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MIKLÓS CSÖRGŐ

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*Enigmas of chance. An autobiography*, by Mark Kac, Harper and Row, New York, 1985, xxvii + 163 pp., \$18.95. ISBN 0-06-015433-0

This wonderfully lively and colorful autobiography tells the story of a man who as a teen-ager fell under the spell of mathematics, never gave it up, and grew to become a brilliant, creative mathematician.

Born in 1914, literally with the opening gunfire of World War I, in Krzemieniec, a town in czarist Russia, as a son of a middle-class Jewish family, Mark Kac was raised in an intellectual tradition. His father held a Ph.D. degree in philosophy from Leipzig and an advanced degree from the University of Moscow, and when needed earned an income by tutoring in mathematics, classical languages, and history.

In 1925, Mark was admitted to the Lycée of Krzemieniec, a school with a long tradition and ambitious standards. In 1930, at the age of sixteen, he achieved his first success in mathematics: he found a new derivation of Cardano's solution of cubic equations and showed it to his mathematics teacher, who sent it on to a journal. By a chain of circumstances the paper

came to the attention of an influential official in the Polish Ministry of Education; he had it refereed and it was published.

After graduating from the Lycée in 1931, Kac enrolled at the University of Lwów. The description of the mathematical activities at that university alone makes this book worth reading. There was a period of glory that began at the end of World War I, about 1918, and ended with the German invasion in 1940. Active in Lwów during that period were Z. Janiszewski, W. Sierpiński, S. Mazurkiewicz, H. Steinhaus, S. Banach, E. Zyliński, S. Ruziewicz, A. Łomnicki, S. Kaczmarz, M. Stark, J. Schauder, S. Mazur, and many others. Some of them contributed by dedicated, stimulating teaching, some by pioneering research, some were in Lwów permanently, others came and left. All were part of an exciting environment where mathematics was talked about, worked on and enjoyed at all hours and places, in the old convent building that housed the mathematics department and its classrooms and, with even more intensity, in nearby coffeehouses.

Kac was most decisively influenced by Professor Hugo Steinhaus, a many-faceted creative mathematician, helpful and encouraging to his students, a man of integrity and, as born out by the way he acted during and survived the Nazi occupation, of courage and resourcefulness. At Steinhaus' suggestion, Kac started exploring the concept of stochastically independent functions. This topic became the main area of interest for both of them and Kac continued working on it for a long time.

Life during this period in Lwów did not consist exclusively of mathematics. The reader will find thumb-nail sketches of friends, teachers, people around the university—most did not survive the Nazi effort to exterminate the intellectuals in occupied Poland. There is a bittersweet cameo story of a romance that, in an eerie way, is commemorated by a picture in the book *Mathematical snapshots* by Steinhaus. There are episodes and anecdotes that could give rise to a volume of short stories, and that present a lively picture of that exciting, challenging group of people who made mathematics at Lwów at that time so memorable.

Kac received his Ph.D. from the Lwów University in 1937. For about a year afterwards, he worked as an actuary for a life insurance company. He was clear about his very dim prospects in Poland and was also aware of the rapidly deteriorating international situation and the rising threat of Nazi Germany. In 1938, his continued efforts to leave Europe paid off: he received a stipend which enabled him to leave for the United States.

After landing in Hoboken, N. J., in November 1938, Kac found a hospitable place in the mathematics department of Johns Hopkins. From then on things were steadily looking up, except for the dark cloud of fear for his family and friends left in Europe. That uncertainty came to an end in 1945 when, at the conclusion of World War II, the extent of the horror that swept Europe became known and there was no doubt left that his entire family and most other people he had been close to had perished in the holocaust.

Mark was rapidly gaining friends and professional recognition. After Johns Hopkins came his stay at Cornell, where he spent the years 1939-1961, met his wife, raised children, and became a respected member of the community. Two

chapters of the book carry us through that time at Cornell. We hear of his colleagues, of travels, and adventures, and achievements, of his work with the Radiation Laboratory at MIT, and through all of this of his never-ending struggle with mathematics. His publications, only modestly referred to, went on clarifying fundamental concepts of probability theory, extending them to number theory, opening new approaches in theoretical physics.

This is not a book on mathematics, but a life story of a mathematician. There are few places devoted entirely to mathematics, or where even some formulas are displayed. One is in Chapter 3, "The Search for the Meaning of Independence," that in a near-popular manner discusses some work initiated jointly with Steinhaus and then continues to show how justified Henri Poincaré was in saying that the normal probability law is considered "*by mathematicians to be a fact of observations and by observers a theorem of mathematics.*" There is just one formula displayed in an amusing discussion of Ehrenfest's "dog-flea" model, and there are some isolated graphs and formulas scattered elsewhere.

After Cornell came a first exhilarating and later on disappointing affiliation with Rockefeller University (1961–1981). The last five years of his life Kac spent at the University of Southern California.

The charm of *Enigmas of chance* cannot be even hinted at by surveying its contents. There is in it the spirit of a warm human being possessed by driving curiosity, by an urge to understand and clarify. There is an account of going through a stormy period in history, with personal tragedies and times of happiness. And there is the picture of a mathematician who, instead of clinging to mathematics as an abstract game, treated it as a bridge to reality; a mathematician who, as quoted by Gian-Carlo Rota, warned that "*axioms will change with the whims of time, but an application is forever.*" To Kac the problem often was the reason for the theory; he admitted that "*almost everything new in mathematics I learned after getting my doctoral degree has been by being forced to learn it in trying to solve a problem.*"

In the Introduction to his book, Kac expressed the hope to be able to impart to the reader some feeling for the thrill that comes with getting a new idea, as well as for the frustrations and disappointments in the life of a scientist. He did it with charm and grace. He also succeeded in carrying out his other wish: the book gives a moving account of a rich life, and the way it was shaped by family, teachers, collaborators, history, and last but not least, by "*that powerful but capricious lady Chance.*"

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*Derivations, dissipations and group actions on C\*-algebras*, by Ola Bratteli, Lecture Notes in Mathematics, vol. 1229, Springer-Verlag, Berlin, Heidelberg, New York, London, Paris, Tokyo, 1986, vi + 277 pp., \$23.60. ISBN 0-387-17199-1

The study of derivations is one of the early disciplines in operator algebra theory with roots back in the beginnings of the subject (see, e.g., [13]).