



# Editorial

David Yost and I began our joint editorship of the *Gazette* at the beginning of 2013 with Issue 1 of Volume 40. In my editorial for that issue I mentioned the news item that in January 2013 Curtis Cooper discovered the largest known prime number. Little did I know that prime numbers would feature prominently in the news in April and May this year.

In April the Chinese mathematician, Yitang Zhang, who entered Peking University in 1978, obtained his PhD from Purdue University in 1991 and is employed by the University of New Hampshire, announced a proof of The Prime Gap Conjecture, which is a giant step towards the 2,000-year-old Twin Prime Conjecture attributed to Euclid. The Twin Prime Conjecture asserts that there are infinitely many pairs of prime numbers which differ by 2. The Prime Gap Conjecture says that there exists an integer  $k$  for which there are infinitely many prime numbers pairs of the form  $(p, p + a)$ , where  $a$  is less than or equal to  $k$ . Zhang proved The Prime Gap Conjecture for  $k = 70,000,000$ . Since Zhang's paper was accepted for publication in the prestigious journal, *Annals of Mathematics*, there has been much activity in reducing the number  $k$ . At the time of writing this editorial, the best result is  $k = 5,414$ . Of course if the number could be reduced to 2, then The Twin Prime Conjecture would be proved.

Australian academics live in an environment where their research performance is evaluated annually and where ARC grants largely go to those in the best research universities in the country. In this context, it is interesting to note that Yitang Zhang is not a young mathematician, that one would not describe his previous publication record as superb, and he is not employed by one of the best universities in the US. Nevertheless, he has broken the back of a 2,000-year-old problem which thousands before him have failed to solve.

In May this year, the Peruvian mathematician, Harald Andrés Helfgott, born in 1977 and currently working at École Normale Supérieure in Paris, announced a proof of The Ternary Goldbach Conjecture, named after Christian Goldbach (1690–1764), who recorded this conjecture in 1742. The conjecture states that 'Every odd integer strictly greater than 7 is the sum of 3 odd prime numbers'.

The Editors of the *Gazette* commissioned Dr Tim Trudgian of ANU to write an exposition of the results of Helfgott and Zhang, and his well-written exposition appears in this issue of the *Gazette*. Tim Trudgian himself was responsible for reducing Zhang's bound of 70 million to less than 60 million. As Tim points out in his article, you can follow the reduction of the 70 million bound at a site <http://tinyurl.com/ktdjgkb> which is moderated by the Australian-born Fields medallist Terry Tao.

In Amnon Neeman's report in this issue of the *Gazette* on the conference in honour of Peter O'Sullivan's 60th birthday, he says 'My view is that what happened at the conference illustrates yet again the sad state of Australian mathematics, an issue that the AustMS has been campaigning about for decades. Over the last decades there has been a brain drain from Australia leaving our coverage of mathematics very thin, with huge holes in areas of major international activity.' These remarks

bring two questions to my mind: (1) Was there a point in time when there was a better coverage of mathematics in Australia? (2) Is it better for Heads of Australian mathematics departments to seek new staff in existing areas of research strength or to cover gaps in Australian mathematics research? I look back on nearly 50 years of mathematics in Australia. In the early days of this period I recall significant research strength in group theory, number theory and fluid mechanics. I am not suggesting there were not others, but these come to mind. Later there were new strengths in areas such as category theory, harmonic analysis, partial differential equations, low dimensional topology and graph theory, while research in applied mathematics became much broader. At the same time as Australia was known for research strength, even leadership, in some areas there were important areas of mathematics research that were not represented in Australia. Today Department Heads who are lucky enough to be able to advertise for new staff should address the question of whether to focus research strengths or fill gaps in research. I prefer the former, but each Head should ponder that question.

Talking about looking back and thinking about the future, in this issue there are obituaries for Bruce Morton and Maurie Brearley. Phill Schultz has provided reviews of the books *Mathematical Excursions to the World's Great Buildings* by Alexander J. Hahn and *Archimedes' Modern Works* by Bernard Beuzamy. Readers should note the request from Hans Lausch for problem donations that can be used in national, regional and international senior-secondary-school mathematics competitions. Finally for your entertainment I draw your attention to Puzzle Corner 33 by Ivan Guo.

*Breaking News:* Emeritus Professor Rodney Baxter FRS of the Australian National University has been awarded a Royal Society medal. Previous winners of this medal include Sir Michael Atiyah FRS, George Boole, Arthur Cayley, Francis Crick, Paul Dirac, Simon Donaldson, Michael Faraday, Roger Penrose, Lord Rayleigh, J.J. Sylvester and Andrew Wiles. More on this is the next issue of the *Gazette*.

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Sid Morris retired after 40 years as an academic. He received BSc (Hons) from UQ in 1969 and PhD from Flinders in 1970. He held positions of Professor, Department Head, Dean, Deputy Vice-Chancellor, CAO and CEO. He was employed by the universities: Adelaide, Ballarat, Flinders, Florida, La Trobe, UNE, UNSW, UQ, UniSA, Tel-Aviv, Tulane, Wales, and Wollongong. He was Editor of *Bull. AustMS* and *J. Research and Practice in IT*, and founding Editor-in-Chief of *AustMS Lecture Series*. He was on the Council of AustMS for 20 years and its Vice-President. He received the Lester R. Ford Award from the Math. Assoc. America. He has published 140 journal papers and 4 books for undergrads, postgrads and researchers, plus an online book, supplemented by YouTube and Youku videos, translated into 6 languages and used in 100 countries. Karl Hofmann and Sid recently completed the 3rd edition of their 944-page book *The Structure of Compact Groups*.