Eugene Barry Fabes (1937–1997)

Carlos E. Kenig and Daniel W. Stroock

Editor's Note: *Eugene Barry Fabes was born in Detroit on February 6, 1937, obtained a Ph.D. from the University of Chicago in 1965, spent two years at Rice University, and then spent the rest of his professional career at the University of Minnesota. He was a student of Antoni Zygmund, wrote more than seventy-five papers in real and harmonic analysis, and was a longtime collaborator of Nestor Rivière. His death on May 18, 1997, was premature and unexpected.*

On May 18, 1997, Eugene B. Fabes died in Minneapolis of a heart attack that he had suffered a couple of days before. At the time of his death he was sixty years old. Everyone, even someone too young to sense mortality, knows that sixty is not very old.

In many ways Gene was an archetypical representative of his generation of Americans who went into mathematics in the 1960s. He grew up in Kansas City, majored in mathematics at Harvard, married Esther (his hometown girl), and headed into the family suitcase manufacturing business. Going into the family business meant going down to Atlanta, Georgia, in 1959. After a year of frustration with the family business and a culture of racial discrimination, Gene applied to graduate schools in mathematics. The following winter, Gene and Esther, together with their five-month-old child, decamped for Chicago. There she and Gene spent the next four and a half years of their lives: Gene studying mathematics under Antoni Zygmund, while Esther tended the family, which, by the time they left Chicago, included a second child and would eventually include a third.

What Gene's move to Chicago represents to a person depends heavily on the era in which that person grew up. To a child of the Great Depression the decision to abandon a secure job devoid of intellectual excitement in favor of an insecure existence filled with intellectual stimulation is an act of either grand heroism or equally grand stupidity. Unfortunately, in view of the job prospects, someone either applying to or emerging from graduate school in 1998 is increasingly likely to share this assessment. In fact, with increasing frequency we watch our own students follow Gene's steps in the opposite direction: that is, go to graduate school, get a Ph.D. in mathematics, and proceed to the "quant" department in an investment house. Thus, Gene's experience serves as a stark reminder of just how incredibly lucky Gene and his generation of Americans were.

According to Esther, Gene knew in high school that he loved mathematics. Presumably that is why he chose to major in mathematics at college. Be that as it may, Gene and his family expected that after graduation Gene would revert to mainstream behavior: go to work in the family business. None of this is so remarkable. On the contrary, the world has been and still is full of people who abandon their academic aspirations in favor of more practical goals. Nonetheless, even though many of these people experience an occasional twinge of regret about their choice, nearly none of them does what Gene did.

The fact that Gene felt that he could make such a decision is a tribute to his personal courage. Esther says that Gene's expectations at the time of his decision to leave business and enter graduate school were modest: he wanted out of the family business, he loved mathematics, and he was ready to take his chances, even if he had not spent a lot

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of time calculating what they might be. As it turned out, his chances were far better than he or anyone else had a right to predict, and this fact is a tribute to both Gene's native talent and the golden era of opportunity in which he and his generation of Americans lived.

First, the mathematics department that Gene entered at the University of Chicago was superb. Its faculty boasted several of the finest mathematicians of the time, and the Chicago graduate program had already produced much of the talent on which American mathematics would rely in the coming decades. Second, Gene soon found a niche for himself in the wonderful group attending the "Calderón-Zygmund Seminar", and it was there that Gene met Nestor Rivière, the first name to appear on what was to become a long list of collaborators. Gene chose Zygmund as his thesis advisor. Whether his selection reflects prescience or just dumb luck is hard to say, but Zygmund turned out to be an ideal thesis advisor for Gene. In fact, Zygmund turned out to be an ideal thesis advisor for a surprising number and variety of students. In particular, he possessed an uncanny knack for wedding the right student with the right problem, and Gene was no exception.

