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Sandrine Dudoit  
Editor

# Selected Works of Terry Speed

 Springer

*Editor*

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*To Terry—teacher, colleague, and friend*



# THEY TAKE THE PRIZES



THE Police Commissioner, Mr. Porter, presented the prizes at the University High School's jubilee speech night in Melbourne Town Hall last night.

Pictured with their prizes are two matriculation students, Suzanne Cory, 18, of East Kew, and Terry Speed, 17, of Elwood. Suzanne came first in her subjects.

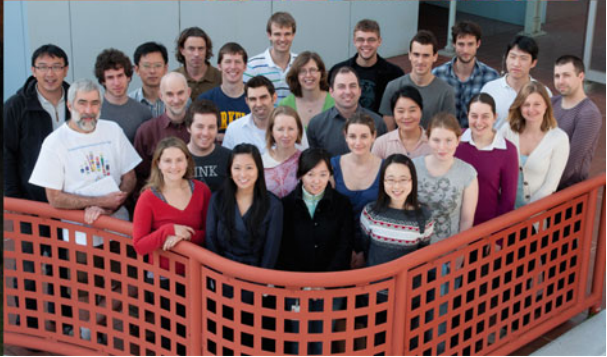
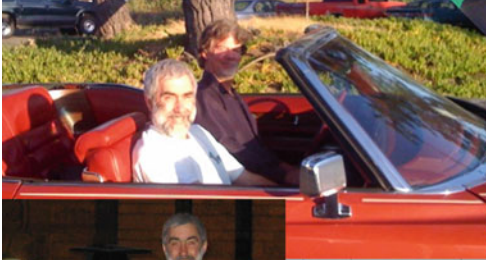
Mr Porter said that parents should not set their children "an impossible task" by forcing them into a career to which they were not suited.

At other speech nights last night:-

- Malvern Grammar, Geoffrey C. 17, also won a prize for drama.
- Special awarded to Grammar students.



# LABOR ATTACKS







## Preface to the Series

Springer's Selected Works in Probability and Statistics series offers scientists and scholars the opportunity of assembling and commenting upon major classical works in statistics, and honors the work of distinguished scholars in probability and statistics. Each volume contains the original papers, original commentary by experts on the subject's papers, and relevant biographies and bibliographies.

Springer is committed to maintaining the volumes in the series with free access of SpringerLink, as well as to the distribution of print volumes. The full text of the volumes is available on SpringerLink with the exception of a small number of articles for which links to their original publisher is included instead. These publishers have graciously agreed to make the articles freely available on their websites. The goal is maximum dissemination of this material.

The subjects of the volumes have been selected by an editorial board consisting of Anirban DasGupta, Peter Hall, Jim Pitman, Michael Sørensen, and Jon Wellner.



# Preface

The purpose of this volume is to provide an overview of Terry Speed's contributions to statistics and beyond. Each of the fifteen chapters concerns a particular area of research and consists of a commentary by a subject-matter expert and selection of representative papers. Note that, due to space constraints, not all articles discussed in the commentaries are reprinted in this volume. The reader is referred to the book website for access to these papers (<http://www.stat.berkeley.edu/~sandrine/Pubs/SelectedWorksTerrySpeed/>). The chapters, organized more or less chronologically in terms of Terry's career, encompass a wide variety of mathematical and statistical domains, along with their application to biology and medicine. Accordingly, earlier chapters tend to be more theoretical, covering some algebra and probability theory, while later chapters concern more recent work in genetics and genomics. The chapters also span continents and generations, as they present research done over four decades, while crisscrossing the globe.

The commentaries provide insight into Terry's contributions to a particular area of research, by summarizing his work and describing its historical and scientific context, motivation, and impact. I've enjoyed reading the personal anecdotes, which remind us that one cannot always dissociate the scholar from the person and show how relationships beginning as professional collaborations can turn into long-lasting friendships. In addition to shedding light on Terry's scientific achievements, the commentaries reveal endearing aspects of his personality, such as his intellectual curiosity, energy, humor, and generosity. The title of Bin Yu's piece, "the  $n \rightarrow \infty$  dimensions of Terry", says it all and captures Terry as an avid and tireless scholar and explorer.

