English-style geometries

Ivor Grattan-Guinness

Mathematical Visions: The Pursuit of Geometry in Victorian England. By Joan L. Richards. *Academic: 1988. Pp.266. $34.95, £22.*

IN THIS revised version of her doctoral dissertation defended at Harvard University, Joan Richards covers an important and rather individual stream of work in English Victorian mathematics: the concern with geometries of various kinds (euclidean, non-euclidean and projective), and the relations between them. Starting out from the renaissance of mathematics at Cambridge in the 1810s, she concentrates on the second half of the century, with chapters devoted to the philosophy of geometry, the popularity of its non-euclidean variety, the role of the projective version, the disputes over teaching the euclidean type in schools, and the early researches of Bertrand Russell.

Russell was not the only person to apply logic to geometry, for the matter involved various issues of consistency and (in)completeness of theories. Richards's own use of vocabulary is less clear than it might be: especially her use of 'analysis' (which is sometimes the mathematical subject and otherwise the proof-method); and of 'validity' of theorems, which can either be truth-values within a theory or their verisimilitude as descriptions of space or of empirical phenomena.

The book shows a high degree of scholarship, with a broad range of sources used, including Parliamentary papers and *Nature* itself (whose origin is falsely attributed on p.164 to T.H. Huxley). The general context of scientific thought is much better outlined than is normally the case in books on the history of mathematics, although I find her characterization of the science of the period as "post-Darwinist" a little narrow, because the life and Earth sciences *in general* provided the mathematicians' stimuli for comparison.

Standard of production is also good. Footnotes are literally so, and the references are repeated in the bibliography at the end. A few items are significant by their absence, however, and when taken into account they somewhat temper the portrait that is presented.

For example, the disputes over school education were richer in content and context than is suggested in Chapter 4. And as Richards hints on pp. 179–180, both sides of the dispute were ignorant of studies of euclidean geometry being pursued on the Continent, which exposed its logical weakness. By 1902 Russell could point out some examples of the modern critical position, in a paper entitled "The Teaching of Euclid".

At the higher level of instruction, especially at Cambridge, the philosophical issues hinged around the principle that 'training the mind', as conceived in the 1820s, was designed to do no more than that, rather than invite the really enquiring mind to pursue original research; and yet important scientists did emerge out of this system. Both sides of the paradox have been exhibited elsewhere, but the point itself is not quite made in this book.

In starting with the Cambridge reform, Richards follows the usual historical interpretation of changes in the British Isles. However, in a volume currently in production with Cambridge University Press, N. Guicciardini has shown that various other institutions in Britain had initiated reforms before that. In England these were the military schools; and thus one is led to wonder as to their roles in nineteenth-century English geometry. The question is not raised, although it is clear that there was considerable interest at least in descriptive geometry.

Finally, the (implicit) characterization of Victorian mathematics as preoccupied with geometry ignores another face, partly in contradiction with that shown here. *Mathematical Universes: The Pursuit of Algebra in Victorian England* could be the title of a book which covered as much mathematical ground and involved as many notable figures as does this one: general algebras, differential operators, functional equations, linear algebra and probability theory were especially favoured topics. Richards discusses aspects of the first of these areas in places, mainly in the context of A. de Morgan, of whom she is currently writing a biography. One hopes that next she will tackle the Victorian interest in algebras more deeply, for few historians possess her knowledge of that period. □

Ivor Grattan-Guinness, Middlesex Polytechnic, Enfield, Middlesex EN3 4SF, UK, is the Immediate Past-President of The British Society for the History of Mathematics.

Little wonders

Tom Fenchel

Microbial Ecosystems of Antarctica. By Warwick F. Vincent. *Cambridge University Press: 1989. Pp.304. £37.50, $75.*

MOST people associate Antarctic life with the large populations of penguins, seals and whales that are sustained by immense numbers of krill and other zooplankton. Yet the harsh environment of most of the continent allows only for microbial life; in the absence of grazing animals, microbes often reach high enough population densities to become macroscopically visible as brown-stained ice, red-coloured snow fields and black crusts on soils. As documented by the 500 or so references in this book, over the past two decades microbiologists have been busy at work on the wide variety of scientific questions involved.

In the core of the book, Warwick Vincent describes the different habitats: snow and ice, sea ice, the open ocean, lakes, streams, soils and rock surfaces. For each of them, environmental factors, the composition of the microbial communities, and their importance for the ecosystems and biogeochemical activities are discussed. We are presented with new insights into Antarctic marine planktonic food chains; for example, it has been found that, during the summer, the receding sea ice creates vertically stabilized and nutrient-rich water masses, and is thus responsible for the bulk of the phytoplankton production which sustains the large populations of marine invertebrates, birds and mammals. The descriptions of microbial life in the most extreme environments — snow, ice bubbles, hyperhaline lakes (which remain unfrozen at −30 °C) and exposed rock surfaces — are fascinating. It is, though, a pity that a section comparing Antarctic microbial communities with their Arctic counterparts was not included.

The other main section of the book treats adaptations to the environment at the cellular level. Survival and metabolic activity at freezing temperatures is an obvious problem, but Antarctic microbes may also be exposed to dehydration and to extremely high salinities (the combined effect of freezing and evaporation). A final chapter is devoted to the effects of human activities, for example pollution and the introduction of xenobiotic microbes, and to the possible practical use of Antarctic microbes. Also included are a glossary, and two appendices on Antarctic climates and tables of environmental data.

This a well-written, well-illustrated and authoritative volume. As well as biologists concerned with the Arctic or Antarctic, anyone interested in bacteria and protists in nature will find it well worth reading. □

Tom Fenchel is in the Marine Biological Laboratory, University of Copenhagen, Strandpromenaden 5, DK-3000 Helsingør, Denmark.

New in paperback

- *The Connection Machine* by W. Daniel Hillis. Publisher is MIT Press, price is $13.95, £12.50. For review see *Nature* **321**, 126 (1986).
- *Klaus Fuchs, Atom Spy* by Robert Chadwell Williams. Publisher is Harvard University Press, price is £9.95, $12.95.
- *Artificial Intelligence: The Very Idea* by John Haugeland. Publisher is MIT Press, price is $9.95, £8.95. For review see *Nature* **319**, 185 (1986).