IN MEMORIAM

GARRETT BIRKHOFF

GARRETT BIRKHOFF, former professor of pure and applied mathematics at Harvard University, died on Friday, 22 November 1996 at his home in Water Mill, New York, where he had moved from Cambridge, Massachusetts about a year ago. Birkhoff retired in 1981 as George Putnam Professor Emeritus. He held the chair since 1969.

Born in Princeton, New Jersey on 10 January 1911, the son of eminent Harvard mathematician George David Birkhoff, he received his mathematical education from his father and his father's Harvard associates.

Birkhoff will be best known for his work in algebra, especially lattice theory, and quantum logic, the latter represented by his joint work with John von Neumann, "The Logic of Quantum Mechanics," (*Annalas of Mathematics* **37** (1936), 823–843. His book *Lattice Theory*, first published in 1940 by the American Mathematical Society, went through three editions (1948, 1973) and remains a classic to this day, as does *A Survey of Modern* Algebra, his joint textbook effort with Saunders Mac Lane. In recounting his work in the early 1930s, Birkhoff wrote that "I had dreamed up lattices while in England . . . , plucking them out of semithin air as a generalization of the Boolean algebra . . . (p. 57, "The Rise of Modern Algebra to 1936," in J. D. Tarwater, J. T. White & J. D. Miller (editors), *Men and Institutions in American Mathematics* (Lubbock, Texas Tech University Press, 1976), 41–63).

In *Die Entstehung der* Verbandstheorie (Hildesheim, Gerstenberg Verlag, 1979, pp. 36–37), Herbert Mehrtens notes that Whitehead incorporated the axiomatics of *Schröder's Der Operationskreis des Logikkaküls* (1877) into his own *Treatise on Universal Algeba* (1898). Whitehead treated the algebra of logic as a special case of his general concept of an algebra and gave the algebra of logic as the "only known member of the non-numerical genus of Universal Algebra". Mehrtens indicates that the title of Whitehead's book suggests the question of its relationship to modern universal algebra and of its very close connection with lattice theory. The answer Mehrtens adds, is that Birkhoff borrowed the name of "universal algebra" from Whitehead's book. Saunders Mac Lane wrote that "the first real paper on universal algebra [was written by] Garrett Birkhoff (1935)," that is, Birkhoff's paper "On the Structure of Abstract Algebras" (*Pro-*

ceedings of the Cambridge Philosophical Society **31** (1935), 433–454. As Mac Lane explains (pp. 17–18, "Part I, History of Algebra: History of Abstract Algebra: Origin, Rise, and Decline of a Movement," in D. Tarwater, *et al.* (editors), *American Mathematical Heritage: Algebra and Applied Mathematics* (Lubbock, Texas Tech University Press, 1981), 3–35),

> In this paper, he proved what is now called Birkhoff's theorem characterizing varieties of algebras closed under (infinite) products, quotients, and the formation of subalgebras. Lattice theory, which had been extracted by Dedekind in 190 from the properties of ideas, was rediscovered by Garrett Birkhoff and also independently by Oystein Ore, who had been influenced by the Göttingen school and had just edited Dedekind's collected works, including the papers on dual groups (= lattices). Ore's emphasis was to apply lattice theory to groups and to ring theory, while Birkhoff was more concerned with a wider sweep including ordered systems. Birkhoff and Karl Menger contributed essentially to the description of projective geometires by lattices. . . .

Birkhoff also carried out research on scientific computing, reactor theory, differential equations, and the history of mathematics His history of the development of modern algebra, for example, is presented in the aforementioned "The Rise of Modern Algebra to 1936" and continued in the next pages in "The Rise of Modern Algebra, 1936 to 1950" in J. D. Tarwater, J. T. White & J. D. Miller (editors), *Men and Institutions in American Mathematics* (Lubbock, Texas Tech University Press, 1976), 65–85).

THOMAS TYMOCZKO

Philosopher of mathematics THOMAS TYMOCZKO died this past summer following a brief illness. His teachers included Hao Wang, Michael Dummett, Burton Dreben, and Hilary Putnam, as well as ethicist Phillipa Foot. He received his doctorate in 1971, after which he joined the philosophy faculty at Smith College, where he continued to serve as Professor of Philosophy until his death. His special concern was the re-introduction of the algorithmic — or what he prefered to call "quasi-empirical" — nature of proof as a result of the use of computers to test equations. Examples of his ideas in this regard are his papers "The Four-Color Problem and Its Philosophical Significance", which first appeared in 1979 in *The Journal of Philosophy* **76**, no. 2, pp. 57–83 and "Computers,