OBITUARY

Saunders Mac Lane (1909–2005)

Outstanding mathematician and mentor who invented category theory.

Saunders Mac Lane, who died on 14 April, was one of the few mathematicians to create a major new concept that has had a lasting effect on the subject. In 1945, he and Sammy Eilenberg introduced the basic ideas of category theory, often described as a language of mathematics that allows the description of transformations from one area of the subject into another by distilling their common properties. More specifically, one can look at common properties of mathematical objects such as algebraic structures (groups, fields or rings) or topological spaces by studying structure-preserving mappings — ‘morphisms’ — between such objects. For example, in the case of vector spaces as mathematical objects, the structure-preserving mappings are the linear transformations, and one can study the ‘category’ of vector spaces using linear mappings as the morphisms between objects of the category. Concentrating on common properties of these structures by stripping away the non-essential aspects of a problem clears the path to new results.

Mac Lane was born in Norwich, Connecticut, and studied at Yale University and the University of Chicago, where he obtained a master’s degree in 1931. After doctoral studies at the University of Göttingen in Germany, and appointments first as an assistant and then as a full professor at Harvard University, he returned to the University of Chicago in 1947. He remained there for the rest of his career, being appointed emeritus professor in 1982.

Perhaps responding to some early comments on category theory, Mac Lane wrote in his autobiography: “At the time, we sometimes called our subject ‘general abstract nonsense’. We didn’t really mean the nonsense part, and we were proud of its generality.” Later, Mac Lane wrote *Categories for the Working Mathematician*, the title of which reflects his ability to convey humorously a serious intention — in this case, to make an abstract idea relevant.

Mac Lane’s innovative contributions to mathematics had two roots. One was his interest in what he called ‘universal knowledge’, which he recognized as a student at Yale. With a wry awareness of the problems this posed, he later wrote: “I believed that a proper academic ought to know everything, but of course, I never did succeed in mastering universality, nor do I know exactly what this might have meant.” The other root was his firm belief that mathematics has to be developed from the specific to the general

and that abstraction is a tool, not a goal. This belief is reflected in the books that he wrote. *A Survey of Modern Algebra*, written 50 years ago with his co-instructor at Harvard, Garrett Birkhoff, is still used as a text; and his classic monograph, *Homology*, in which every general concept is presented starting from a specific mathematical situation, still serves as an introduction and reference to that subject.

Mac Lane’s impact on the mathematical community went beyond his contributions as a researcher. According to the online ‘Mathematics Genealogy Project’, he had 39 students and 1,028 ‘descendants’. He recognized talent and let it flourish with modest interference. Among his protégés were Irving Kaplansky, his first PhD student at Harvard, who later headed the Mathematical Sciences Research Institute at the University of California, Berkeley; and John Thompson, winner in 1970 of the highest mathematical honour, the Fields medal, for his work on the so-called ‘odd-order’ problem, which solved the Burnside conjecture that every finite simple group of non-prime order must have even order.

Recalling his work with Thompson, Mac Lane wrote: “By the end of the second quarter, in which I had tended to emphasize infinite groups, I had essentially come to the end of my knowledge on group theory. Thompson, who was in the course, came to me to say that he wished to write a thesis on group theory. I encouraged him, but did not trouble to say that my own knowledge of the subject was somewhat limited. But not to worry — I arranged for eminent theorists, such as Richard Brauer, Reinhold Baer, and Marshall Hall, to visit Chicago. Each Saturday morning, I listened to Thompson tell me what he had been up to with groups; the subject fitted his interest, and he chose his own problems.”

This spirit of guidance and selfless encouragement probably grew out of Mac Lane’s time in Göttingen, then the Mecca of mathematics, in the early 1930s, where he became immersed in an atmosphere of intellectual challenge and excitement that formed his views. It was there that he received his PhD with a thesis on “Abbreviated proofs in logic calculus”. Following ideas from Alfred North Whitehead and Bertrand Russell, he worked on formalizing mathematical proof. The subject did not impress his advisers Hermann Weyl and Paul Bernays, and in Mac Lane’s own words: “My thesis did not attract any following, nor did it have any influence on subsequent studies of mechanized proof.”

In his later career, Mac Lane took his responsibilities to the wider scientific community very seriously, always devoting his full energies to the task at hand. He was elected to the National Academy of Sciences in 1949, and served as vice-president of the academy and of the American Philosophical Society, and as president of the American Mathematical Society. During his presidency of the Mathematical Association of America in the 1950s, he began the association’s first efforts to improve the teaching of modern mathematics. He was also a member of the National Science Board (1974–80), which provided science policy advice to the US government. In 1976, he led a delegation of mathematicians to the People’s Republic of China to examine the conditions affecting the development of mathematics there. In 1989, he received the highest US award for scientific achievement, the National Medal of Science.

During the past few years, Mac Lane was engaged in writing his autobiography, and I have been privileged to be a part of that process. In the book, he wanted to convey to a new generation of mathematicians the joy of the creative process and the excitement that he experienced in being part of history. ■

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