Due to space constraints, this volume is only the tip of the iceberg, as it is clearly impossible to give a complete account of Terry's work. And it is certain that additional significant contributions are forthcoming — Terry's thirst for knowledge has not abated, and neither has his dynamic pace. For "coming attractions", one will have to wait for another such volume ...

Berkeley, CA  
June 2011

*Sandrine Dudoit*



## Acknowledgements for the Series

This series of selected works is possible only because of the efforts and cooperation of many people, societies, and publishers. The series editors originated the series and directed its development. The volume editors spent a great deal of time organizing the volumes and compiling the previously published material. The contributors provided comments on the significance of the papers. The societies and publishers who own the copyright to the original material made the volumes possible and affordable by their generous cooperation:

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Oxford University Press  
Princeton University and the Institute for Advanced Studies  
Royal Statistical Society

Statistical Society of Australia  
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University of California Press  
University of Illinois, Department of Mathematics  
University of North Carolina Press

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First and foremost, I would like to thank the fifteen contributors for their insightful and inspiring commentaries. This project would not have been possible without their hard work, support, generosity, and enthusiasm. In particular, they were remarkably gracious and efficient while working under pressure to meet tight publication deadlines. I have thoroughly enjoyed interacting with each of them and have learned much about Terry's career and life while reading their commentaries.

I am grateful to the reviewers for immediately and kindly agreeing to contribute to this volume and for their thoughtful reports.

I have greatly appreciated Jim Pitman's guidance and support throughout this project, regarding both the general editing process and technical aspects of bibliography management.

Matthew Watkins' work on Terry's bibliography was very valuable.

I am also thankful for Darlene Goldstein's encouragement and help during the final stages of this project.

Last but not least, editing this volume was an extraordinary opportunity to work with Terry again and "delve into his many lives". I have learned immensely from him, whether in a Berkeley classroom, sipping a milkshake on Bancroft Avenue, attending a performance at the San Francisco Opera, or trying to keep up with him on a morning jog in the mountains overlooking Lago Maggiore. His sharp intellect, vast culture, humanism, energy, enthusiasm, and humor never cease to inspire me. For this, I am most thankful.

Berkeley, CA  
June 2011

*Sandrine Dudoit*





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## Biographical Sketch of Terry Speed

Terence Paul (Terry) Speed was born on March 14th, 1943, in Victor Harbor, South Australia. He grew up in Melbourne, attending Westgarth Central School and University High School. In his final year of high school, he decided that he wanted to pursue a career in medical research, influenced by the award that year (1960) of the Nobel Prize in Medicine to Sir Frank Macfarlane Burnet, the Director of Melbourne's Walter and Eliza Hall Institute (WEHI) of Medical Research. In 1961, Terry enrolled in a joint Medicine and Science degree at the University of Melbourne. By the end of the first term, his lack of enthusiasm for laboratory work prompted him to change his enrollment to Science alone, majoring in mathematics, while maintaining a strong interest in genetics. He graduated in 1964 with an honours degree in mathematics and statistics. In his final year, he edited the magazine *Matrix* of the mathematics students society and also attended lectures on algebra at Monash University, located in an outer suburb of Melbourne. At the end of that year, he married Freda Elizabeth (Sally) Pollard, whom he had met at a party at the home of Carl Moppert, then a Senior Lecturer in the Department of Mathematics at the University of Melbourne.

Although an attempt to join the PhD program in the Department of Statistics at the University of California, Berkeley (UCB) fell through, Terry was awarded an Australian Commonwealth Postgraduate Research Scholarship in the Department of Statistics at the University of Melbourne. He began his graduate studies in 1965, under the supervision of Professor Evan J. Williams. Rather than pursuing research in the area of his supervisor (Fisherian statistics), Terry developed an interest in probability theory, along the lines of Michel Loève's work at Berkeley. He did not however complete his doctoral degree at that point. In mid-1965, he took a job as a tutor in the Department of Mathematics at nearby Monash University and enrolled for a part-time PhD in mathematics under the supervision of Professor Peter D. Finch. With hindsight, it is interesting to note that several elements that were to feature prominently in Terry's later life had already manifested themselves: interests in medical and genetic research, the Walter and Eliza Hall Institute, and probability and statistics as practiced in the Department of Statistics at the University of California, Berkeley.

