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Book Review: *Enigmas of Chance, an Autobiography*

Enigmas of Chance, an Autobiography. Mark Kac. Harper and Row Publishers, New York, 1985, 163 pp.

There are few of us, either in the field of probability or statistical mechanics, who can have failed to be charmed by one or more lectures by Mark Kac. This slim volume, published after Mark's death, speaks to us in the same wise and often humorous voice. Although the Mark I knew was unfailingly cheerful, his early life was marked by the effects of Polish anti-Semitism, and the growing cloud of Nazism on the European scene. Nevertheless, he managed to produce some of the most elegant and fundamental results in probability theory, number theory, and statistical mechanics that have emerged in this century.

Mark's early life was spent in his native Poland, where he studied at the University of Lwow, doing his Ph.D. degree with Hugo Steinhaus, who proved to be a major influence on his approach to mathematics and indeed to life itself. Mark was perceptive enough to see that no matter how great were his mathematical abilities, there would be no place for him in a Poland ridden by anti-Semitism. In 1938, therefore, he emigrated to the United States, leaving behind him a Europe that was fated for the major tragedy of World War II. Sadly, his family was unwilling or unable to leave Poland and perished in the Holocaust. To the end of his life, as far as I know, Mark refused to lecture in Germany because of it.

The United States in 1938 was still in the throes of the Depression, and universities here could offer only temporary positions to this extremely promising yound emigre mathematician. Many departments, in addition, practiced a genteel anti-Semitism that limited the number of Jewish assistants or professors who could be hired. In 1939 Mark was offered an instructorship at Cornell University which eventually developed into a permanent position, at which he remained for approximately twenty years. From 1943 onwards till the end of the Second World War he was associated on a part-time basis with the Radiation Laboratory at MIT

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together with many other eminent scientists. Until that time he was a pure mathematician, but the war work at the Laboratory introduced him to the world of applications, which, for the rest of his life, continued to fascinate him. Together with Arnold Siegert he made fundamental contributions to the theory of noise. Later, at Cornell, he developed the formula that came to be known as the Feynman–Kac formula which basically relates the propagator to the solution of the Schrödinger equation in quantum mechanics, but has come to play a fundamental role in probability theory as well.

Mark's interest in statistical mechanics dated from his acquaintance with George Uhlenbeck, who posed to him the problem of solving Ehrenfest's so-called dog flea model. This proved trivial to someone with Mark's abilities but the paper on it that appeared in the American Mathematical Monthly won the Chauvenet prize for mathematical exposition. His abilities in this line are still remembered by all who have either read his papers of heard him speak. From there he went on to develop the spherical model with Ted Berlin which is a kind of mean field approximation to the Ising model, but which contains the essence of the theory of phase transitions in it.

In 1961, at the urging of George Uhlenbeck, he went on to become a professor at the Rockefeller University which at the time was expanding its fields of research by introducing new departments, including those of Mathematics and Physics. I met Mark casually somewhat earlier, but I spent a year at the University in 1964, and got to know him much better then, spending many a lunchtime being regaled by his seemingly endless fund of stories, some about the famous mathematicians that he had known, others about the difficulty in getting a permanent visa to the United States (he had to spend a few days in Cuba to manage that!). Indeed the introduction of the physical sciences had managed to change the Rockefeller University from a distinguished but somewhat stodgy institution, to one that I thought likely to change the approach to biomedical problems in a fundamental way. Alas, that was not to be. Although Mark spent twenty years at Rockefeller, biology remained biology and mathematics remained mathematics. During his time there he worked, among other things, on the theory of the Maxwell construction in thermodynamics, and wrote "Can One Hear the Shape of a Drum?" which won him a second Chauvenet prize.

The years from 1939 to the end of his life were both happy and productive, the shadows that fell on his youthful years dissipated in the more congenial climate of an America that rewarded him first with opportunities and finally with recognition and awards. To those of us who knew

Mark, and even those who didn't, this autobiography will remain a pleasure to read and a reminder of the wonderful and warm person who contributed so importantly to twentieth century science.

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