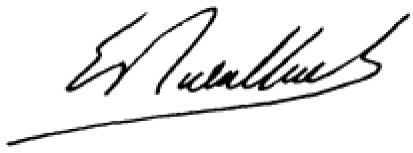

Emilio Rosenblueth

1926-1994

Written by Luis Esteva

Submitted by the NAE Home Secretary

In the early morning of January 11, 1994, ended the life of an exceptional man, after an outstanding career in engineering research and practice in Mexico, rich in contributions of international relevance.

Emilio Rosenblueth was born in Mexico City in 1926. In 1948 he graduated as a civil engineer from the National Autonomous University of Mexico (UNAM), and in 1951 he obtained his Ph.D. degree from the University of Illinois. His dissertation contains contributions to the analysis of structural response, which still today, more than forty years later, form part of the criteria recommended for the practice of earthquake-resistant design.

Upon his return to Mexico from Illinois, he spent several years working as a researcher at the Institute of Geophysics of UNAM, and as a structural designer at the Federal Commission of Electricity. At the same time, he started his career as a consulting engineer. He was appointed professor of the School of Engineering at UNAM in 1954 and researcher at the Institute of Engineering of the same university upon its opening in 1956. He acted as director of that institute from 1959 to 1966 and remained a member for the rest of his life, with the exception of the period 1977-1982, when he was under-minister of educational planning at the Ministry of Public Education

of Mexico. From 1966 to 1970 he split his time at UNAM between the activities of scientific research and the responsibilities of dean of science.

From the start of his career, Emilio remained at the forefront of research in earthquake engineering and structural reliability in the world. His influence on the development of these areas was decisive because of both the value of his own contributions and the impact they had on the work of other researchers. His work is characterized by his ability to identify new relevant problems, define them conceptually, formulate rational frameworks for their analysis, evaluate their importance through the use of simplified models preserving the essential features of the detailed ones, and present his conclusions in forms useful both to those who would apply them in the practice of structural engineering or in the formulation of recommendations, and to those who would take them as starting points for new research programs. His work was always valuable by itself and for the ideas it sowed. Emilio was a world leader in the development of the probabilistic theory for the analysis of seismic response of linear systems, as well as of simplified models, based on that theory, which form the basis of criteria applied in the practice of earthquake-resistant design of complex systems. This encompasses his contributions to the methods for seismic response analysis of multi-degree-of-freedom systems, of systems with in-plan eccentricities, and of slender structures, such as chimneys. Equally valuable, because of their simplicity and their practical relevance, are the methods and criteria he proposed for taking into account the simultaneous action of several earthquake-ground-motion components.

The first high-intensity earthquake to affect Mexico City after several tall buildings were constructed occurred in 1957. Emilio played a prominent role in updating the Mexico City Building Code, in particular its earthquake-resistant-design chapter, where he introduced a number of innovative concepts, many of which were incorporated later on in the regulations for earthquake-resistant structures of the most advanced

countries. Shortly after this, he developed a probabilistic model for studying the influence of soft soil, such as the clay formation in the Valley of Mexico, on the characteristics of earthquake ground motion.

Even during his days as under-minister of educational planning for the Ministry of Education, he found reason and time to formulate conceptual mathematical models of problems that appear when making decisions under uncertain conditions. His ideas about the processing of doubtful information and the combination of expert opinions in decision making belong to this time. Those ideas crystallized some time later in published articles. A large number of articles of analysis and dissemination about education in general and problems specific to that field in Mexico were also produced during those years. At the end of 1982, Emilio resumed his career as a full-time researcher.

Emilio was not only a researcher capable of identifying the essence of the problems, studying them, and solving them. The profoundness and rigor of his work did not keep him away from the world of practical criteria and simple formulas. On the contrary, everything he produced would end up modifying a norm, furnishing a new tool for everyday work, or changing the ways of looking at a practical problem; and he did not leave all applications to others. He was the author of several innovative structural systems that helped in obtaining efficient solutions to important engineering problems.

Most of Emilio's professional work as a structural designer and as a consultant in this and related specialties took place at DIRAC, a leading group of consulting engineering firms in Mexico City, of which he was one of the founders in 1956, its general director from 1956 to 1970, and its president from 1970 to 1977. Many outstanding projects in Mexico and abroad benefited from his unusual ability to grasp the most relevant theoretical and practical problems, from his clear and wide vision, and from his decided drive to optimize. His involvement in practice was the source of a fertile interaction with his research programs, as well as with his participation in building code revisions.

He was always guided by the same rule of action, optimizing for society. Thus, he felt compelled to know and understand other disciplines besides engineering in his search for the information and tools needed to solve the problems that the real world posed to him. He understood the need of researchers to isolate themselves in the laboratory or in their mathematical models, the problems they want to solve; but he taught us that engineers, on the contrary, must understand the interactions occurring among nature, men, and engineering works if they are to achieve their goal of optimizing. But optimizing implies assigning values to the possible consequences of those interactions as they are affected by engineering decisions. This takes an engineer to the study of the values of individuals and societies, of their preferences and their attitudes in the face of uncertainty and risk. In the search for information, tools, and social values an engineer interacts with specialists in diverse disciplines: mathematicians, geophysicists, and sociologists, among others; an engineer learns from them and contributes to their fields.

Emilio's work as an educator is also outstanding. Very few have known how to stimulate their students as well as he did with new problems and novel ideas. He let them do their jobs and forced them to make use of all their resources and capabilities. Those who worked with him will not forget the challenges he made them face and the profit derived from having overcome those challenges.

In 1976 Emilio was designated an honorary member of the American Concrete Institute and an honorary foreign member of the American Academy of Arts and Sciences; in 1977, an honorary member of the International Association for Earthquake Engineering; in 1982, an honorary member of the American Society of Civil Engineers. In 1970 he was elected to the U.S. National Academy of Sciences, and in 1977 the National Academy of Engineering, both as a foreign associate member. He was a member of the National Research Council's Division of Engineering Committees on Earthquake Engineering Research, Ground Motion Panel (1966-1969) and the Structural Synthesis and Design Panel (1967-1969); the

Commission on Engineering and Technical Systems, Committee on Reliability Methods for Risk Mitigation in Geotechnical Engineering (1992-1993); and the international liaison representative to the U.S. Committee for the Decade for Natural Disaster Reduction (1989-1991).

Emilio was the recipient of a large number of national and international awards. To name a few among the Mexican awards, he received the Research Award of the Mexican Academy of Scientific Research in 1963, the National Science Award in 1974, and the UNAM Award in Physical Sciences in 1986. The international awards he received include the Walter L. Huber Civil Engineering Research Prize in 1965, the Moisseiff Award in 1966, the Alfred M. Freudenthal Medal in 1967, and the Nathan M. Newmark Medal of the American Society of Civil Engineers in 1987; the Prince of Asturias Prize offered by the King of Spain in 1985; and the Bernardo A. Houssay Inter-American Science Prize from the Organization of American States in 1988. In 1987 he was designated emeritus professor of UNAM. A few weeks before his death he received from the hands of the president of Mexico the National Engineering Award, granted by the Organization of Civil Engineers of Mexico (Colegio de Ingenieros Civiles de México).

To enumerate the positions held by Professor Rosenblueth in the scientific and professional organizations of Mexico and the rest of the world, the actions he carried out, the groups with which he collaborated, and the fruits he left would be an exhausting job. His work will endure in the daily work of many who devote their efforts to putting science and technology at the service of mankind, in particular those who strive to develop and apply criteria and methods to make optimum use of the resources of society for human safety and well-being.