



IN MEMORIAM

Werner Goldsmith

Professor in the Graduate School, Department of Mechanical Engineering, Emeritus

Professor in the Graduate School, Department of Bioengineering, Emeritus

Berkeley

1924 — 2003

The University of California, Berkeley lost a loyal son and a devoted faculty member when, in the afternoon of August 23, 2003, surrounded by his loving family, Werner Goldsmith, at 79 years of age, died peacefully at home in Oakland after a one and a half month bout with leukemia. Goldsmith was one of the foremost authorities on the mechanics of impact and the biomechanics of head and neck injuries and was still active in these fields until the week before his death. He was born in Düsseldorf, Germany, on May 23, 1924, the only child of Siegfried and Margarethe Goldschmidt. He attended lower schools in Düsseldorf, but, because of persecution under the National Socialist government in Germany, could not go on to high school there. When Goldsmith was 14 years old, his parents arranged with a cousin in the United States to provide appropriate papers that allowed him to emigrate from Germany and come to the United States. His parents were not able to escape from Europe, and they later died in the Nazi death camp at Auschwitz. A foster family opened their home to him in Mount Vernon, New York, where he attended the A.B. Davis High School from 1939 to 1941. After graduation, he spent the summer of 1941 working as a bellboy to accrue funds for his college education. He attended the University of Texas, and graduated in 1944, after three years. He augmented a scholarship/loan from the university by assorted jobs, as a newspaper deliverer, as a typist in the university library, and as a reader. He remained in Austin for an additional year working as a tutor in applied mathematics while earning a master's degree in mechanical engineering in 1945 in the area of thermal systems. That same year he became a U.S. citizen. For two years after he obtained his master's degree, Goldsmith held appointments or positions at the University of Pittsburgh as instructor in mathematics, at the Westinghouse Electric Corporation as an engineer, and at the University of Pennsylvania as a lecturer in engineering.

Goldsmith began his long association with the University of California, Berkeley in 1947 as a doctoral student in mechanical engineering, continuing his research in thermal systems, and completed the Ph.D. in mechanical engineering in two years. He was appointed assistant professor in the Department of Mechanical Engineering at Berkeley in 1949. At that time, he decided to switch his research and teaching interests from the area of thermal systems, which was already strongly represented in the department by more senior and well established faculty members, to that of dynamics problems in solid mechanics. He felt that this change in direction would add breadth and strength to the department, and provide him greater opportunities for independent growth. In spite of this significant shift in his scholarly activities, his progression through the academic ranks was rapid. He was appointed associate professor in 1955 and professor in 1960. It was also in 1960 that his book entitled *Impact: The Theory and Physical Behavior of Colliding Solids* was published (Edward Arnold Publishers, London). This treatise, which was the first organized collection of work in the field, had a significant influence when it was published, and attracted many investigators to that field of research. It is still one of the most important works available on impact, and was republished in 2001 in the

Dover Publications series of classic texts in engineering. Goldsmith's research in that field was diverse and prolific. His early work emphasized the applications of wave propagation and impact to military problems, and he served as a consultant to the U.S. Naval Weapons Center at China Lake, California, from 1951 until his death. His research included, among many other topics, investigations in penetration mechanics, dynamic properties of numerous materials, and wave propagation in bodies having a variety of geometrical shapes. His interest in impact problems continued for the duration of his life, as is evidenced by his recent monumental 300- page review article, "Non- Ideal Projectile Impact on Targets," published in the International Journal of Impact Engineering in 1999.

In the mid- sixties, however, Goldsmith's interests expanded, and he became one of the pioneers in the developing fields of bioengineering and biomechanics. He was asked by the National Institute of Neurological Diseases and Stroke of the National Institutes of Health to chair the Head Injury Model Construction Committee, whose purpose was to conduct a study that would eventually lead to an understanding of the response of the head to impact. During this period (1966-70) he conducted an extensive review of biomechanical activities at both American and European institutions and later published the results of this investigation in a series of four papers. These and other papers on head injury during the late sixties, which melded his considerable knowledge of dynamical solid mechanics with newly- learned physiology and anatomy, once again, like his book on impact, acted as a stimulus, drawing many researchers into an important emerging field. Experimental work on head injury models began in his laboratory in 1967 and continued, quite literally, until the final week of his life. Research in fundamental aspects of head and neck injury was interwoven with a variety of practical problems, such as design and evaluation of various protective headgear. The appropriate design of such protective gear, to which Goldsmith made such significant contributions, is still an ongoing, important area of research. Coincidentally, in the early 1970s, Goldsmith pioneered in developing the Bioengineering Joint UC Berkeley/ UC San Francisco Graduate Group, which, years after his retirement, led to the establishment at UC Berkeley of the Department of Bioengineering. To aid in the teaching of courses in that area, Goldsmith and several of his colleagues wrote one of the earliest comprehensive books in that field, Introduction to Bioengineering (Oxford University Press, 1996). In recognition of the influential contributions he made to the creation of that department, he was appointed as a professor emeritus in the Department of Bioengineering in January 2003. In this way, Goldsmith had the distinction of being appointed the first professor emeritus in the newest department of the College of Engineering, even though he had never been a professor in the department; probably the first time this has happened at UC Berkeley.