At Monash, Finch had eclectic interests in probability theory and mathematics and encouraged Terry to examine probability and measure theory on the class of lattices generalizing Boolean algebras that corresponded to the intuitionistic logic of L. E. J. Brouwer. This led to Terry's 1969 PhD thesis entitled *Some topics in the theory of distributive lattices*. In addition to working on his doctoral research, Terry taught introductory probability and statistics to large classes for four years running, and developed and presented undergraduate lecture courses on information theory (introductory and advanced), measure theory, projective geometry, and lattice theory. He also lectured on the theory of games to students in the Department of Mathematics at the new La Trobe University, located in another outer suburb of Melbourne. On top of this, he completed a Diploma of Education at Monash, reasoning that, if all else failed, he would be happy as a secondary school mathematics teacher and that it would be wise to be qualified.

While waiting for the examiners' reports on his thesis, Terry met Professor Joe Gani, then Director of the Manchester-Sheffield School of Probability and Statistics in the United Kingdom. Gani encouraged him to consider a lecturing position in the School. The presence in Manchester of Professor K. R. Parthasarathy — who carried out research on probability theory over algebraic structures such as locally compact abelian and Lie groups — proved to be the clincher. So off to Sheffield he and Sally went! Sheffield was an exciting place at that time, with excellent staff and lots of visitors. Equally important was its accessibility to other centers of probability and statistics such as Manchester and London. Initially, Terry travelled to Manchester weekly to attend Partha's seminar and went down to London to attend seminars at Imperial College, meetings of the Royal Statistical Society, and the like. There was lots of train travel. However, Terry's career in Partha-style probability theory did not take off and, in due course, he found himself collaborating with Elja Arjas on the topic of random walks, an experience that was both satisfying and productive. A later visitor to Manchester, Professor Debrabata Basu, re-kindled his interest in Berkeley-style statistics and led to a new obsession: sufficiency.

Terry returned to Australia to head the small group of statisticians in the Department of Mathematics at the University of Western Australia (UWA). He started at UWA as Associate Professor in 1974, became Professor in 1975, and spent a very happy and productive period there, culminating in being appointed Head of Department in 1982. From late 1977 until early 1979, he had his first sabbatical, spending time at the University of Copenhagen, Princeton University, Rothamsted Experimental Station, and UC Berkeley, all with Sally, and on his own at the Indian Statistical Institute in Calcutta.

In 1982, Terry was invited to apply for the position of Chief, Division of Mathematics and Statistics, at Australia's Commonwealth Scientific and Industrial Research Organization (CSIRO). He took up that appointment in 1983 and had a very hectic first year, being based in Canberra, but travelling to visit members of his division in every state capital and several other centers around Australia.

In 1984, he spent two enjoyable months visiting the Department of Statistics at the University of California, Berkeley, in a way, fulfilling his unrealized dream from 1964. While there, he was encouraged to apply for a permanent position, and three



years later, in fall 1987, joined UCB as a tenured professor. On the basis of his administrative experience with CSIRO, he was appointed Department Chair 1989–94, after which he took a second sabbatical, encouraged by Sally to explore job opportunities back in Australia. Nothing happened on this front for two years, but in 1996, a former classmate from University High School, Professor Suzanne Cory, by then Director of the Walter and Eliza Hall Institute of Medical Research, invited him to start up bioinformatics at WEHI. Sally said “yes!” and so he half accepted. From August 1997 to July 2009, Terry split his time evenly between UCB and WEHI or, as he used to say, spent half his time in Berkeley, half in Melbourne, and the other half in the air in between.

Following yet more encouragement from Sally, Terry officially retired from teaching at UC Berkeley at the end of the US academic year 2008–9 and took on a full-time appointment at WEHI. At the time of writing, he still has four PhD students, three postdoctoral fellows, and a number of continuing collaborations at Berkeley. He visits there for short periods every 1–2 months and remains as active as ever.

