Louis Nirenberg

Louis Nirenberg has had one of the longest, most feted – and most sociable – careers in mathematics. In more than half a century of research he has transformed the field of partial differential equations, while his generosity, gift for exposition and modest charm have made him an inspirational figure to his many collaborators, students and colleagues.

Louis Nirenberg was born in Hamilton, Canada, in 1925 and grew up in Montreal, where his father was a Hebrew teacher. His first interest in mathematics came from his Hebrew tutor, who introduced him to mathematical puzzles. He studied mathematics and physics at McGill University, Montreal, avoiding the draft during World War II thanks to Canada's policy of exempting science students, and graduated in 1945.

The summer after graduating Nirenberg worked at the National Research Council of Canada on atomic bomb research. One of the physicists there was Ernest Courant, the elder son of New York University professor Richard Courant, who was building up NYU's mathematics department. Nirenberg asked Ernest's wife, who was a friend of his from Montreal, to ask her father-in-law for advice about where to do graduate studies in theoretical physics. Richard Courant responded that he should study mathematics at his department at NYU.

Nirenberg went for an interview in New York and was offered an assistantship. He got his masters in 1947, and embarked on a Ph.D. under James J. Stoker, who

suggested to him an open problem in geometry that had been stated by Hermann Weyl three decades previously: can you embed isometrically a two-dimensional sphere with positive curvature into three Euclidean dimensions as a convex surface? In order to prove that you can, he reduced the problem to one about nonlinear partial differential equations. The PDEs in question were elliptic, a class of equations that have many applications in science. Nirenberg's subsequent work has been largely concerned with elliptic PDEs, and over the following decades he developed many important theorems about them.

Nirenberg never left mathematics, nor indeed NYU. Once he got his Ph.D. in 1949 he stayed on as a research assistant. He was a member of the faculty – known since 1965 as the Courant Institute of Mathematical Sciences – his entire career, becoming a full professor in 1957. Between 1970 and 1972 he was the Institute's director, and he retired in 1999. He still lives in Manhattan.

In the 1950s the Courant Institute was rapidly becoming one of the US's top research centres for applied mathematics, on a par with more established universities, although it only had a small number of staff. Nirenberg was one of its leading lights, and the mathematician who did the most work in providing a theoretical grounding for modern analysis of PDEs.

Nirenberg has always preferred to work in collaboration, with more than 90 per cent of his papers written jointly (none, however, with John F. Nash Jr., whom

Nirenberg got to know well during the academic year 1956–57). Important papers include results with his student August Newlander on complex structures in 1957, with Shmuel Agmon and Avron Douglis on regularity theory for elliptic equations in 1959, with Fritz John introducing the function space of functions with bounded mean oscillation in 1961, with David Kinderlehrer and Joel Spruck developing regularity theory for free boundary problems in 1978 and with Basilis Gidas and Wei Ming Ni about the symmetries of solutions of PDEs in 1979. A paper on solutions to the Navier–Stokes equations, co-authored with Luis A. Caffarelli and Robert V. Kohn, won the American Mathematical Society's 2014 Steele Prize for Seminal Contribution to Research.

As well as demonstrating vision and leadership, Nirenberg has shown remarkable energy and stamina, continuing to produce ground-breaking work in different areas of PDEs until his 70s. He is known not only for his technical mastery but also for his taste, instinctively knowing which are the problems worth spending time on. He has supervised more than forty Ph.D. students and is an excellent lecturer and writer.

Ever since he spent the academic year 1951–52 in Zürich, Switzerland, and Göttingen, Germany, Nirenberg has been a well-travelled and active member of the international mathematical community. On his first professional visit to Italy, in 1954 to attend a conference on PDEs, he immediately felt surrounded by friends. "That's the thing I try to get across to people who don't know anything about mathematics, what fun it is!" he has said. "One of the wonders of mathematics is you go somewhere in the world and you meet other mathematicians and it's like one big family. This large family is a wonderful joy." He was present at the first big US–Soviet joint maths conference in Novosibirsk in 1963, and in the 1970s was one of the first US mathematicians to visit China.

Nirenberg has gathered a significant number of prestigious accolades. He won the American Mathematical Society's Bôcher Memorial Prize in 1959. In 1969 he was elected to the National Academy of Sciences. He won the inaugural Crafoord Prize, awarded by the Royal Swedish Academy of Science and given in areas not covered by the Nobel Prizes, in 1982 (together with Vladimir Arnold). He received the Steele Prize for Lifetime Achievement from the American Mathematical Society in 1994, and he received the National Medal of Science in 1995, the highest honour in the US for contributions to science. In 2010 he was awarded the first Chern Medal for lifetime achievement by the International Mathematical Union and the Chern Medal Foundation.