

**The Prime Number Conspiracy** by *Thomas Lin* (ed.). MIT Press, 2018 (336 p.) isbn: 978-0-26253-635-6.

Thomas Lin is since 2012 the founder and editor in chief of the highly regarded online *Quanta Magazine*, a non profit publication with the purpose of promoting science. It is funded by *The Simons Foundation*, an organization created by James Simons, a billionaire mathematician and hedge-fund founder. The idea is that the articles cover topics from hard science in about five to ten pages. They should be intellectually rigorous, yet engaging stories that are somewhat outside the mainstream media.



Thomas Lin

With this book, Lin has selected 37 of these stories related to mathematics in general. The title of the books is the same as the title of the fourth contribution, which, just like the first three, is discussing prime numbers, but the other ones are not. So the book title may be a bit misleading as if promising a book completely devoted to prime numbers. The texts are written in a magazine style, which is sometimes the reflection of an interview of for example a scientist who just published a ground breaking result in his discipline, or one that won a prize. It can also be that it is just an accessible description of an important result. For example in the prime number part we find two reports about how the gap between successive twin primes was made smaller. Another one is about the number of prime factors of an integer being even or odd. It is using a technique that helped to develop new results related to the prime number theorem. The one that delivered the title of the book is about the fact that the rightmost digit of a prime number is equally distributed over 1,3,4,6,7,8,9 (for an odd prime it cannot be 2 or 5).

There are six other parts. I cannot enumerate here all 37 subjects, so I just give an idea of what the parts are about and somewhat randomly pick some topics as an illustration. The second part is called “Is math the universal language of nature?” The first report is on Monstrous Moonshine theory (linking the monster group and string theory) and another is about a universality phenomenon in the spectra of random matrices, and more generally how order is hidden in all kinds of random phenomena in nature.

Part 3 is about important proofs that were discovered “by accident”. The proof of the Gaussian correlation inequality (GCI), solution of the Kadison-Singer problem, pentagonal tessellation of the plane or sphere packing in higher dimensions are examples of results found by serendipity, e.g. by someone unknown to the community, or by using a technique from a related field that is unusual in the domain.

The reports in part 4 shed some light on how the best mathematical minds are functioning. Maryam Mirzakhani, Artur Avila, and Manjul Bhargava, all winners of the Fields Medal in 2014, Peter Scholtze was winner in 2018, Yitang Zhang is the one who featured in the first report of this book. He found an upper bound for the gap between  $k$ -tuples of primes (the twins have  $k = 2$ ). Among the “older” minds interviewed are Freeman Dyson, without a PhD, but prominent member of the IAS in Princeton, and Michael Atiyah former president of both the London and the Edinburgh Royal Society.

The next part is about computers and mathematics. Security problems in software code, the design of a formal motivic cohomology system, bringing the graph isomorphism problem closer to the class P than to NP and other reports on complexity theory. Part 7 is about infinity: the continuum hypothesis, and recent results in complexity, Ramsey and model theory. The last part is about mathematicians that were inspired by their mathematical heroes or that have been inspiring for others: Ken Otto admires Ramanujan, Francis Su is former president of the MAA, Rebecca Goldin is director of the Statistical Assessment Service and motor behind STATS, a non profit organization to promote statistical literacy among journalists.

The book is similar to Devlin’s collections “The Best Writings on Mathematics” (there is in fact some overlap), or “What’s Happening in the Mathematical Sciences” from the AMS. Not for the utter layman, but generally accessible for any mathematician. All the contributions are from the first five years of the existence of Quanta. They are however slightly edited to make them up-to-date. Almost simultaneously appeared a volume with a collection of papers about physics called *Alice and Bob meet the wall of fire*.

Adhemar Bultheel