axioms and, as light relief, also features some elementary number theory – prime factorisation, modular arithmetic, Fermat's little theorem, Wilson's theorem, Hamming error-correcting codes and Rabin codes. Part III contains the construction of the real numbers (via equivalence classes of Cauchy sequences in $\mathbb{Q}$) and the complex numbers (as ordered pairs of reals), as well as a glimpse of the quaternions and their connection with vector analysis. Polynomials are introduced with the chapter culminating in the construction of Liouville (transcendental) numbers and a proof of the fundamental theorem of algebra. As ever, the author writes with verve and wit with many characteristic "Körnerisms" among the anecdotes in the text and footnotes: even the index is amusing!

I felt the book could be enjoyed in three different ways. Reading the text and skipping the proofs provides a roadmap of the journey, the issues involved, and the challenges to be faced and overcome. Following the details of the proofs would give early undergraduates plenty of practice in standard modes of reasoning although (beware!) there are some subtler proofs that take a bit of unpacking. And, although knowledge of their other courses is not presumed, such readers would enjoy spotting which arguments derive from more general ones in the theory of groups, rings and fields. Finally, those already familiar with the subject matter can relish and admire the skill with which the author organises and presents the material. As examples, I would highlight the clear exposition of the relationship between the least member principle and the principle of induction, the very full presentation of equivalents of the fundamental (completeness) axiom for $\mathbb{R}$, the use of Cantor's original non-diagonalisation proof that $\mathbb{R}$ is uncountable, and the proof of the fundamental theorem of algebra. The latter is the author's own take on the "show that $|P(z)|$ attains a minimum value $|P(z_0)|$ and then show $P(z_0) = 0$" line of argument and involves proving that $z^m = \alpha$, $|\alpha| = 1$, has a root without introducing angles. A fitting endpoint to the book is provided by Palais's neat proof of Frobenius's famous theorem that if $\mathbb{R}^n$ can be given the structure of a skew-field, then $n = 1$, 2 or 4, corresponding to $\mathbb{R}$, $\mathbb{C}$ and H. The text is interleaved with mainly routine exercises, solutions to which are available on the author's website.

In his book *Mathematics for the general reader*, [2], the Oxford analyst E. C. Titchmarsh wrote, "I am all in favour of an intelligent theory of number. It should add to the pleasure of mathematics, just as an intelligent theory of rigid dynamics should add to the pleasure of bicycling. But it is possible to pedal along without it." *Where do numbers come from?* certainly adds to the pleasure of mathematics as well as narrating a journey that surely every mathematician should undertake at some stage. As such, I enthusiastically recommend it to all *Gazette* readers.

*References*

1. E. Landau, *Foundations of analysis* (translation by F. Steinhardt), Chelsea (1951).
2. E. C. Titchmarsh, *Mathematics for the general reader*, Hutchinson's University Library (1948) p.11.

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**The maths of life and death** by Kit Yates, pp. 333, £20 (paper), ISBN 978-1-78747-542-7, Quercus Books (2019)

This is an interesting, useful and important book on some serious topics involving mathematics: exponential growth, medical health, the law, media statistics, number systems, algorithms, and mathematical epidemiology. Such matters are discussed with well-chosen examples from real life, and explained authoritatively over seven superbly written chapters. There is also an epilogue on mathematical emancipation. Mathematics and statistics can be difficult to understand, even for trained mathematicians. Unfortunately, to make matters worse, we are frequently presented with mathematical smokescreens conjured up by charlatans, often when mathematics is not even an appropriate tool to use. We then need experts in the appropriate areas to explain to us what it is all about.

The author is a mathematical biologist who is also an unparalleled story teller. He uses the most appropriate, engaging, witty and even lyrical, colloquial prose to produce an articulate and accessible text in excellent plain English. The lucid accounts can be compared with the best kind of journalism, but also with an added dose of scholarship. The topics often involve a tragedy or a farce, imprisonment or freedom, and even life or death. He has done the necessary research on behalf of the reader to cover in depth many of the famous cases involving medicine, law, and much else, using evidence-based science in his explanations. Moreover, he has a good knack of explaining the esoteric, or even the genuinely recondite, items to lay persons without patronising them. For example, it will be difficult for anyone to do a better job in explaining the topics 'P vs NP', 'greedy algorithms', and 'optimal stopping strategies' to persons with little or even no mathematical training.

There are quotable morsels of wisdom in every chapter:

> Finding the answers to these … questions should take you a long way towards determining the veracity of the figures. Not being able to find the answers tells its own story. There are multiple ways to be economical with the truth using mathematics.

Does the author get carried away with the importance of mathematics by over-selling it? Well, I also quote from the epilogue:

> There are places where mathematics is completely the wrong tool for the job, activities in which human supervision is unquestionably necessary. Even if some of the most complex mental tasks can be farmed out to an algorithm, matters of the heart can never be broken down into a simple set of rules. No code or equation will ever imitate the true complexities of the human condition.

Perhaps the most useful and important chapter is the last one, with the title 'Susceptible, Infective, Removed: Containing disease is in our own hands'. It is on the scourge of infectious diseases such as smallpox, Ebola, and variants of influenza. The book just misses out on the latest outbreak of the coronavirus which causes Covid-19, and I reached the chapter in March 2020 when the virus was about to become widespread in the world.

The suggestion in the Introduction that '[T]his is not a maths book. Nor is it a book for mathematicians' is sometimes used as an invitation to mathematicians to read it, especially when the reader is told that there is not a single equation in the whole book. I accepted the invitation, and I learned so much from it that I cannot praise it highly enough. It is very rare that I suggest a book should be a 'must read', but I expect this one to become a well-deserved 'best-seller'. You should buy several copies and offer them as gifts to your friends, including mathematicians.

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