Goldsmith's extensive research and knowledge in impact and the biomechanics of head and neck injuries led to his being called to testify as an expert witness in many court cases, some of them famous, involving automobile collisions, falls, beatings, etc. More recently, his experience in the legal arena led to his study of pediatric head and neck injuries, in particular the forensics associated with the violent shaking of an infant or child (referred to as 'shaken baby syndrome'). He led a group of scholars who argued that prosecutors and doctors who allege death by shaken baby syndrome are often ignorant of basic biomechanics, and therefore frequently make false accusations of child abuse. Because of the competence he developed in this area, he once again became involved as an expert witness in important court cases.

Goldsmith was a devoted and able teacher. He even taught courses in bioengineering and biomechanics, and continued to mentor students in research, well beyond his year of retirement. He was especially effective working one- on- one with graduate students, guided many of them in their research, and served as the dissertation advisor for 35 Ph.D. students and the thesis advisor for 46 master's students. He was well- known for looking after students doing research with him, at both the undergraduate and graduate levels. His concern for his students did not end when they left UC Berkeley. He frequently championed and assisted them in their later careers.

Goldsmith was a man of prodigious energy and perseverance. That, coupled with his creativity, ingenuity and originality, led to a multitude of important and useful publications (over 300 journal papers and technical reports). He was as courageous in his research as he was in the way he lived his life, and would venture into uncharted, ill- defined areas where many others preferred not to go. In this way, he encouraged the development of new fields. In addition, Goldsmith was a consultant to a variety of industries and governmental bodies, including the U.S. Army, the Air Force, and the Navy; the National Institutes of Health; Federal Products Safety Commission; Federal Trade Commission; Lawrence Radiation Laboratory; and the National Research Council. He received many honors and accolades. His awards, to list but a few, included a Guggenheim Fellowship; two Fulbright Fellowships; election as a Fellow of the American Academy of

Mechanics; election to the National Academy of Engineering; having an entire issue of the International Journal of Impact Engineering dedicated to him in honor of his 70th birthday; the Berkeley Citation; elevation to the rank of Honorary Member of the American Society of Mechanical Engineering; having been chosen by the Berkeley Engineering Alumni Society as a Distinguished Engineering Alumnus for 2001; and receiving the title Doctor honoris causa of the University of Patras, Greece, in 2002.

Goldsmith had many interests and abilities aside from those technical. He loved to travel, and used every one of his sabbatical leaves to live in a foreign country. In addition to his adopted English and native German, he spoke French fluently, and some Greek. He collected antique maps, stamps with maps on them, first day covers, coins, and primitive masks. He was an inveterate photographer and had a collection of several thousand photos, many taken of famous engineers at the myriad professional meetings that he had attended. Tragically, these collections were lost in the Oakland hills fire of 1991. But, being the survivor that he was, Goldsmith rebuilt some of his collections as best he could. He was a lover of classical music: he played the piano, and, for years, had season subscriptions to the San Francisco Symphony. He enjoyed the study of history and over the course of several years, Goldsmith, under the sponsorship of his department, authored the book, Mechanical Engineering at Berkeley, The First 125 Years, published in 1997. He had a strong sense of justice, and was outspoken and vigorous in his defense of victims of injustice. He enjoyed playing cards: for years he was a member of the group that met regularly at lunchtime at The Faculty Club to play hearts, and was a Life Master in the American Contract Bridge League.

He is survived by his wife, Penelope A. Goldsmith; son Stephen Goldsmith; daughters Andrea Goldsmith and Remy Margarethe Goldsmith; and grandchildren Michelle S. Goldsmith, Dimitry Pobyvovk, Daniel Salz and Nicole Salz. In addition to his remarkable professional contributions, he leaves behind many fond memories among his numerous friends, colleagues, and associates, relationships made and forged over almost eight decades. He will be missed dearly, and long and affectionately remembered.

Stanley A. Berger
George Leitmann
Jerome L. Sackman