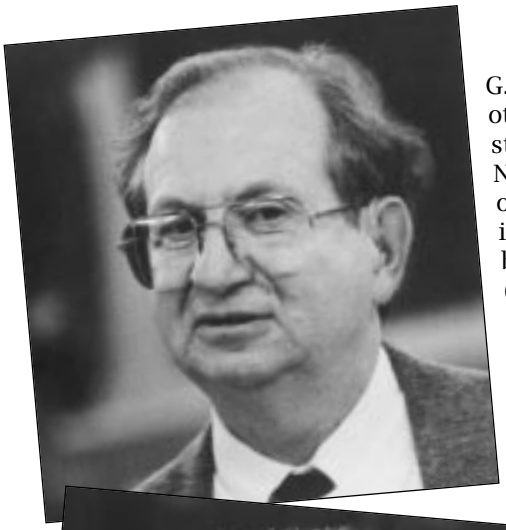
Toward the end of Gene's graduate career he and Nestor started to collaborate on a program that was to consume most of their energies for the next decade. Their collaboration made a fine spectator sport. Borrowing (and abusing) Isaiah Berlin's terminology, Gene played "hedgehog" to Nestor's "fox". Nestor was given to (occasionally ingenious) flights of fancy that would leave Gene depressed and unhappy. But Gene's revenge would come the next day, when, after a night of hard and meticulous calculation, he would confront Nestor with the cold facts. In this way they produced a string of papers in which they took mutual and justifiable pride. In fact, many of the papers in this series have become "classics". With hindsight one realizes that Gene's collaboration with Nestor also set the pattern that Gene would follow throughout his career. Namely, Gene never had any truck with the old adage warning against the evils of mixing business with pleasure. For Gene mathematics was both an intellectual stimulant and a social lubricant, and because he thoroughly enjoyed both these aspects, he saw no reason to separate them.

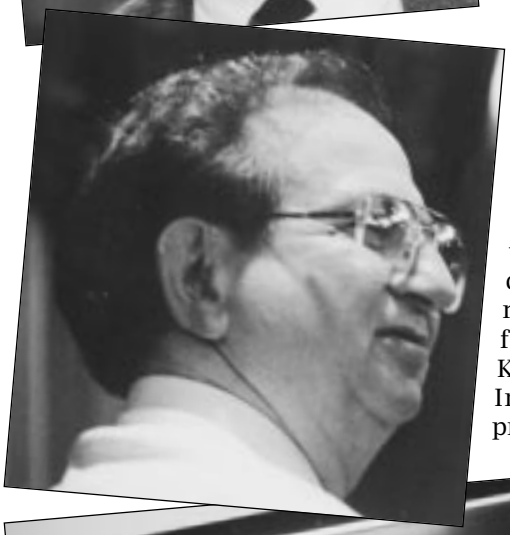
From the very beginning Gene's mathematical work centered on the development and application of real variable methods in the study of partial differential equations. This was to become Gene's lifelong scientific direction, and he was one of the leading researchers in this area. His influence continues to be strongly felt through several sources: his more than seventy-five articles, his twenty-one Ph.D. students (some of whom have become leading analysts), the many postdoctoral fellows who had the good fortune to work with him, his more than forty collaborators, and the many colleagues whom he inspired. All of these reflect Gene's remarkable vision, which gave him the knack to detect rich areas for research before they had been thoroughly mined by others. Once he had spotted such an area, he would, by dint of sheer determination and hard calculations, work out some particular case or partial result. These calculations would get the ball rolling. Next, Gene, in collaboration with students or colleagues, would seek the hidden structure and depth that underlay his original calculations. When, as they often did, these efforts met with success, new horizons would be opened.

