After receiving my early education by correspondence (not uncommon then for children in the bush), when we moved house in 1954 I attended Biddeston State School (I rode a horse to school, as did several other children) until 1959, when I went to Toowoomba Grammar School as a boarder. While there I discovered I had a talent for distance running, and was captain of the athletics team and Darling Downs champion in the mile.

In the Senior Public Examination (matriculation) in 1963, I was 5th in the State, and top in Mathematics and Science, for which I received a medal from BHP and an Open Scholarship to the University of Queensland.

I attended the University from 1964 to 1967 taking the four-year honours degree in Mathematics. I was a member of the University athletics club, winning the Australian Universities cross-country in 1966, and spent a year as club secretary. I graduated with First Class Honours in Mathematics and a University Medal in 1968. That year, I also won a Rhodes Scholarship to Oxford.

At Oxford, where I was a student at Balliol College, I took my DPhil in 1971, under the supervision of Peter Neumann; my thesis was on "Structure of suborbits in some primitive permutation groups". These permutation groups also happen to be automorphism groups of graphs and designs, and the work pitched me into combinatorics as well as algebra. My external examiner was Donald Higman, who was a pioneer of the use of combinatorial techniques in the study of permutation groups (and co-discoverer of the Higman–Sims group which featured prominently in my thesis).

One of my discoveries was that graph-theoretic methods could be used to give much simpler proofs of some old theorems of W. A. Manning on permutation

groups; at Peter Neumann's suggestion, this was the subject of my first publication, in volume one of the *Bulletin of the London Mathematical Society* in 1969.

2. Employment

In 1971 I was awarded a Junior Research Fellowship at Merton College, Oxford. During the three-year fellowship, I spent a semester at the University of Michigan, at Donald Higman's invitation. At the end of the semester, I travelled across the USA by Greyhound, meeting on the way mathematicians including Ed Assmus, Bill Kantor, Marshall Hall Jr., and Herb Ryser.

At the end of my fellowship in 1974, I took a job as a lecturer at Bedford College, London, where I shared an office with Warren Dicks. Before being offered this job, I had agreed to stand in for Dan Hughes at Westfield College while he was on leave; Bedford allowed me to fulfil this commitment. As well as undergraduate teaching, I gave a course of lectures on connections between graphs and designs. At about the same time, Jack van Lint also lectured at Westfield on codes and designs, and Dan Hughes encouraged us to publish our lectures in the relatively new London Mathematical Society Lecture Note series.

In 1975, a tutorial fellowship was advertised at Merton College; encouraged by friends there, I applied, and was successful. Though reluctant to leave Bedford College, I spent eleven very good years at Merton. Among other things, I was Principal of the Postmasters (Merton-speak for Dean) for several years, and was also chair of the Mathematics and Philosophy Committee which administered the joint degree in Mathematics and Philosophy.

At Oxford I supervised 13 DPhil students, including Eric Lander (currently President and Director of the Harvard/MIT Broad Institute for Genome Research) and Dugald Macpherson (a professor at Leeds and leading model theorist).

In late 1985, a chance visit by Dan Hughes (then at Queen Mary College) led to the offer of a position there, which I accepted, moving in September 1986. I was appointed as a Reader but became Professor of Mathematics the following year. I retired from Queen Mary in 2012, and am currently Professor Emeritus in Mathematics there.

In London I briefly revived my mathematics career and ran the London marathon twice, with a best time of 2 hours 46 minutes 59 seconds in 1987.

3. Teaching

While at Queen Mary, I gave lecture courses on a variety of topics in algebra, analysis, logic, combinatorics, coding theory, computational group theory, probability, operational research, and cryptography.

Several of these courses I designed myself. These include *Complexity and Optimization in OR* (jointly with Thomas Wolf), *Cryptography*, and *Introduction*

to Algebra. Currently I am teaching another new course which I designed, entitled *Mathematical Structures*, which all mathematics and joint honours students take in the first semester. The course is an attempt to equip the students with the right mindset for successful study of mathematics, and the problem-solving skills which will serve them well in subsequent employment. The course has been very successful, though it is too early to see what the long-term effects will be.

I was awarded a Drapers Prize for Teaching and Learning at the 2007 graduation: the graduating students showed their pleasure by a Mexican wave (the first time those present had seen such a thing at a graduation ceremony).

