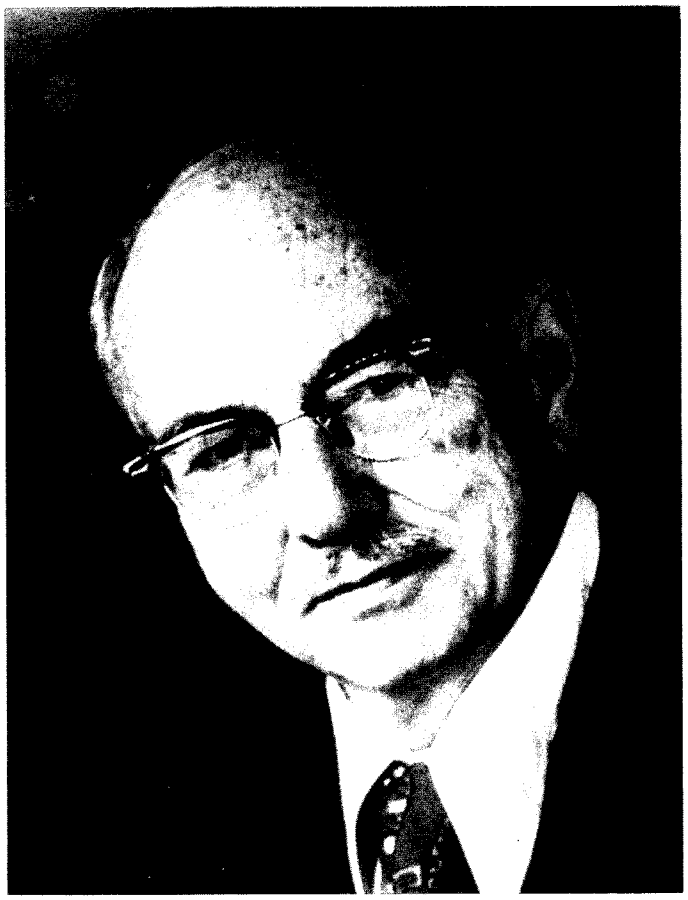
Edward James McShane
1904–1989

E. J. McShane was born in New Orleans and died 85 years later in Charlottesville, Virginia. He was a major contributor to several areas of mathematics, including the calculus of variations, integration theory, control theory, and stochastic calculus. He had a strong concern for the well-being of his fellow mathematicians and contributed to this in many ways. He was a deeply cultured man, with a flair for languages and a great variety of other interests. He was widely known for his warmth, generosity, and modesty, and for his fund of humorous and interesting anecdotes.

McShane was elected to the National Academy of Sciences in 1948. He served as President of the Mathematical Association of America in 1953 and 1954, and President of the American Mathematical Society in 1958 and 1959. Thus he was one of only four people who have, in the past fifty years, served both the AMS and the MAA as President. He later served from 1956 to 1968 as a member of the National Science Board. These periods of service, in addition to his service on numerous committees, illustrate the breadth and the depth of his concern for the mathematical community.

McShane's father was a medical doctor and his mother a former school teacher. He grew up in New Orleans, and throughout his life felt a strong attachment to that city. He graduated from Tulane University in 1925, receiving the Bachelor of Science and Bachelor of Engineering degrees simultaneously. He turned down an offer from General Electric and instead continued as a student instructor of mathematics at Tulane, receiving a Master of Science degree in 1927. He maintained an interest in the mathematics associated with engineering problems, but once remarked that he had never regretted his decision to become a mathematician rather than an engineer. He received a honorary doctorate from Tulane in 1949.

In the summer of 1927, McShane entered graduate school at the University of Chicago. During 1928-1929, it was necessary for financial reasons to interrupt his studies and teach at the University of Wichita. Nevertheless, he was able by 1930 to complete his doctoral dissertation and to receive his Ph.D. degree from Chicago under the supervision of G. A. Bliss and L. M. Graves. For the following two years he held a National Research Council Fellowship, spent at Princeton, Ohio State, Harvard and Chicago. This was a period during which the calculus of variations for multiple integrals was developing rapidly, including the problem of finding a minimal surface with given boundary (Plateau's problem). The "direct methods" explained in L. Tonelli's then new book *Fondamenta di Calcolo della Variazione* provided a key tool in these developments. McShane had earlier learned Italian in order to read opera libretti. He read Tonelli while yet a graduate student, and soon afterward reached the forefront of research on multiple integral problems.



In 1931 he married Virginia Haun, who survives him. Over the years the McShanes had an unusually warm, closely knit family life with their three children and later two sons-in-law, all trained in music as well as mathematics. (Later six grandchildren joined the group.) McShane himself was a devoted amateur cellist who found great pleasure in his family's musical activities. In his later years, he developed a strong interest in Chinese painting and calligraphy, and spent many happy hours in improving his technique.

Because of the Great Depression, openings in mathematics departments were virtually nonexistent in 1932. The McShanes spent 1932-1933 at Göttingen, during which time he translated into English the two volumes of Courant's *Differential and Integral Calculus*. They also saw at first hand some frightening aspects of the onset of Nazi power in Germany. After two years (1933-1935) on the faculty at Princeton, McShane joined the Department of Mathematics at the University of Virginia as a full professor in the fall of 1935. He remained there for the rest of his career, except for leaves of absence spent at other institutions.

