Revolutions in Mathematics

Edited by Donald Gillies, Clarendon Press, Oxford, 1992
Reviewed by Kevin Vander Meulen, Redeemer College, Ancaster, ON, Canada.

Revolutions in Mathematics arose out of a debate stirred from the question: Can ideas in Thomas Kuhn's *The Structure of Scientific Revolutions* be fruitfully applied in the history of mathematics?

The papers in *Revolutions* are written by and for historians and philosophers of mathematics; and this reviewer does not belong to either group. I am a mathematician whose main area of research is algebraic graph theory. But I do like to dabble in the history and philosophy of mathematics for several reasons: I enjoy it, it enriches my teaching and it is necessary in order develop a personal Christian perspective on the nature of mathematics with some depth. In particular, I read this book with a vested interested in trying to learn more about the nature of mathematics itself, not because the particular debate (about whether there are revolutions in mathematics) was on the forefront of my mind.

Donald Gillies sets the stage with a careful introduction to the debate, including a brief summary of the positions with his own thrown in. Michael Crowe's paper begins the debate with "Ten 'Laws' concerning patterns of change in the history of mathematics". This annotated list includes the assertion that revolutions never occur in mathematics. Crowe distinguishes between transformational/revolutionary discoveries versus formational discoveries (wherein new areas are formed or created without the overthrow of previous doctrines) and thus concludes that "revolutions may occur in mathematical nomenclature, symbolism, metamathematics, methodology and perhaps even the historiography of mathematics" but not *in mathematics*.

Some of the subsequent papers challenge Crowe on what he then means by *"in mathematics*", getting into discussions about the nature of mathematics. Joseph Dauben forwards that the term revolution can "imply a radical change or departure from traditional or acceptable modes of thought" and demonstrates one expected characteristic of a revolution: resistance to change. Much of the discussion, is centered on the definition of revolution. In light of different definitions, several candidates of revolutions in mathematics are forwarded with varying degrees of success, including the introduction of non-Euclidean geometry, irrational numbers, infinitesimal calculus, non-commutative algebra, Hilbert's formalism, and Cantor's theory of the infinite. The last chapter of the book is an essay describing assumptions about the development of mathematics that have changed through research.

Reading *Revolutions* for its insights into the nature of mathematics by how it contrasts with science is not out-of-line with the intentions of this book. As Thomas Kuhn explains in the postscript of his well-known manuscript, his theory was mainly borrowed from other fields such as history of literature, art, music and political development. He is claiming that science has some similar development patterns. Thus the book under review explores where mathematics too has development patterns similar to other subjects.

The book is an enlightening read but not a light read. For the general reader, it might become too technical at times, but the book would certainly have been disappointing if it did not delve into detailed examples. Thus, an interested reader is bound to learn something new.

I do not in general recommend this book for the undergraduate student. As this is an edited collection of papers, and since several papers review the positions of other authors, some chapters can be read in isolation. Perhaps there are a couple of chapters, namely those by Crowe and Dauben which are accessible to the undergraduate. But such a mathematics student should have at least some previous experience with Thomas Kuhn's *The Structure of Scientific Revolutions.*