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Louis Nirenberg, 'One of the Great Mathematicians,' Dies at 94

Winner of the math world's equivalent of a Nobel, he puzzled out equations describing the vibrating of strings, the flow of heat and the movement of water.

By Kenneth Chang

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Louis Nirenberg, a mathematician who explored the complexities of equations commonly used by physicists and engineers, and who shared the 2015 Abel Prize, a top math award modeled after the Nobels, died on Sunday in Manhattan. He was 94.

His death, at NewYork-Presbyterian Hospital/Columbia University Medical Center, was announced by New York University, where Dr. Nirenberg spent his entire academic career.

"It's really hard to overstate how important" Dr. Nirenberg was, Walter A. Strauss, an emeritus professor of mathematics and applied mathematics at Brown University, said in a phone interview. "He was one of the great mathematicians of the 20th century."

Dr. Nirenberg's work focused on partial differential equations, which describe the vibrating of strings and drums, the flow of heat, the movement of water and many other phenomena.

These types of problems "are hard, they are deep, they are very, very interesting," said Charles L. Fefferman, a Princeton University mathematician.

The equations can have an infinite number of solutions, and few of the solutions can be written down exactly. Instead, mathematicians try to pin down the general behavior of the solutions and try to prove what is possible and what is not.

For example, the Navier-Stokes equations (named after the French physicist Claude-Louis Navier and the Irish-born mathematician George Gabriel Stokes) describe the flow of incompressible liquids like water. An unsolved question is whether a flow that starts smooth always stays smooth or whether the velocity of the fluid could, at least mathematically, become infinite in some regions.

Dr. Nirenberg, working with two other mathematicians, was not able to come up with a conclusive answer, but they made major progress by showing that such regions, if they exist, must be exceedingly small.

Among others, Dr. Nirenberg also worked on equations used to describe elasticity and strain, the propagation of combusting flames, the possible shapes of geometric surfaces and the movement of water waves.

"Louie in his day came up with some very fundamental ideas simply about how functions behave," Dr. Fefferman said.

Dr. Nirenberg, in wheelchair, receiving the 2015 Abel Prize in mathematics from King Harald V of Norway in Oslo. Dr. Nirenberg shared the award with John F. Nash Jr., at left. (Dr. Nash died four days later in a car crash.) Scanpix/The Abel Prize

In 2015, Dr. Nirenberg and John F. Nash Jr., the mathematician whose life was depicted in the movie "A Beautiful Mind," shared the Abel Prize for "striking and seminal contributions" to the field of partial differential equations. The prize is awarded by the Norwegian Academy of Science and Letters. (Dr. Nash and his wife were killed in a car crash in New Jersey on arriving from Norway four days after receiving the award.)

"Far from being confined to the solutions of the problems for which they were devised," the Abel committee wrote, "the results proved by Nash and Nirenberg have become very useful tools and have found tremendous applications in further contexts."

Louis Nirenberg was born in Hamilton, Ontario, on Feb. 28, 1925. His parents were immigrants from Ukraine, and his father taught Hebrew.

After finishing his bachelor's degree in physics and mathematics at McGill University in Montreal in 1945, Dr. Nirenberg worked for a summer at the National Research Council of Canada, where he met Ernest Courant, the son of the mathematician Richard Courant, a founder of what is now known as the Courant Institute of Mathematical Sciences at New York University.

Asked for advice on pursuing a career in theoretical physics, the elder Dr. Courant persuaded him to go to N.Y.U., to study math first. He stayed in math. After finishing a master's degree at N.Y.U. in 1947, he embarked on doctoral research on an unsolved geometry problem that had been posed three decades earlier by Hermann Weyl, a prominent German mathematician and physicist.

"It's very unusual to assign a well-known open problem as a dissertation topic," said Peter D. Lax, a longtime colleague of Dr. Nirenberg's at Courant and also an Abel Prize winner. "And it's even more unusual for the candidate to solve it, but Louie did."

Dr. Nirenberg finished his doctorate in 1949 and stayed at N.Y.U. as a research assistant. He became a full professor in 1957, and from 1970 to 1972 he was the institute's director.

His honors include the Steele Prize for Lifetime Achievement from the American Mathematical Society in 1994 and the National Medal of Science in 1995. In 2010 he was awarded the first Chern Medal for lifetime achievement by the International Mathematical Union. He was a member of the National Academy of Sciences.

Dr. Nirenberg in 2016. "For a while, letters of recommendation from him were discounted," a colleague said, "because he was such a nice guy that he didn't want to say anything bad about anybody."
via The Abel Prize

Dr. Nirenberg is survived by his companion, Nanette Aubin; his sister, Deborah Goldberger; a daughter, Lisa Macbride; a son, Marc; and two grandchildren. His wife, Susan Nirenberg, died in 1998.

"He was very, very, very nice guy," Dr. Fefferman said. "For a while, letters of recommendation from him were discounted, because he was such a nice guy that he didn't want to say anything bad about anybody."

Dr. Nirenberg struggled with cancer and other maladies in recent years, but, as a dedicated gourmand, he insisted on continuing to go out to restaurants.

"Even though he was in a wheelchair, he wanted to go out," said his colleague Jalal M.I. Shatah, who arrived at the Courant Institute as a postdoctoral researcher in the 1980s.

Dr. Shatah visited Dr. Nirenberg for the last time two weeks ago. "We were making plans to go to the Museum of Modern Art," he said, "and we were making plans for his 95th birthday."

In an interview published in 2002 in the Notices of the American Mathematical Society, Dr. Nirenberg talked of how he chose what mathematical questions to pursue. He recalled a conversation in which he told a young mathematician that he would sometimes read a paper and, not liking the proof it presented, start thinking of other approaches.

"What about your case?" Dr. Nirenberg asked the young mathematician.

"I never found a proof I didn't like," the colleague responded.

Dr. Nirenberg described his reaction: "I thought, 'This is hopeless!'"

Kenneth Chang has been at The Times since 2000, writing about physics, geology, chemistry, and the planets. Before becoming a science writer, he was a graduate student whose research involved the control of chaos. @kchangnyt

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