In the late 1930s, McShane developed methods to provide existence theorems and necessary conditions for a very large class of single integral problems in the calculus of variations. He introduced the use of convex cones of variations, and observed that optimality of a trajectory implies the existence of a hyperplane separating a certain cone and ray from each other. This approach later provided the key to Pontryagin's principle in control theory during the 1950s, and to later developments in convex and nonsmooth analysis.

With the onset of World War II, McShane agreed to head a mathematics group at the Ballistics Research Laboratory in Aberdeen, Maryland. During this period (1942-1945) he wrote with J. L. Kelley and F. V. Reno a book on *Exterior Ballistics*, regarded as a definitive work on the subject. He was the AMS Colloquium Lecturer at the summer meeting of 1943.

McShane was deeply offended by the injustices suffered by some of his colleagues during the anti-communist hysteria that followed the war. In response to a question on the security form of the Aberdeen Proving Grounds, asking whether he had ever been involved with organizations that had at any time advocated the violent overthrow of the U.S. government, he replied affirmatively–that he was an employee of the State of Virginia. During the McCarthy era, the House Un-American Activities Committee "invited" him to express his views, but he was not subpoenaed. He did not cooperate with HUAC, but wrote a letter in which he stated his views and backed them up with quotations from various sources.

Over the years McShane achieved an extraordinarily deep understanding of integration processes as they arise in various guises. He wrote three books on integration, in addition to a number of research articles. His 1944 volume *Integration* provided a readable introduction to the Lebesgue theory at a time when few such books existed in English. He once remarked that any textbook was likely to be criticized by its readers for not supplying enough details, and by experts in its field for supplying too many details. He said that in writing the book on integration he had ignored the second possibility, since he was writing to instruct and not to impress. Many students benefited from the clarity of his exposition.

McShane's 1953 monograph on *Order Preserving Maps and Integration Processes* was an outgrowth of his search for a mathematically correct setting in which to treat divergent integrals in quantum physics. He was considerably bothered by what he considered pseudo-mathematical reasoning in the physics literature. After reading one such "pseudoproof" of a result for which a correct proof due to von Neumann was already available, McShane commented: "Anyone who can write such statements has forfeited all right to be scornful of the woman who could 'trace her ancestry to William the Conqueror with only two gaps'."

His interest in the mathematical foundations of quantum mechanics and quantum field theory continued for many years after World War II. Although his ambitious program in these areas did not reach fruition, the attempt profoundly influenced his subsequent work on integration processes and stochastic calculus. This is seen, for example, in his excellent 1963 survey article on *Integrals Designed for Special Purposes* and in his 1974 book on *Stochastic Calculus and Stochastic Models*, which is the definitive treatment of his approach to that subject.

In the 1960s and 1970s, when McShane's research interests turned toward developing a stochastic differential and integral calculus, the stochastic calculus of K. Ito was already in existence. It provided a convenient way to represent an important class of stochastic processes, called Markov diffusions, as the solutions to stochastic differential equations. For a stochastic differential equation in the sense of Ito, the random inputs are Brownian motion processes whose formal time derivatives are "white noises." However, at the time there was considerable confusion in the engineering literature about the correct interpretation if an idealized white noise is replaced either by a physical "wide band" noise or by a discrete process introduced for numerical approximation to the solution of the stochastic differential equation. This important issue was clarified by the work of McShane, Stratonovich, and Wong-Zakai.

In 1957, J. Kurzweil defined a modification of the Riemann integral that turned out to be more general than the Lebesgue integral. McShane's last book, *Unified Integration*, published in 1983, develops in a similar

vein a theory of integrals with applications to physics, differential equations, and probability.

During the 1950s and 1960s, McShane took a serious interest in efforts then under way to revitalize undergraduate mathematics in the United States. The MAA's Committee on the Undergraduate Program in Mathematics was established during his term as MAA President, and ever since then has been a leader in these endeavors. In 1964 he received the MAA's Annual Award for Distinguished Service to Mathematics.

Although AMS and MAA were the two organizations that benefited administratively from McShane's services as President, his research efforts were also of great interest to members of the Society for Industrial and Applied Mathematics. The September 1989 issue of SIAM's *Journal on Control and Optimization* is dedicated to McShane.

McShane's strong sense of fairness was exhibited in many ways. For instance, as an editorial board member he went out of his way to see that papers by young authors were refereed fairly and helpfully. He was extremely popular with the graduate students at the University of Virginia because of his clear lectures, his amusing anecdotes, and his willingness to think about their problems. During the 1940s and early 1950s, the university did not provide office space for graduate students, so McShane made his own office available as a common room where the graduate students could do their work and meet to discuss problems of common interest. His visits to the office were often accompanied by the introduction of a new mathematical problem or by his own contribution to a problem already under discussion. (One student, having made some progress on a problem but finding himself unable to solve it completely, intoned "Oh, for the brain of McShane!") Not only McShane himself, but his wife Virginia and the McShane children were extremely helpful and hospitable to the graduate students. They contributed greatly to fostering a sense of mathematical camaraderie at the University of Virginia.

A popular mathematical joke claims that mathematical talent passes from the father to the son-in-law. It is true that the McShanes' sons-in-law, H. N. Ward at the University of Virginia and R. B. Warfield at the University of Washington, are both research mathematicians. However, the McShanes' daughters, Jennifer Ward and Ginger Warfield, are also mathematicians, and Ginger is a member of the UW faculty. Some of the grandchildren have also exhibited exceptional mathematical talent.

Both mathematical research and the mathematics community have been enriched by McShane's contributions and his many years of dedicated service to our profession.

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