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BOOK REVIEWS

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WILLIAM DUNHAM *The Genius of Euler: Reflections on His Life and Work* (Mathematical Association of America, 2007), 309 pp, 0 883 85558 5/9 780 883 85558 4 (hardback), £25.99; C. EDWARD SANDIFER *The Early Mathematics of Leonhard Euler* (Mathematical Association of America, 2007), 391 pp, 0 883 85559 3/9 780 883 85559 1 (hardback), £25.99.

In 2007 the mathematical world celebrated the Tercentary of the great scientist Leonhard Euler. In this connection the Mathematical Association of America secured an edition of the books *The Genius of Euler: Reflections on His Life and Works* and *The Early Mathematics of Leonhard Euler*. The books are splendid. They are replete with enthusiasm for the subject and also contain many interesting illustrations, such as the title pages of Euler's monographs, pages from his articles and portraits of him and of his contemporaries.

The title of the first book comes from Marquis Condorcet's 'Eulogy to Mr Euler': 'there is no one who . . . is not guided and sustained by the genius of Euler'. Some articles about Euler from different years are collected in this first volume. The oldest dates back to 1872 (Glaisher) and the most recent is a 2006 article by Klyve and Stemkovsky. Part I of the book is largely biographical, while part II is mathematical. This division is rather misleading as Euler's life is a life of mathematics lived regardless of historical conditions.

Fragments of biographical articles supplement each other very well. Sometimes a phrase throws light on decades of Euler's life. For instance, Cajori quotes a letter of d'Alembert to Friedrich the Great: 'It is the destiny of your majesty to be always at war; in summer with the Austrians, in winter with mathematics'. The articles are not all of the same type: some are only one page long (such as 'A mnemonic for Euler's constant' by Morgan Ward); others are thematic reviews that give an account of the history of specific problems and Euler's discoveries and subsequent developments.

The details of Russian history are omitted from the first book. It was political instability in Russia that influenced Euler to leave St Petersburg and spend 25 years in Berlin at the invitation of the King of Prussia. There are also one or two inaccuracies: Nicolas Bernoulli (1623–1708) had four sons rather than three, for example. The spelling of names, e.g. Leonhard or Leonard, Nicholas or Nicolas, Friedrich or Frederieck, is not uniform.

Some articles from Euler's vast mathematical output are given in part II. Some titles are 'Euler and infinite series', 'Euler and the Zeta function', 'Euler and differentials', 'Leonhard Euler's integral: a historical profile of the gamma function', 'On the calculus of variations. . . ' and 'Euler and the fundamental theorem of algebra'. The papers from the second part concern very different problems but they are unified by the method of study: series expansions. The extraordinary intuition of Euler allows him to avoid mistakes and risks related to the application of divergent series. His inventiveness led him to recurrence relations that unify results from number theory and the theory of interpolation. New special functions arise from Euler's masterly transformations: the famous zeta, gamma and beta functions.

Two illustrations make one's eyes light up. One picture presents a 'council' of the genius: Archimedes, Newton and Gauss. Another displays 'the complete set': Archimedes, Newton,

Euler and Gauss. Such illustrations make one wonder what modern science would look like had nothing from these books ever appeared!

Practically every article contains information on terminology and notation proposed by Euler. All are in use in modern mathematics. This observation can be extended. It is emphasized that Euler's courses present the first educational literature in the modern sense of the word. Euler was the first author to discuss proofs and not to hide the motivation behind his demonstrations. Finkel, Boyer and Alexanderson note that Euler not only shares his way of thinking openly but also warns about possible mistakes. Even Euler's commentaries on his book about artillery were translated from German into English and French.

The second volume, *The Early Mathematics of Euler*, is intended as a mathematical biography. It presents the original and fascinating story of mathematics in the St Petersburg period of Euler's life, before his departure to Berlin. C. Edward Sandifer attempts to take readers back into the past and is highly successful in achieving this. The time from 1725 to 1741 is divided into the periods 1725–1727, 1728, 1729–1731, and so on. Each section starts with information on world events, events in Euler's life, the sum of Euler's work during the period, and Euler's mathematical papers appearing in the period. The author then gives an account of every article. Such a presentation creates a distinctive narrative atmosphere—an attractive aspect of the work that has significant merit.

One can see how early the huge circle of Euler's interests was formed. These include arithmetic and algebra (continued fractions, the remainder theorem, etc.), geometry and topology (lune of Hippocrates, the problem of Königsberg bridges, etc.), number theory (Fermat's little theorem, Diophantus's problems, prime numbers, Euler's function), differential equations and the calculus of variations, infinite series and products (Cauchy's criterion, the zeta function, etc.), astronomy and geography, mechanics and the theory of music, and many more.

These books will undoubtedly be received with interest, and with gratitude to the editor William Dunham and the author C. Edward Sandifer.

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MARTIN NOWAK *Evolutionary dynamics: exploring the equations of life* (Belknap Press/Harvard University Press, Cambridge, MA, 2006), 384 pp, 978 0 674 02338 3 (hardback), £21.80.

Martin Nowak is well known for his work in evolutionary game theory, evolution of language and carcinogenesis. In the book under review, he presents highlights of his multifaceted research.

In the preface he writes,

> The life sciences, and biology in particular, are on the brink of an unprecedented theoretical expansion. Every university is currently aiming to establish programs in mathematical biology and to offer its students an interdisciplinary education that spans fields as diverse as mathematics, molecular biology, linguistics and computer science. At the borders of such disciplines, progress occurs. Whenever the languages of two disciplines meet, two cultures interact, and something new happens.

I think this passage conveys the careless triumphalism that characterizes mathematical biology, as well as its siblings, bioinformatics and systems biology. It also gives a good taste of what Nowak's style is like.

Nonetheless, it is true that biology is awash with data that stubbornly resist being converted into knowledge and understanding. Hence the two main modes of deploying the exact sciences in biology: one that is data led and attempts to find patterns in the deluge of information coming from high throughput techniques; and one that is hypothesis led, which tries to isolate important elements in a sea of detail, somehow organize them in a mathematical model and use that as a