I have given postgraduate or level 7 courses on *Permutation Groups*, *Projective and Polar Spaces*, *Group Theory*, *Codes and Ciphers*, *Classical Groups*, and *Counting* (aka *Enumerative and Asymptotic Combinatorics*). I have also given short courses in Eindhoven, Rome, Budapest, Prague, Tehran and Barcelona, as well as two LTCC Intensive Courses on *Synchronization* and on *Laplacian Eigenvalues and Optimality* (the latter with R. A. Bailey).

My habit now is that, for every course I teach, I produce and polish to the best of my ability a set of lecture notes. These are available on my web page and now includes nine sets of undergraduate notes and six sets of graduate notes.

23 students have obtained PhDs under my supervision at Queen Mary, and I currently have four students, of whom one has submitted and two others will do so shortly.

4. Research

As noted earlier, most of my research lies in either Algebra or Combinatorics, with excursions into Logic and other areas (including Measurement Theory in mathematical psychology). However, I do not see anything real in these divisions. If I had to describe my research briefly, I would say "Symmetry and Structure". These two themes run through much mathematics, sometimes orthogonally, sometimes reinforcing each other. One of my favourite theorems is the theorem of Engeler, Ryll-Nardzewski and Svenonius in model theory. This asserts that, for a countable structure M in a first-order language, the following properties are equivalent:

- axiomatisability (M is determined up to isomorphism by its first-order theory and the fact that it is countable);

- symmetry (the automorphism group of M has only finitely many orbits on n-tuples for every natural number n).

Of course, the second part of this equivalence means that a sequence of natural numbers is associated with any such structure, linking enumerative combinatorics

and formal power series to group theory and model theory. I coined the term *oligomorphic* for groups with the stated property, and much of my work has involved these groups and structures.

I have always thought that the purpose of a group is to act on something; much of my research involves using deep properties of groups in order to understand better the structures (finite or infinite) they act on, which may be designs or graphs (in my early work), or more general first-order structures, metric spaces, etc.

My most influential paper was an investigation of the impact that the Classification of Finite Simple Groups (believed then to be imminent) would have on the theory of finite permutation groups. This work, especially the results on orders of primitive groups, have been applied in many areas, from graph isomorphism to profinite groups.

The work of which I am most proud involves finding unexpected connections between apparently different things. One of my most cited papers (with J.-M. Goethals, J. J. Seidel and E. E. Shult) used the classification of root systems from the theory of Lie algebras to get substantially improved results on graph spectra (a useable classification of graphs with least eigenvalue -2).

MathSciNet lists 295 of my publications, with 133 co-authors; as always, this is a little behind the truth. A few recent publications are listed at the end of this report.

I was awarded the London Mathematical Society's Junior Whitehead Prize in 1979, and the Institute of Combinatorics and its Application Euler Medal for Lifetime Achievement in 2003.

5. Seminars and special lectures

I have given talks at seminars and conferences, at universities and government or industrial research organizations in the U.K., Eire, Belgium, the Netherlands, France, Germany, Italy, Greece, Hungary, the Czech Republic, Slovenia, Russia, Tunisia, U.S.A., Canada, Jamaica, Iran, India, Japan, Australia and New Zealand. These include: section speaker, International Congress of Mathematicians, Kyoto 1990; section speaker, European Congress of Mathematics, Barcelona 2000; plenary speaker, Australian Mathematical Society meeting, Brisbane 2000; plenary speaker, Canadian Mathematical Society meeting, Halifax, 2004; plenary speaker, New Zealand Mathematics Colloquium, Dunedin, 2004; and speaker at EMS regional meetings in Prague 2004 and Barcelona 2005.

I was London Mathematical Society Popular Lecturer in summer 2001: this involved three talks (in Strathclyde, Leeds and London), and a video was produced from the third talk.

I gave the 2007 Kathleen Ollerenshaw Lecture at the University of Manchester; the 2009 Copson Lecture at the University of St Andrews; and the 2010

Coulter McDowell lecture at Royal Holloway, University of London.

I was the London Mathematical Society's 2008 Forder Lecturer: this involved a month-long lecture tour of New Zealand giving 13 lectures in six different centres, including a popular lecture to 150 people in Auckland, and an interview on Radio New Zealand.

In 2013 I will deliver the London Mathematical Society's Gresham Lecture; the title is "Mathematics: The Next Generation", and I will discuss the development and delivery of the Mathematical Structures module at Queen Mary.

