# Princeton University

Honors Faculty Members
Receiving Emeritus Status

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The biographical sketches were written by colleagues in the departments of those honored, except where noted.



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*Faculty Members Receiving Emeritus Status*

# Edward Nelson

Edward Nelson is a mathematician whose work has again and again opened new vistas on a remarkable range of subjects. He began his career as a probabilist and analyst, and he is currently working on logic and foundations. In between, Ed has done fundamental work on mathematical physics and, in an earlier phase of his work on logic, he developed internal set theory, a radically different approach to non-standard analysis. His work continues to evolve and retirement will bring no change to this.

Ed's work is widely recognized for the vistas it has opened: in 1995, he won the Steele Prize for research of seminal importance, recognizing his contributions to constructive quantum field theory in the late '60s and early '70s. He has been a member of the American Academy of Arts and Sciences since 1975 and the National Academy of Sciences since 1997.

Ed was born May 4, 1932, in Decatur, Georgia, and spent his early childhood, through first grade, in Rome, Italy, where his father worked for the Italian YMCA. He returned to the United States at the advent of the Second World War and later attended high school at the Bronx High School of Science, and then the Liceo Scientifico Giovanni Verga in Rome.

Ed wrote his dissertation at the University of Chicago, where he was a student of Irving Segal. His initial research focus was analysis and probability. His graduate studies took place at the time of the Korean War, and Ed, whose deep religious beliefs are fundamental to his nature, was a conscientious objector. He worked for two years at Methodist Hospitals in Gary, Indiana.

His first mathematical appointment was at the Institute for Advanced Study as an National Science Foundation postdoctoral fellow. Three years later, he joined the Princeton faculty as an assistant professor. He was promoted to associate professor in 1962, and then

to full professor in 1964. Though Segal was very active in developing mathematics for the purpose of solving fundamental physical problems, Ed did not pursue this path at Chicago, but when he got to Princeton, he attended several physics courses of Arthur Wightman and began to closely study papers of Richard Feynman and Kurt Symanzik. Ed saw clearly how to use probabilistic ideas to construct relativistic quantum fields—a problem that had eluded great efforts by other researchers. His papers began the "Euclidean revolution" and had a transformative effect on mathematical physics.

However, he soon left this field, which had quickly attracted a large and active following, and began developing his next radical idea, internal set theory, and beginning his move into logic. His starting point in this was actually drawn from his work in constructive field theory, and the beautiful thesis of his student Greg Lawler used this approach to nonstandard analysis to solve a probabilistic problem of interest in field theory. Ed gives an interesting description of the process by which he directed this thesis: he would provide Greg a conjecture, and Greg would return with a counter-example. He would then tell Greg that such-and-such could not be true, and Greg would return with a proof. The result was a beautiful thesis done in what Ed describes as "jig time."

Ed served for a number of years as director of graduate studies, reflecting his deep commitment to graduate education. He polished four of his graduate courses into books published in the *Mathematical Notes* series by Princeton University Press. The books are truly marvelous but cannot capture the verve and originality of Ed's teaching. One of the books, *Tensor Analysis*, based on a course he gave on differential geometry, includes a theorem that says—literally—that it is possible to park in any parking space just slightly longer than your car if you use enough iterations of the parallel parking maneuver. To do this, one would like to be able to "slide" sideways into the parking place. Ed modeled the configuration space of the car as a certain four-dimensional manifold and studied the interactions of four vector fields on this manifold, showing how "steer" and "drive" could be used to produce "wriggle" and then "slide." It is enormously fun reading, for

mathematicians anyhow, but it had a serious purpose as an introduction to the subject of "holonomy." As delightful as the version in the book is, the version in class was illustrated with a toy car Ed purchased at the Woolworth's, then on Nassau Street, for this purpose. He got a "sitting ovation" at the end of his lecture!

For Ed, however, the best and most rewarding part of teaching has been the direction of Ph.D. theses, which he did with great success: many of his students now enjoy successful and careers in an unusually wide range of fields of research. No doubt the new mathematics he will produce as professor emeritus will continue to inspire researchers in an ever-widening range of research fields.