



Richard Skalak

RICHARD SKALAK

1923-1997

BY SHU CHIEN

RICHARD SKALAK, an internationally renowned authority in bioengineering, mechanical engineering, and civil engineering, died on August 17, 1997, at the age of seventy-four.

Elected to the National Academy of Engineering in 1988, Richard was a leader in applying engineering principles and techniques to elucidate many important biomedical problems. He had the unique ability to combine elegant theoretical modeling with modern experimental investigations to develop new concepts on the structure and function of living systems in health and disease.

During his career, which spanned more than half a century, Richard published more than two hundred original scientific papers and authored six books. He trained twenty Ph.D. students and a similar number of postdoctoral fellows, most of whom hold key positions in academia and industry. His outstanding research and educational efforts have generated strong effects worldwide in fluid mechanics, biorheology, and tissue engineering.

Richard received his B.S. (1943), C.E. (1946), and Ph.D. (1954) in civil engineering and engineering mechanics from Columbia University. From 1944 to 1946 he served in the U.S. Naval Reserve as an instructor in radar and sonar in Washington, D.C. He was an instructor in the Department of Civil Engineering and Engineering Mechanics at Columbia from 1948 to 1954, while pursuing his Ph.D. study. He was appointed assistant

professor in the department in 1954 and a full professor in 1964. Richard was a talented and dedicated teacher; he won the Columbia University Great Teacher Award in 1973. He was appointed James Kip Finch Professor of Engineering Mechanics in 1976. At Columbia, Richard was also director of the Bioengineering Institute (1978 to 1988) and chairman of the Department of Civil Engineering and Engineering Mechanics (1985 to 1988). After forty years of distinguished service at Columbia, in 1988 Richard was recruited by the University of California, San Diego (UCSD), as professor of bioengineering.

Richard's early research at Columbia was focused on fluid mechanics. He made significant contributions to the analysis of water hammer effects and fluid turbulence. In 1960 to 1961 he spent a sabbatical year with Professor George Batchelor in the Department of Theoretical Physics and Applied Mechanics of Cambridge University, studying the statistical theory of turbulence. In the mid-1960s he began to combine engineering mechanics and biomedical sciences in his pioneering investigations with Dr. Alfred Fishman and colleagues at Columbia University College of Physicians and Surgeons on wave propagation in pulmonary circulation.

In 1967 to 1968 Richard spent a sabbatical year in Dr. P.I. Brånemark's laboratory at the University of Gothenburg, where he conducted the classical work on experimental studies and theoretical analysis of the flow and deformation of human blood cells in living microcirculation. Upon returning to Columbia, he initiated a series of imaginative and pace-setting research studies on blood rheology, including the rheological properties of red blood cells and cell membranes, viscoelasticity of white blood cells in the passive and active states, microrheological and molecular bases of cell aggregation and adhesion, blood cell interactions in capillaries and microvascular networks, and flow properties of blood in circulation. These interdisciplinary studies established the biorheological principles of blood flow and have important implications in many disease states.

Richard also made prominent contributions in several other fields of bioengineering, including the biomechanics of craniofacial growth, lung parenchyma, skin replacement,

osseointegration, and titanium implants. He played a major role in fostering tissue engineering, in which the principles and methods of engineering and life sciences are integrated to understand the structure-function relationships in normal and pathological tissues and to develop biological substitutes for the restoration, maintenance, or improvement of tissue functions. He organized the first few symposia in tissue engineering and fostered its development as the new frontier of biomedical engineering.

Richard had an outstanding ability to formulate problems by distilling their essence into clear mathematical form and to seek out the subject that is fundamental and important. His analytical approach guided many innovative experimental studies and generated new understanding of biological function. He had an unceasing, unselfish drive to create and innovate, and to teach by example these qualities to students and associates. He was extremely interested in the education of young scientists. Even during the last few weeks of his life, Richard held regular research discussions with his students and fellows; in fact, he made the sessions more frequent to provide as much guidance as possible.

In recognition of his outstanding achievements, Richard received many awards and honors. These included the Alza Medal from the Biomedical Engineering Society (1983), the Poiseuille Medal from the International Society of Biorheology (1989), and the Theodore von Kármán Medal from the American Society of Civil Engineers (1987). The American Society of Mechanical Engineers bestowed on him the Centennial Service Award (1980), the H.R. Lissner Award (1985), the Melville Medal (1990), and the Applied Mechanics Division Award (1997).

Richard was elected to many honorific societies. He was a fellow of the American Society of Mechanical Engineers, American Academy of Mechanics, American Society of Civil Engineers, New York Academy of Medicine, Society of Engineering Science, American Institute of Medical and Biological Engineering, and American Association for the Advancement of Science. In 1990 he was awarded the Medal of Merit from the Czechoslovakian Academy of Sciences and an honorary M.D. degree from the

University of Gothenburg.

Richard served in many leadership capacities for professional societies and scientific journals. He was president of the Society of Engineering Science and the Society of Biomedical Engineering and editor-in-chief of the *Journal of Biomechanical Engineering*. He was a cochairman of the First World Congress of Biomechanics in 1990, and a cochair of the 1997 Biomedical Engineering Society Annual Fall Meeting.

There were many reasons for Richard's success in life. Particularly noteworthy are his intellectual capacity, dedication to excellence, integrity, sincerity, dependability, generosity, enthusiasm, and vision. He was generous in sharing his ideas and experience. He was always positive and encouraging, and his enthusiasm was contagious. He encouraged his colleagues and students to embark on new areas of investigation that represent the horizon of the future.

Richard was tireless in his working habits, including the efficient use of his time on the airplane and in the hotel during his many foreign and domestic trips. He was remarkable in his administrative ability and inter-personal affinity. As director of the Bioengineering Institute at Columbia University, he laid the foundation for the current development in this field at Columbia. In recognition of his lifelong contribution, a "Richard Skalak Colloquium in Biomedical Engineering" was established at Columbia University in 1996.

From 1992 to 1996, Richard was the founding director of the Institute for Mechanics and Materials established by the National Science Foundation at. In this capacity, he was extraordinarily successful in promoting interactions between the disciplines of mechanics and materials at the national level, the goal set forth by NSF in establishing the institute. At UCSD, Richard contributed importantly to the establishment and advancement of the Institute for Biomedical Engineering and the Department of Bioengineering. A Richard Skalak Memorial Lectureship has been established at UCSD Bioengineering in his memory and honor.

In Richard Skalak's passing, the field of bioengineering lost a great leader and pioneer, all those who knew him lost a wonder

ful friend and a superb human being. His spirit, his thoughts, and his deeds have spread to all parts of the world and will be a guiding light for generations to come.