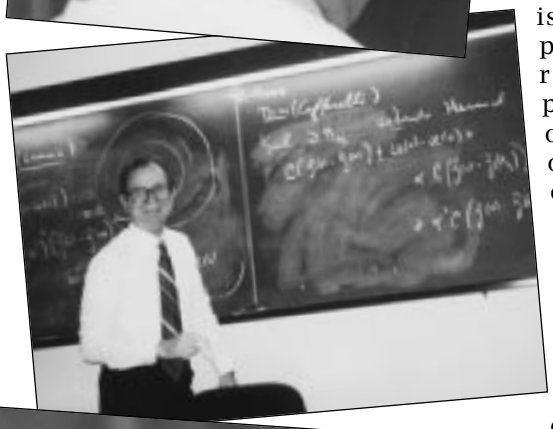
Photograph courtesy of Mrs. Eugene Fabes.

Eugene Fabes

During his career Gene repeated the pattern just outlined many times. Excellent examples are provided by his extension jointly with Rivière of the Calderon-Zygmund Theorem to allow for kernels having mixed degrees of homogeneity, his initiation of the study of singular integrals along curves, his pioneering study of the initial Dirichlet problem for parabolic equations (under optimal regularity conditions on the coefficients), his detailed study (with M. Jodeit and J. Lewis) of the Dirichlet problem for Laplace's equation (on sectors and quadrants), and his later study of the same problem on C^1 domains (with Jodeit and Rivière). These articles led to the development of the theory of boundary value problems on Lipschitz domains, work to which many people eventually contributed: Gene himself, A. P. Calderón, B. Dahlberg, D. Jerison, J. Pipher, Gene's student







Photographs courtesy of the School of Mathematics, University of Minnesota.

G. Verchota, and many others. More recently his study (with his student N. Garofalo and S. Salsa) of "backward Harnack inequalities" for parabolic equations led (partly in collaboration with Gene) to outstanding developments in the work of M. Safonov and his student Y. Yuan. Finally, in work with his Ph.D. students Cerutti and Escauriaza, Gene defined a "good solution" to nondivergence form equations by regularizing the coefficients and passing to the limit on a subsequence, a procedure made possible by the famous estimates of Krylov and Safonov. In this work they proved that the solution thus obtained is unique (independently of the regularization) provided the set of discontinuities of the coefficients is very small. Such results are very delicate, especially in view of Nadirashvili's recent example that, in the case of general discontinuities, uniqueness of the "good solution" may fail.

Gene was a man who generated enormous excitement for mathematical ideas, and he found great joy in communicating both the ideas and the excitement to others. As a consequence he was a wonderful teacher, at all levels and all over the world. In particular he and Italy had a mutual admiration pact that was a joy to behold. The summer before Gene died his grateful Italian students and postdoctoral visitors hosted a conference under the title "Twenty Years of Eugene Fabes at Cortona".

In spite of his commitment to teaching and research, Gene never shirked his administrative responsibilities. At the University of Minnesota's School of Mathematics he served at various times as director of graduate studies, associate head, head, and was at the time of his death deputy director of the Geometry Center.

Ph.D. Students of Eugene Fabes:
Max Jodeit (1967)
Julio Bouillet (1972)
Steve Sroka (1975)
Angel Gutierrez (1979)
Patricia Bauman (1982)
Gregory Verchota (1982)
Russell Brown (1987)
Nicola Garofalo (1987)
Gail Nelson (1988)
Wilfredo Urbina (1988)
Wenjie Gao (1988)
Maria Cristina Cerutti (1990)
Luis Escauriaza Zubiria (1990)
Santiago Marin-Malave (1990)
Bartolome Barcelo (1991)
Mark Patrick Sand (1991)
Jin Keun Seo (1991)
Roberto Scotto (1993)
Raymond Spencer (1994)
Dorina Mitrea (1996)
Osvaldo Mendez (1997)

In summary, the mathematics community was fortunate indeed that Gene made the decision he did when he left Atlanta those many years ago. For those of us who knew him personally, Gene's death is a tragedy. Even for those who did not know him, it is sad to recognize the passing of the era in which his decision to choose mathematics over suitcases seemed reasonable.