

In Memoriam: Shmuel Einav, 1942–2022



Shmuel Einav

A pillar of the biomedical engineering community and the field of biofluids and cardiovascular engineering— Prof. Shmuel Einav, passed away earlier this year. Besides his major contributions to the field of biomedical engineering (BME), Prof. Einav was an inspiring and beloved figure who was appreciated by many in the bioengineering community, in Israel and around the world. He was part of a small group of visionary academics who have worked resolutely and persistently to establish BME as an independent and rigorous academic discipline that became the prosperous

research field it is today. Shmuel Einav passed away in Israel surrounded by his family on Feb. 20, 2022. He peacefully succumbed to an illness he battled for two years.

Shmuel was born on Oct. 30, 1942 in Tel Aviv, Israel. He received his B.Sc. in mechanical engineering and M.Sc. in nuclear engineering in 1964 and 1968 from the Technion, Israel Institute of Technology. He continued his graduate studies at Stony Brook University, where he received a Ph.D. in mechanical engineering in 1972. Initially focusing his research interest on fluid mechanics he continued his postdoc training at Boston University where he started his lifetime venture in bioengineering by utilizing Laser Doppler Anemometry (LDA) for noninvasive measurements and mapping of flow fields in bioengineering. He applied LDA to study *in vivo* flow of red blood cells and published this pioneering work in *Biorehology* (1975). In 1973 he joined the Faculty of Engineering at Tel Aviv University, where he rose through the academic ranks. Shmuel was closely following the rapid developments in bioengineering and developed research collaborations with leading researchers in the U.S. and Europe. He was a visiting professor at Boston University, MIT, University of California at Berkeley, Caltech, City College of New York, and Stony Brook University.

Around 1986 Shmuel led the process of granting advanced degrees in BME at Tel Aviv University and in 1993 he became the founding chair of the BME department. In 2000 he led the process for approval of the Israeli Council of Higher Education to begin undergraduate studies in BME at the Technion, Tel Aviv, and Ben-Gurion Universities and Afeka College. Working tirelessly to promote the young field of BME, Shmuel initiated in 1996 a collaborative activity of academia-industry-government for the inclusion of BME within the framework of a governmental scientific and technological infrastructures program—a part of the startup boom that spurred the rapid development of BME companies in Israel. He led the development of more than 15 startup companies as the director of the technology transfer organization of Tel Aviv University. Shmuel was the incumbent of the Herbert Berman Chair for Vascular Bioengineering at Tel Aviv University and founded several bioengineering research centers. Prof. Einav was also a past President of the Israeli Society for Medical and Biological Engineering.

Driven by boundless curiosity and always looking for innovative research directions, his research has led to new insights into the way we diagnose and treat cardiovascular diseases. He is credited with significant advances in our knowledge of blood flow and cardiovascular system in health and disease, computational approaches to assess the severity of the disease and the efficacy of treatment, the development of implantable medical devices such as prosthetic heart valves and ventricular assist devices, and

systems for the diagnosis and treatment of heart disease and blood vessels. His studies on blood flow, blood-tissue interaction, and turbulent flow characteristics in occluded arteries focused on the role of hemodynamics in the initiation of atherosclerosis, the dynamics of cardiovascular flows, and the influence of flow and the associated shear stress on vascular endothelial biology. This led to advancing our knowledge of opening blocked arteries, diagnosing vulnerable plaques and the discovery of microcalcifications in their fibrous caps, and the use of nanotechnology and therapeutic ultrasound for recovery and regeneration of blood vessels.

Recognized by the international science community for his contributions to BME Shmuel was elected as a Fellow of the International College of Medical and Biological Engineering, the European Alliance for Medical and Biological Engineering & Science, the Biomedical Engineering Society, American Institute for Medical and Biological Engineering and the American Society of Mechanical Engineers. He was among the initiators and the driving force of the International Biofluid Symposium and Workshop which he led and chaired conferences from 2003 on. A memorable one was the Dead Sea conference in Israel that also served as an opportunity to celebrate his 70th birthday—an event that was attended by about 120 participants and spouses from 22 countries. Shmuel organized and chaired this ad hoc organization till the last conference that was held in February 2020 in Tucson, AZ, just before the Covid-19 pandemic brought to a halt such in-person meetings, but he could not arrive because of his deteriorating health.

Prof. Einav served as a Distinguished Visiting Scholar at Caltech—California Institute of Technology. During his regular stays at Caltech, he became the founding director of the California Friends Laboratory for Biomedical Computing and Parallel Processing. Following his long tenure at Tel Aviv University, Shmuel returned in 2004 to his alma mater— Stony Brook University as a distinguished professor and was named associate dean for research and graduate studies in the College of Engineering and Applied Sciences and the director of the medical technologies division at Stony Brook’s Center of Excellence in Wireless and Information Technology. In that capacity, he directed innovative projects such as developing and applying therapeutic ultrasound as a stimulus for angiogenesis and vascular regeneration and research for developing dynamic wireless sensor systems for health monitoring.

As a linchpin of academic and scientific prowess, Shmuel was an inspirational figure, a kind and loving person who saw himself as a mentor for young talent and a facilitator of new ideas. Known as a “man of people” Shmuel was loved by many in our bioengineering community. He was a mentor and a friend to many, setting a formidable example of how to conduct oneself as a human being and demonstrate devotion to the goal while respecting others with endless patience and benevolence. Many of us turned to him for his advice that he gladly shared in his typically generous and wise demeanor. At times Shmuel was proactively advising more than a few of us by offering an observation or pointing toward a promising path—steering younger colleagues in a direction that they likely benefited from in their careers. His curiosity and attention to others were limitless— characterized by an optimistic attitude, gentle and polite, supportive and helpful. In the many testimonies that poured from colleagues from around the world upon his passing away, this sentiment came forcefully through. Shmuel was also an avid amateur classical musician throughout his life, playing the violin in a chamber music quartet.

In Israel, the public also knew him for his voluntary public service. He was a member of the Pedagogic Council of the Ministry of Education and served as the chairman of the Technological-Scientific Educational Program of the Ministry where he worked to introduce the field of BME into high school curricula. He was

one of the founding members of the Tel Aviv—Los Angeles Partnership, a community-based operation, which jointly promotes cultural, educational, and socio-medical projects. In recognition of his scientific and societal contributions Prof. Einav was awarded in 2013 the prestigious Landau Prize in Arts and Sciences in the fields of Medical and Biomedical Engineering, for “innovative achievements and groundbreaking medical research; initiating and constructing the field of BME in Israel and worldwide; contributing to the advancement of research in cardiovascular medicine for the benefit of mankind; developing instructional programs in BME in Israel and worldwide; teaching and instructing many generations of engineers, scientists and physicians; and extensive public advocacy.”

Professor Shmuel Einav is survived by Hassia, his wife of 57 years; his daughters, Dr. Gali Einav; Noyah Einav; Rona Lee Einav-Aviv; and five grandchildren.

Shmuel was a researcher, teacher, leader, mentor, inspiration, and friend to many in the BME community. He will be deeply missed.

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