6. Conference organisation and talks

I was joint organiser of a 6-month programme on "Combinatorics and Statistical Mechanics" at the Isaac Newton Institute, Cambridge, in January–June 2006. I was also joint organiser of the 16th BCC at Queen Mary, 1997, and of a LMS/EPSRC short course on "Design in Combinatorics and Statistics" at Queen Mary in 2002.

I organised a special session on Combinatorics, and was a principal speaker, at the 1996 British Mathematical Colloquium. I also co-organised a special session on Combinatorics and Finite Geometry at the first ever joint Belgian/London Mathematical Societies meeting in 1999.

Recent short meetings organised include "Combinatorics and Statistical Mechanics", London, 2005; "Algebra and Design of Experiments", London, 2007; "A celebration of Karl Gruenberg", London, 2008. I am currently organising an LMS Durham Symposium on "Graph Theory and Interactions" in summer 2013.

A conference for my 60th birthday took place in Ambleside in August 2007; speakers include Persi Diaconis, Eric Lander, Cheryl Praeger and Alan Sokal. A conference for my 65th will take place next summer at Queen Mary; speakers will include László Babai, Peter Neumann, and Anatoly Vershik.

7. Administration, service

Since 1994 I have been chair of the British Combinatorial Committee, the charity which supports combinatorial mathematics in the United Kingdom. Its most important role is organising the biennial British Combinatorial Conference, a large international conference which I helped organise at Queen Mary in 1997 (on that occasion it attracted 319 delegates). I have been re-elected to this position at the conference Business Meeting every two years since 1995.

I was on the SERC mathematics committee from 1989 to 1992 (this committee no longer exists!) I was on the EPSRC Mathematics College from 1995 to 2005.

In 1996 and 2001 I was on the Pure Mathematics Panel for the UK Research Assessment Exercises. I also helped produce the Queen Mary submission in 2008.

In 2003 and 2011 there were International Reviews of UK mathematics, commissioned by EPSRC. I was responsible for presentations to the panel on both occasions, on Combinatorics in 2003 and Algebra in 2011.

I am honorary Editor-in-Chief of the *Australasian Journal of Combinatorics*, a journal which (I am happy to say) will move to Diamond access in 2014. I am also on the editorial boards of a number of other journals, but intend to reduce my commitment to these. in 1990 I became editor of the *Queen Mary Maths Notes*, a very successful series which has been effectively killed off by web publication.

8. Media appearances

I appeared on a BBC *Horizon* programme "To Infinity and Beyond", and also discussed infinity on a BBC World Service radio programme. I have also been briefly on television discussing cryptography and also interest rates, and was quoted on the front page of the *Daily Telegraph* discussing palindromic dates. Future media appearances are under discussion!

9. Publications

I have authored or co-authored eleven books: three undergraduate texts (on algebra, combinatorics, and set theory), two graduate texts (on permutation groups and on codes and designs), three research monographs and three edited conference proceedings.

Recent papers include

1. P. J. Cameron and J. Nešetřil, Homomorphism-homogeneous relational structures, *Combinatorics, Probability and Computing* **15** (2006), 91–103; doi: 10.1017/S0963548305007091

2. P. J. Cameron and A. M. Vershik, Some isometry groups of the Urysohn space, *Ann. Pure Appl. Logic* **143** (2006), 70–78; doi: 10.1016/j.apal.2005.08.001

3. R. A. Bailey, P. J. Cameron and R. Connelly, Sudoku, gerechte designs, resolutions, affine space, spreads, reguli, and Hamming codes, *American Math. Monthly* **115** (2008), 383–404.

4. P. J. Cameron, T. Prellberg and D. Stark, Asymptotic enumeration of 2-covers and line graphs, *Discrete Math.* **310** (2010), 230–240; doi: 10.1016/j.disc.2008.09.008

5. R. F. Bailey and P. J. Cameron, Base size, metric dimension, and other invariants of groups and graphs, *Bull. London Math. Soc.* **43** (2011), 209–242; doi: 10.1112/blms/bdq096

6. T. Gateva-Ivanova and P. J. Cameron, Multipermutation solutions of the Yang–Baxter equation, *Comm. Math. Phys.* **309** (2012), 589–631; doi: 10.1007/s00220-011-1394-7

7. J. Araújo, P. J. Cameron, J. D. Mitchell and M. Neunhöffer, The classification of normalizing groups, *J. Algebra* **373** (2013), 481–490; doi: 10.1016/j.jalgebra.2012.08.033

8. P. J. Cameron, M. Gadouleau and S. Riis, Combinatorial representations, *J. Combinatorial Theory* (A), in press.