JOSEPH F. TRAUB

1932–2015

Elected in 1985

"For initiating optimal iteration theory, for creating significant new algorithms that solve diverse problems, and for educational leadership in computing."

SUBMITTED BY THE NAE HOME SECRETARY

JOSEPH FREDERICK TRAUB, a pioneering computer scientist and founder of the Computer Science Department at Columbia University, died August 24, 2015, in Santa Fe, New Mexico. He was 83. Most recently the Edwin Howard Armstrong Professor of Computer Science, he was an early pioneer in computer science years before the discipline existed, and he did a lot to shape the field.

He was born June 24, 1932, in Karlsruhe, Germany, the only child of Leo Traub, a banker, and the former Mimi Nussbaum. After the Nazis seized the bank in 1938 the family fled, arriving in New York in 1939. Joe attended Bronx High School of Science, where he was captain of the chess team, and City College of New York, where he earned degrees in math and physics (1954) before entering Columbia University intent on a PhD in theoretical physics. That plan changed when he discovered computers, not at Columbia—which had no computers—but at the IBM Watson lab then located in Casa Hispanica, just off campus at 612 W. 116th Street. He was hired there as a fellow, with the perk of unlimited computer time.

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In 1959 he earned his PhD under the Committee of Applied Mathematics at Columbia. After his first choice to work on a chess problem was rejected, he proposed instead a quantum problem that involved 6 months of programing to calculate the ground energy state of a helium atom, correct to four decimal places.

After graduating, Traub went to work at Bell Labs, then in its "golden 60s" when researchers were given wide latitude to choose projects and conduct pure research. It was there that a colleague one day walked into his office with a problem: Could Traub find the zero of a function that involved an integral? Mulling over the problem led to two observations: one, it was expensive to compute the function; and two, there were lots of ways of solving it. His thinking about how to select the best possible algorithm led to his 1964 monograph *Iterative Methods for the Solution of Equations* (Prentice-Hall). It was the start of his career, with many publications to come.

Traub was most known for his work on optimal algorithms and computational complexity applied to continuous scientific problems. In collaboration with Henryk Woźniakowski, he created the field of information-based complexity, where the goal is to understand the cost of solving problems when information is partial, contaminated, or priced. Applications for information-based complexity are diverse and include differential and integral equations, continuous optimization, path integrals, high-dimensional integration and approximation, and low-discrepancy sequences.

Understanding the role of information about a problem was a unifying theme of Traub's contributions to a number of diverse areas of computing. Often collaborating with others, he created significant new algorithms, including the Jenkins-Traub algorithm for polynomial zeros, the Kung-Traub algorithm for comparing the expansion of an algebraic function, and the Shaw-Traub algorithm to increase computational speed. He authored or edited 10 monographs and some 120 papers in computer science, mathematics, physics, computational finance, and quantum computing.

Apart from his scientific research, he had a major role in

building and leading organizations that promoted computer science. In 1971, at the age of 38, he was appointed chair of the Computer Science Department at Carnegie Mellon University, overseeing its expansion from fewer than 10 professors to 50 and making it one of the strongest computer science departments in the country. Based on his achievements there, Columbia University in 1979 invited him to found its Computer Science Department. He accepted the offer and chose to locate computer science in the engineering school, which at the time had a single computer, only three tenured faculty members teaching computer science—and a huge demand for computer classes.

After securing a $600,000 gift from IBM (which later provided another $4 million), he was able to add faculty and attract top students. Within a year the department was awarding bachelor's and master's degrees as well as PhDs. As chair of the department (until 1989), he oversaw the 1982 construction of the Computer Science Building, working closely with architects to come up with a final design that would later win awards.

Traub liked building things from scratch. In 1985 he was the founding editor in chief of the *Journal of Complexity* (a position he held at the time of his death). He was invited to serve as the founding chair (1986–92) of the Computer Science and Technology Board (now the Computer Science and Telecommunications Board) of the National Research Council, and was reappointed chair from 2005 to 2009.

His awards and honors are many and include election to the National Academy of Engineering in 1985, the 1991 Emanuel R. Piore Medal from IEEE "For pioneering research in algorithm complexity, iteration theory and parallelism, and for leadership in computing education," and the 1992 Distinguished Service Award from the Computer Research Association. He was a fellow of the Association for Computing Machinery, American Association for the Advancement of Science, Society for Industrial and Applied Mathematics, and New York Academy of Sciences. He was selected by the Accademia Nazionale dei Lincei in Rome to present the 1993 Lezioni Lincee, a cycle of

six lectures. And in 1999 he received the New York Mayor's Award for Excellence in Science and Technology, presented by Mayor Rudy Giuliani.

In 2012, his 80th birthday was commemorated by a symposium at Columbia University to celebrate his pioneering research and other contributions to computer science.

Traub always described himself as lucky: Lucky in his early life that his parents were able to flee Nazi Germany in 1939 and settle in New York City; that he had a knack for math and problem solving just when those skills were needed; that a fellow student's prescient suggestion led him to visit IBM's Watson Laboratories where he first encountered computers. And lucky to be among the first to enter a new, unexplored field when he had the ambition to make new discoveries and a hunger to do something significant. In an interview recalling his life, he said "I'm almost moved to tears but who could have expected such a wonderful life and such a wonderful career."

His luck extended to his personal life. He was married to Pamela McCorduck, a noted author who also taught science writing at Columbia.

He enjoyed skiing, tennis, hiking, travel, and good food, and regularly spent his summers in Santa Fe, where he was an external professor at the Santa Fe Institute and played a variety of roles over the years, often organizing workshops to bring together those working in science and math.

He is survived by Pamela; daughters Claudia Traub-Cooper and Hillary Spector, from his first marriage, to Susanne Traub; and four grandchildren.