To quote from one of Terry’s recent e-mails: “Life has been hectic!”

Terry has (co-)authored over 300 refereed articles, in journals such as *Nature* and *The Annals of Statistics*, and on a wide variety of subjects, ranging from distributive lattices and ring theory in algebra, to pre-processing of high-throughput microarray and sequencing data in genomics. He contributes a regular column, *Terence’s Stuff*, to the *Institute of Mathematical Statistics Bulletin*, with his unique and provocative opinions on the current state of statistical practice and education. His book *Stat Labs: Mathematical Statistics Through Applications* provides a glimpse into his teaching philosophy, which integrates the theory of statistics with its practice through case studies. As illustrated by his dizzying travel schedule, he is a much sought-after speaker worldwide. He has delivered prestigious lectures such as the 2001 Wald Memorial Lectures and 2006 Fisher Lecture, at the Joint Statistical Meetings, and the 2007 Hotelling Lectures, at the University of North Carolina, Chapel Hill.

Terry is an active and dedicated member of the main statistical and biological professional societies, journal editorial boards, and grant and peer review committees. He is also highly-solicited as a consultant and scientific advisory board member in industry. He is a Fellow of the Institute of Mathematical Statistics (1984), the American Statistical Association (1989), the American Association for the Advancement of Science (1990), and the Australian Academy of Science (2001). He has received various honors, including the 2002 Pitman Medal (Statistical Society of Australia), the 2003 Moyal Medal (Macquarie University), an Australian Government Centenary Medal (2003), the 2004 American Statistical Association Outstanding Statistical Application Award (for the paper Irizarry et al. (2003), *Biostatistics*, 4(2):249–264), as well as an Achievement Award for excellence in health and medical research (2007) and an Australia Fellowship (2009) from Australia’s National Health and Medical Research Council (NHMRC).

In addition to his invaluable contributions to research, Terry is an extraordinary teacher, who has trained and influenced generations of students at Berkeley, in Australia, in the United Kingdom, and beyond. According to the Mathematics Genealogy Project (<http://genealogy.math.ndsu.nodak.edu/id.php?id=30979>), he has advised or co-advised 60 PhD students and has over 120 “descendants”. He is a most inspiring and generous mentor. His contagious enthusiasm and intellectual curiosity have made him one of the most popular advisors in the UC Berkeley Department of Statistics and a great resource for students in other departments.

Berkeley, CA  
June 2011

*Sandrine Dudoit*  
*with contributions from Terry Speed*

## PhD Students of Terry Speed

Name	Institution	Year
Michael Evans	Monash University	1973
Philip Pegg	University of Sheffield	1973
James (Jim) Pitman	University of Sheffield	1974
John Whitehead	University of Sheffield	1975
Anne Houtman	Princeton University	1980
Harri Kiiveri	University of Western Australia	1982
Matthew Knuiman	University of Western Australia	1983
Jens Breckling	University of Western Australia	1987
Bin Yu	University of California, Berkeley	1990
Sang Ho Lee	University of California, Berkeley	1991
Trang Nguyen	University of California, Berkeley	1991
Rudy Guerra, Jr.	University of California, Berkeley	1992
Darlene Goldstein	University of California, Berkeley	1993
Ferdinand Verweyen	University of California, Berkeley	1993
Mary Sara McPeck	University of California, Berkeley	1993
Steven Rein	University of California, Berkeley	1993
Ann Kalinowski	University of California, Berkeley	1995
David Nelson	University of California, Berkeley	1995
Hongyu Zhao	University of California, Berkeley	1995
Gregory Alexander	The American University	1996
Mark Grote	University of California, Berkeley	1996
Karl Broman	University of California, Berkeley	1997
Barathi Sethuraman	University of California, Berkeley	1997
William Forrest, III	University of California, Berkeley	1998
Lei Li	University of California, Berkeley	1998
Sandrine Dudoit	University of California, Berkeley	1999
Ru-Fang Yeh	University of California, Berkeley	1999
Shiyang Ling	University of California, Berkeley	2000
Simon Cawley	University of California, Berkeley	2000

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